Household Finance Issues in India

THESIS

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SHREYA LAHIRI
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Under the Supervision of
DR. SHREYA BISWAS

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CERTIFICATE

This is to certify that the thesis titled Household Finance Issues in India submitted by Shreya Lahiri ID No 2019PHXF0424H for award of Ph.D. of the Institute embodies original work done by him/her under my supervision.

Signature of the Supervisor: Shreya Biswas
Name in capital letters: DR. SHREYA BISWAS
Designation: Assistant Professor

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Abstract

Household finance is the field of study that focuses on how households use financial instruments to fulfil their objectives. In 2006, John Campbell coined the term 'Household finance' for the first time. He showed that households' decision-making regarding financial activities is sub-optimal, and they often commit investment mistakes. Household finance is an emerging field of research and is well-researched in advanced economies, whereas this is still an under-researched domain in emerging economies. Studying household finance separately in an emerging economy context is warranted on account of several reasons. Firstly, the findings based on white, educated, industrialised, rich democracies may not apply to emerging economies characterised by a large share of low-income households. Secondly, the issues emerging economies face differ from those faced by advanced economies, given differences in risk preferences, institutions, education, etc. Thirdly, many young households in emerging economies are participating in the financial market for the first time.

Given the unique features of emerging economies, the objective of the thesis is to explore household finance issues in the context of an emerging market economy like India. The Reserve Bank of India published the Household Finance Committee Report in 2017, which highlights the household finance issues in India for the first time. According to this report, Indian households hold a considerable amount of investment in physical assets and lower financial assets. Additionally, only a small share of households participates in the insurance market. This thesis addresses four research questions related to household finance issues in India.

The first research question analyses how financial literacy is related to the financial behaviour of individuals. The motivation behind this research question is the low levels of

financial awareness regarding various financial products and policy push toward increasing financial literacy in India. Using a nationally representative Financial Investment Insights survey of 2018 covering individuals aged 15 years and above, this essay finds that financial literacy is related to improved financial behaviour. The chapter employs an instrumental variable approach to address the endogeneity. Additionally, the chapter finds that the effect of financial literacy on financial behaviour is stronger for individuals having confidence in their financial management skills, males, and those residing in urban areas. Importantly, the chapter empirically shows financial planning as a channel through which financial literacy can improve financial behaviour. The finding of this chapter underscores the substantial requirement of arranging financial literacy programs, especially focusing on female and rural individuals.

The second research objective examines the long-term effect of a covariate shock on the investment portfolio of households. Given its geographical location, India experiences high-frequency natural disasters. The chapter considers the Tamil Nadu flood of 2015 as a case in point to examine the effect of covariate shock. Using multiple rounds of the All-India Debt and Investment Survey and employing a difference-in-difference approach, the chapter finds that flood leads to a change in the investment portfolio of affected households. In the aftermath of the flood, households are less likely to hold illiquid physical assets and more likely to participate in the financial market. Further, the findings indicate that real estate drives the negative result observed for illiquid assets, and investment in retirement funds drives the positive result for financial assets. Therefore, the result suggests that there is scope for financial awareness programs to make households aware of the benefits of investing in liquid financial assets, which in turn can improve the financial resilience of households in the wake of future shocks.

The third research objective focuses on the relationship between housing and the financial investments of households. The existing empirical literature has yet to have a consensus on the relationship between these two asset classes. A high homeownership rate among Indian households suggests that revisiting this question in the Indian context is worthwhile. Using the All India Debt and Investment Survey-2019, this chapter suggests that there is a trade-off between housing and financial investment for urban households. The stringent budget of the households due to committed expenditure related to housing possibly substitute the financial investment of the households. Additionally, the substitution effect of housing is stronger for young and poor households. In contrast, the substitution effect of housing is weaker for households with more dependents. Therefore, the findings draw policy implications highlighting the need for subsidies covering repair and maintenance costs so that the budget constraints of homeowners do not lead to a fall in investment in financial assets.

The fourth objective is to examine the association between internet density and the risk management practices of households. Compared to advanced economies, insurance penetration in India is very low. Evidence from developed nations suggests that internet access improves financial behaviour in several countries. This chapter utilises the All India Debt and Investment Survey of 2019 and employs probit and tobit approaches and finds that higher internet density in the district improves insurance uptake and insurance demand of the households, respectively. Additionally, the association is found to be lower for young and male-headed households. Importantly, we find that income is a channel through which higher district-level internet density improves the risk management behaviour of households. Hence, the findings highlight the need for scaling up and fastening access to the internet to improve the risk management practices of households.

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List of abbreviations

Abbreviation	Full form
AIDIS	All India Debt and Investment Survey
ATM	Automated Teller Machine
BRICS	Brazil, Russia, India, China, and South Africa
DID	Difference-in-Difference
HFC	Household Finance Committee
FII	Financial Inclusion Insight
GOI	Government of India
GDP	Gross Domestic Product
IAMAI	Internet and Mobile Association of India
ICT	Information and Communication Technology
IPC	Indian Penal Code
IPCC	Intergovernmental Panel on Climate Change
IRDAI	Insurance Regulatory and Development Authority of India
ITU	International Telecommunication Union
IV	Instrument Variable
IV2SLS	Instrumental Variables estimation using Two-Stage Least-Squares

KVP	Kisan Vikas Patra
LTE	Long Term Evolution
MCOCA	Maharashtra Control of Organised Crime Act
MOHFW	Ministry of Health and Family Welfare
MOSPI	Ministry of Statistics and Program Implementation
MPCE	Monthly Per Capita Expenditure
NABARD	National Bank for Agriculture and Rural Development
NAFIS	All India Rural Financial Inclusion Survey
NCRB	National Crime Records Bureau
NFHS	National Family Health Survey
NPS	National Pension System
NSC	National Savings Certificates
NSSO	National Sample Survey Organisation
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Square
PF	Provident fund
POSB	Post Office Savings Bank
PMJDY	Pradhan Mantri Jan-Dhan Yojana

PMAY	Pradhan Mantri Awas Yojana
PSM	Propensity Score Matching
RBI	Reserve Bank of India
RRB	Regional Rural Bank
SLL	Special and Local Laws
US	United States
WEIRD	White, Educated, From Industrialized Rich Democracies

Chapter 1

Introduction

Summary

Household finance is the study that explores the way how households make use of the financial instruments to accomplish their purposes. Though the area is well researched in advanced economy settings, examining the household finance issues separately in an emerging economy context is worthwhile as the issues faced by the households in the economies are different. Among several emerging economies, Indian households are characterised by a few unique features. For example, Indian households hold a major portion of their investments in terms of physical assets, hold insufficient retirement planning and products, have lower participation in financial assets and insurance market. This thesis deals with a few such issues in the Indian settings and explores the financial behaviour of Indian households.

1.1 Overview

"The possibility that household finance may be able to improve welfare is an inspiring one" - Campbell (2006)

Household finance studies how households can utilize financial instruments to achieve their goals. It deals with how household members make decisions regarding financial activities and how government policies impact the provision of financial services (Tufano,2009). Household finance is a growing field at the intersection of economics, development, finance and behavioural studies.

In 2006, Campbell coined the term "Household Finance" in his presidential address to the American Finance Association. He primarily highlighted the possibility of optimising

household welfare with the help of financial instruments. Campbell (2006) postulates that household finance has specific features - a) households have significant non-traded assets (including human capital), b) households hold illiquid assets, i.e., majorly housing, c) households are subject to complex taxation, and d) they find difficulties in borrowing. He compared two types of approaches pertaining to household finance. The first one is normative household finance which deals with what the households should do, whereas the second one is positive household finance-which deals with how households actually use financial instruments and interact with financial markets. Using both approaches, he showed that the consequence of the discrepancies between the ideal and actual household behaviour is severe and far-reaching, especially for low-income and less-educated households. In this regard, Campbell has argued that an '*investment mistake'* takes centre stage in household finance. Additionally, he postulates that individuals must have a certain financial understanding to choose among sophisticated financial products available to them. However, though household finance is a growing research area in the context of both advanced and emerging economies, the fact that a significant proportion of low-income households with insufficient financial knowledge reside in emerging economies; there is an urgent need for investigating household finance issues in such country settings. Household finance remains an under-researched area in the context of emerging economies. Notwithstanding this, Badarinza et al. (2019) additionally provide three reasons highlighting the need to study household finance in emerging markets. Firstly, they argue that household finance studies in emerging market contexts can provide external validity to the findings in advanced country settings. The current understanding in this field is based on WEIRD (White, educated, from industrialised, rich democracies) households that are not likely to be representative of the global population (Henrich et al., 2010). Therefore, the conclusions

from existing studies till now may not be applicable to all households across the world. Secondly, households in emerging economies may have unique characteristics. For example, there may be differences in risk preference, living standards, nature of the job, Government policies, and the overall economic and political environments across countries. Therefore, there is a need to carefully identify the unique constraints and situations that drive the financial activity of households in emerging economies. Thirdly, many young households in emerging economies are now participating in financial markets. Further, evidence suggests that there is a long-lasting impact of financial market experience on financial behaviour (Anagol et al.,2021; Malmendier and Nagel,2011). Hence, how these young households interact with financial markets needs to be carefully studied as it can potentially have welfare consequences. Given this background, this thesis examines household finance issues in the Indian context.

The rest of the chapter is structured as follows. Section 1.2 briefly discusses the international evidence, Section 1.3 provides the household finance landscape in India, whereas Section 1.4 identifies the research gap. Section 1.5 presents the research questions, and finally, Section 1.6 highlights the contributions of the thesis.

1.2 International evidence

A large body of literature examines various aspects of household finance in advanced countries. Firstly, a set of studies explain the portfolio choice of the households. Cardak and Wilkins (2009) find that homeownership, financial awareness, and age strongly determine the households' risky asset-holding pattern of Australian households. Heaton and Lucas (2000) find that entrepreneurial income risk impacts the portfolio choice of U.S. households. They show that households with high and variable business income hold less share in risky assets than other wealthy households. Similarly, other studies find a negative impact of labour income risk on

households' stockholdings (Bertaut and Starr-McCluer,2002; Heaton and Lucas,2000; Fratantoni,1998; Guiso et al.,1996). Besides this, studies identify education as a positive factor of risky asset investment (Yamashita,2003; Bertaut and Starr-McCluer,2002; Fratantoni,1998; Bertaut,1998). In fact, Hryshko et al.(2012) show that increased cognition and characteristics linked with having a white-collar job as one of the channels through which education improves household investment portfolio. Besides education, a set of studies document that financial literacy significantly increases the risky asset investment of households (Li et al.,2020; Bianchi et al.,2017; Van Rooij et al.,2011). Additionally, using the Portuguese Security Commission database, Abreu and Mendes (2009) show that investors' educational attainments, along with their financial knowledge, positively affect portfolio diversification. Lusardi and Mitchell (2014) highlight the importance of financial literacy for financial decision-making and overall financial well-being for U.S. households. Other studies provide evidence of a significant positive association between age and stockholding (Fujiki et al.,2012 in Japan; Cardak and Wilkins,2009 in Australia). In contrast, Guiso and Jappeli (2002) find an inverted U-shaped relation between risky asset investment and age. On the other hand, few studies document the significance of bequest motives for wealth accumulation (Ameriks et al.,2011; Dynan et al.,2002; Beratut,1998). Moreover, Campbell et al. (2019) find that even if households invest in risky assets, they make costly mistakes and are slow learners.

Another set of studies explores how shocks affect household balance sheets. An early study by Mishkin (1978) shows that the liabilities of U.S. households increased during the great depression, whereas the financial asset holdings and net worth fell, highlighting the severe imbalance in the household balance sheet due to the crisis. Mian et al. (2013) find that following

the housing collapse in the U.S. in 2006-2009, poorer and leveraged households show a significant increase in marginal propensity to consume out of their housing wealth.

Few studies have also focused explicitly on retirement planning. In this regard, Lusardi and Mitchell (2007) show that financial literacy is related to improved retirement planning. Additionally, Lusardi and Mitchell (2008) provide evidence for females with low financial literacy and, in turn, less likelihood of retirement planning. Likewise, few studies in several countries settings also show a positive association between financial literacy and retirement planning (Niu and Zhou,2018 in China; Brown and Graf,2013 in Switzerland; Van Rooij et al.,2012,2011 in the Netherlands; Bucher-Koenen and Lusardi,2011 in Germany). Further, a recent study by Holden and Schrass (2021) analyses the role of individual retirement accounts (IRA) in the retirement savings of U.S. households. Interestingly, Fan et al. (2022) show that U.S. individuals with financial hardship are more likely to estimate retirement needs and have non-employer-sponsored retirement funds.

1.3 Household finance landscape in India

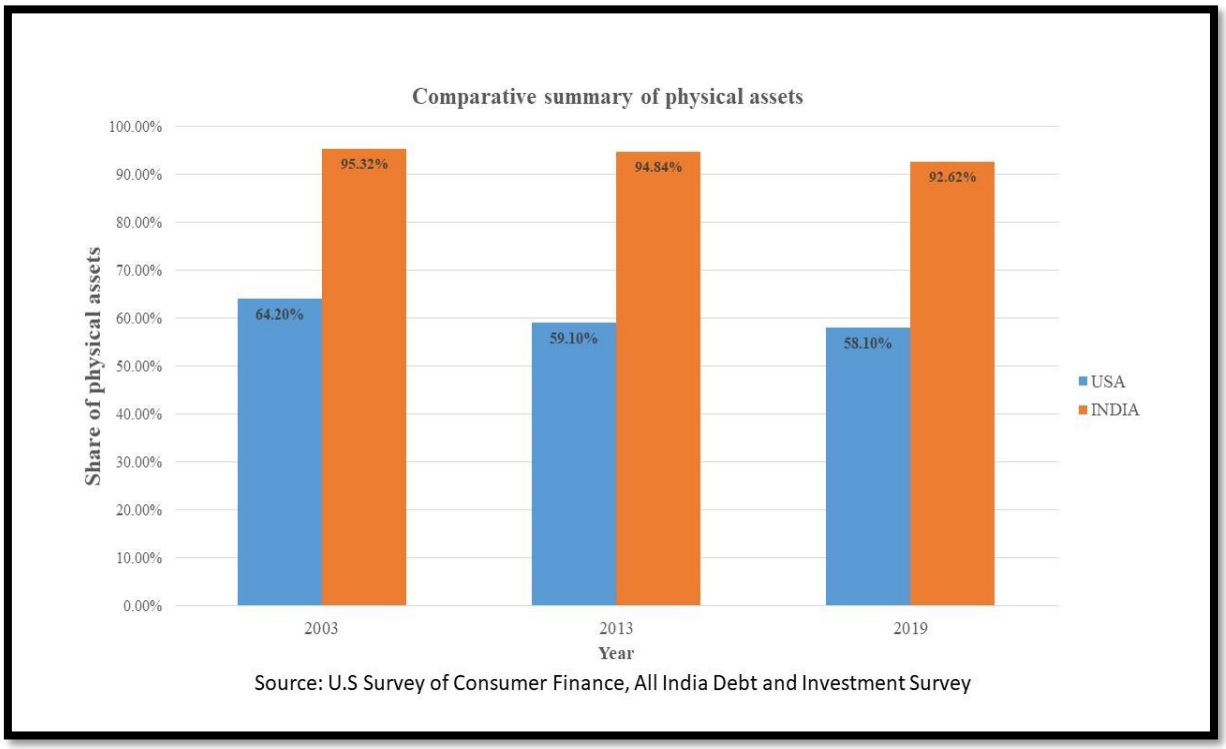
Given the pivotal role of household finance, the Indian central bank, the Reserve Bank of India (RBI), documented the first Household Finance Committee (HFC) report in 2017 based on the findings of the HFC. According to this report, the Indian household finance landscape has certain unique features discussed below:

a) Large holding of physical assets and low financial assets

Indian households hold a large portion of their wealth in physical assets, mainly gold and real estate. In fact, households in India invest 84 percent of their wealth in real estate and 11 percent in gold, and 5 percent in financial assets. More importantly, this does not vary significantly with age, i.e., the observation remains fairly constant for young and poor households. Figure 1.1

presents the comparative trend in physical assets holding of households of India and United States. Despite the share of holding decreases over time; however, the average share of physical assets is far lower than that of developed country throughout the periods.

Figure 1.1: Comparative summary of physical assets



Source: U.S Survey of Consumer Finance, All India Debt and Investment Survey

b) Low mortgage penetration

Despite holding substantial physical assets, households are less likely to borrow early in life, and their borrowing subsequently increases in the later stage. They are more likely to be indebted at the time of retirement.

c) Absence of retirement planning

There is almost an across-the-board absence of retirement planning among Indian households. Despite the availability of investment-linked life insurance products and pension accounts, most Indian households either do not have pensions or have insufficient funds post-retirement life.

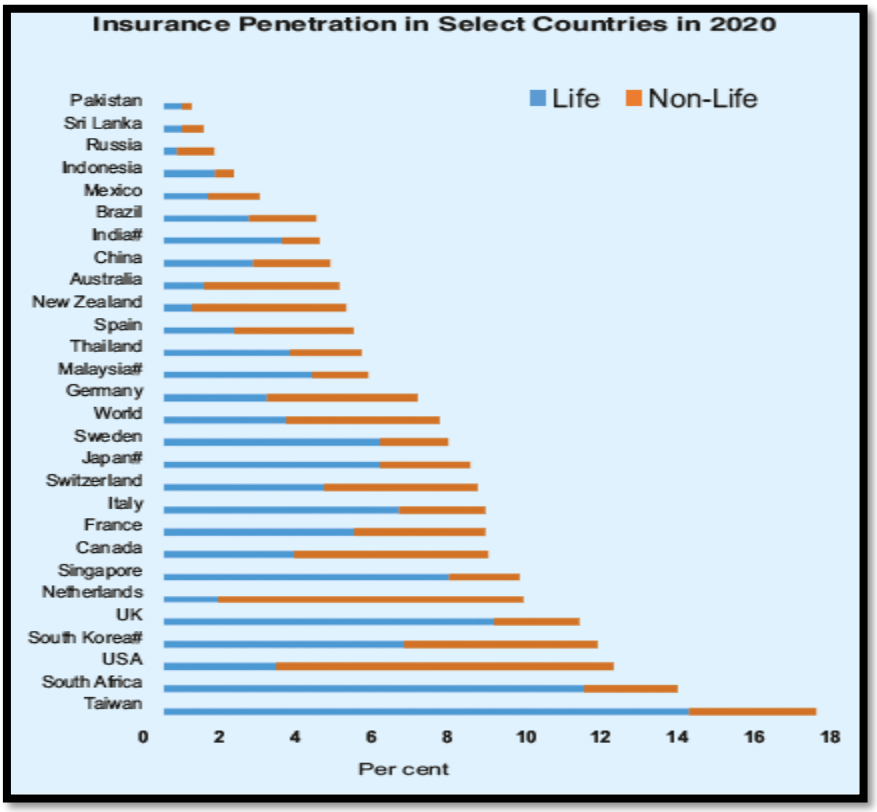
d) High informal debt

The report highlights a high level of unsecured debt in household balance sheets, especially from non-institutional sources such as moneylenders. This leads to a high-interest cost burden on vulnerable households.

e) Low insurance penetration

A very low share of households in India have insurance (both life and non-life insurance products). This phenomenon highlights the vulnerability of Indian households, as various parts of India witness high-frequency natural disasters, including rainfall, flood, etc. Despite the fact, according to the report of the Insurance Regulatory and Development Authority of India (IRDAI,2020-21), the insurance penetration rate is still lower than in many developed and even developing countries in 2020 (Figure 1.2).

Figure 1.2: Insurance penetration in countries (Source: IRDAI Report,2020-21)



1.4 Indian evidence and the gap in existing research

In the Indian context, only a few studies have rigorously analysed household finance-related issues using large country-level datasets. Vishwanath et al. (2020) identify that trust issues in the financial system, cognitive and behavioural biases, and heterogeneous needs based on wealth levels, education, and region of residence drive the financial decision of Indian households. Additionally, they identify the challenges and explore the scope for innovation toward achieving universal financial inclusion. Likewise, Rampal and Biswas (2022) investigate the socioeconomic determinants of household investment portfolios of low-income households in India. Their results identify affordability as the critical indicator for asset holding of households. They also find that factors like educational attainment, social connection, and confidence in institutions play a major role in investment and the likelihood of owning a diversified portfolio. Additionally, Das et al. (2019) identify caste, faith, and gender are the key determinants of homeownership.

On the other hand, few studies analyse how shocks affect household portfolios. For instance, using the flood as an income shock, Beyer et al. (2022) provide evidence for reduced income and expenditure of the flood-affected households in the aftermath of the Kerala flood of 2018. Similarly, Tamuly and Mukhopadhyay (2022) document that cumulative natural disasters significantly and negatively impact household consumption across all social and economic groups. In contrast, Patnaik et al. (2019) find a sharp increase in consumption just after the Chennai flood in 2015. Gopalakrishnan et al. (2019) document that when households experience a single positive income shock, they are more likely to rise their investment in financial assets as well as real estate. In contrast, consecutive positive income shocks only increases investments in real estate.

Studies have also analysed determinants of insurance uptake in India. For example, Kakar and Shukla (2010) identify education, occupation, and asset ownership as the significant determinants of life insurance demand. On the other hand, Cole et al. (2013) recognise that non-price factors, i.e., liquidity constraints, lack of trust, and limited salience, are significant barriers to the insurance demand of rural Indian households. In this regard, Cole et al. (2012) provide evidence for the positive correlation between financial literacy and weather insurance. Given the background literature in the Indian context, we identify the following research gaps:

a) Studies in the context of advanced countries have explored the relationship between financial literacy and financial behaviour. Recognising the importance of financial literacy, the Government of India has introduced financial literacy program in the country. However, in the Indian context, the relationship between financial literacy and household investment behaviour using large datasets is less explored.

b) Only a few studies have explored the effect of shocks on household's savings and investment behaviour; not many studies have analysed the effect of exogenous shocks on the portfolio choices of households.

c) Given the stylized fact that a large fraction of Indian households holds real estate, studies have not explored the relationship between financial assets and real estate investments in Indian households.

d) Despite the low penetration of insurance among Indian households, there remains scope for investigating what factors can instill insurance uptake by households.

1.5 Research questions

The first research question analyses whether financial literacy can improve the financial attitudes of Indian individuals. According to the Organisation for Economic Cooperation and Development (OECD) definition, financial literacy is the combination of awareness, knowledge, skills, attitude, and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being[1]. Several studies use this measure to explain the impact of financial literacy in the improvement of financial behaviour like retirement planning, stock investing (Van Rooij et al.,2011 in the Netherlands context), and institutional borrowing (Bahovec et al.,2015), stock market participation (Thomas and Spataro, 2018; Kadoya et al., 2017; Arrondel et al., 2012), households' financial well-being (Lusardi,2006), cash flow management, savings, and investment (Hogarth et al., 2003). Few studies in the emerging economy find that higher financial literacy is related to improved financial decision-making in middle-class Asian households (Grohmann,2018) and financial inclusion (Grohmann et al.,2018). Even in the Indian context, a few studies in India find the impact of financial literacy on IT enterprises (Shaik et al.,2022) and the financial behaviour of Mumbai residents (Bhandare et al.,2021). However, the findings of these studies are not representative of households all over India. Hence, Chapter 2 focuses on examining the effect of financial literacy on household's financial investment behaviour using nationally representative data.

Examining this relationship using a large dataset in India is important for two reasons. Firstly, a considerable portion of India's huge population is unaware of available financial products and services, so that often face fraudulence during financial decision-making. Therefore, researchers search for ways to improve the financial attitude of individuals by reducing the probability of

[1] https://www.oecd.org/finance/financial-education/49319977.pdf

investment mistakes and fraudulence. On the other hand, the level of financial literacy in India is inferior compared to that observed in developed countries (Agarwalla et al., 2015). Klapper et al. (2015) find that India has the lowest financial literacy score among BRICScountries. According to the Organisation for Economic Cooperation and Development, International Network on Financial Education study conducted in 2017 (OECD/INFE, 2017), India stands below the average score of 12 among 21 countries. India's large population lacks the rudimentary skill to make proper financial decisions and commit financial mistakes. Hence, the study's finding regarding the link between financial literacy and financial attitude is important from a policy perspective.

The second research question focuses on the effect of shock on household finance in India. Hanspal et al. (2020) assess the effect of the pandemic in the U.S. and find that the pandemic led to financial wealth loss among the households who save and are otherwise better off, and it also led to higher expected debt at the household level. In India, Beyer et al. (2019) studied the short-run causal effects of the Kerala floods on household budgets, assets, and borrowing. However, there is a scarcity of studies investigating the long-term impact of the shocks on household finance. In this regard, Chapter 3 analyses how households' investment portfolios respond to an exogenous shock proxied by flood in the long run. Examining the question in the Indian context is worthwhile because, in India, the frequency of heavy rainfall resulting in floods, landslides, and crop damage is rising (Roxy et al.,2017). Eckstein et al. (2021) identify India as one of the most vulnerable countries likely to witness rising sea levels and increased river flooding. From the perspective of urban flooding, India is the second most susceptible country after China (Bandyopadhyay et al., 2021).

The third research question focuses on the relationship between housing and investment in financial assets. As mentioned earlier, the HFC report (RBI, 2017) documents that an

overwhelming proportion of Indian households own physical assets. Among physical assets, housing takes centre stage. The relationship between housing and financial assets is ambiguous. One set of studies suggests that housing substitutes financial investment (Zou and Deng,2019; Cocco,2005; Flavin Yamashita,2002), whereas another set of studies indicates that housing may increase financial investments (He et al.,2019; Cardak and Wilkins, 2009; Fratantoni,1998). The former studies argue that the committed expenditure associated with homeownership may reduce financial investment. In contrast, the latter argues that the homeowners are wealthy and have higher home equity, leading to higher investment in financial assets. However, most of the research regarding homeownership in the Indian context comprises what drives homeownership: the demand side. Gopalakrishnan et al. (2019) is the only study that sheds light on the fact that Indian households often invest in financial assets as a transitory investment, and households that invest in a house in the earlier period are less likely to invest in financial assets in the next period. The central research question of Chapter 4 is to examine whether housing investment among Indian households affects their financial investment. Investigating the effect of housing in India is worthwhile as the HFC report (RBI, 2017) highlights that a large fraction of the population across all wealth categories is homeowners (over 60 percent in the lowest wealth quintile to over 90 percent in the highest wealth quintile), which is higher than not only that of advanced economies like the United States, United Kingdom, and Germany but is also higher than Thailand and is very close to China.

The fourth research question explores whether internet density can determine household's insurance uptake. In 2020, the penetration of insurance in India was 4.2 percent, below the average of 9.4 percent for the OECD countries[2]. National Bank for Agriculture and

[2] Source: OECD statistics: https://stats.oecd.org/Index.aspx?DataSetCode=INSIND

Rural Development (NABARD) All India Rural Financial Inclusion Survey (NAFIS)-2017[3] reports that over 30 percent of households agree with the statements "*I tend to live for today and let tomorrow take care of itself"*, "*Money is there to be spent*" and "'*I find it more satisfying to spend money than to save for the long-term*" indicating a polarisation towards spending money and having short term orientation towards financial planning and hence, in turn, lower insurance uptake. Additionally, product complexity and behavioural factors like trust issue in institutions and lack of awareness and understanding of the product, its features, and benefits lead to an aversion to the uptake of insurance products (Cole et al., 2013) also have an impact on the take-up of the product. The HFC report (RBI, 2017) documents time inconsistency in the payoffs related to owning insurance as a reason for the low uptake of the product. International evidence suggests several means to improve the risk management practice of the households, such as higher income, education, and urbanisation (Hwang and Gao,2003), banking sector development (Beck and Webb,2003), social connection (Cai et al.,2015), etc. Chapter 5 empirically investigates whether internet density in the district is one of the predictors of insurance demand by Indian households. Evidence suggests that internet use results in improved financial outcomes in several country contexts (Benlagha et al.,2020; Pellegrina et al.,2017). However, internet density in India which is 43 percent which is much lower than that of advanced countries[4] (94.8 percent in the United Kingdom, 90.9 percent in the United States). Noteworthy is the fact that internet density in India has been growing at a fast pace; hence exploring the role of internet density as a tool to improve the insurance behaviour of households in India is a worthwhile exercise.

[3] https://www.nabard.org/auth/writereaddata/tender/1608180417NABARD-Repo-16_Web_P.pdf
[4]Source: World Bank

Chapter 2

Role of financial literacy in affecting financial behaviour of individuals[5]

Summary

The primary goal of this chapter is to search for a way to improve household financial behaviour. To do that, we use the nationally representative Financial Inclusion Insights survey conducted in India in 2018 for our analysis and empirically analyse whether financial literacy can improve the financial behaviour of individuals in the context of emerging markets like India. We consider the financial literacy score based on the standard financial literacy quiz that includes questions related to basic numeracy, interest rates, inflation, and diversification concepts. This study examines the effect of financial literacy on timely bill-payment and savings behaviour. Using an instrumental variable approach, we account for the possible endogeneity associated with the financial literacy variable. Very few individuals have correctly answered all the questions capturing all four aspects of financial literacy. Our analysis suggests that improvements in financial literacy scores increase the likelihood of exhibiting superior financial behaviour. The results are robust to alternative methods, alternate definitions of financial literacy, outcome variables, and the inclusion of additional controls. We find financial literacy enhances financial planning, possibly improving financial behaviour. The effects are prominent for those with more confidence, males, and those residing in urban areas. This is among the few studies that provide insights regarding how improvements in financial literacy

[5]This chapter is published as an article https://www.emerald.com/insight/content/doi/10.1108/MF-09-2021-0440/full/html
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can improve financial behaviour in an emerging economy context. Further, the heterogeneous effects based on gender and area of residence underscore the need for complementary policies.

Keywords: Financial literacy, financial behaviour, financial planning

2.1 Introduction

Financial decisions of individuals affect life outcomes, including economic well-being, health outcomes, and intergenerational wealth transfer, among others. Evidence suggests that inefficient financial decision-making and financial mistakes are widespread. Financial mistakes committed by households range from low levels of participation in the stock market, inadequate portfolio diversification, a tendency to invest in local firms, inability to select a fee-minimising portfolio as well as suboptimal use of credit cards (Choi et al., 2009; Campbell, 2006). Even though sound financial decision-making is essential for individuals residing in both advanced and emerging economies, it assumes greater importance in the latter context given the absence of social security, a significant proportion of the population engaged in agriculture or the informal sector, along with rising life expectancy. In the developing world, access to financial services remains a critical challenge, and countries have implemented national policies targeting the financial inclusion of people with low incomes.

Given the importance of financial decision-making, policymakers across the world have focused on ways and means to improve financial behaviour. Financial literacy and investments in financial education programs to improve consumers' financial behaviour have taken centre stage. Financial literacy is believed to be a significant ingredient of sound financial decision-making and can equip individuals so they are less likely to commit financial mistakes. In layman's language, financial literacy refers to the understanding of financial concepts,

awareness regarding products and institutions, and the capability to manage one's own money. The role of financial literacy greatly varies across developed and developing countries. Several studies find that financial literacy affects economic outcomes in a developed country. Specifically, studies in developed countries find that individuals with low levels of financial literacy are less likely to participate in the stock market (van Rooij et al., 2011). Lower financial literacy is also found to be related to holding costly household debt (Moore, 2003).

The level of financial literacy is lower in developing countries compared to the developed world. In BRICS nations[6], only 28 percent of adults are financially literate. For G7[7] countries, it stands around 55 percent (Global Financial Literacy Excellence Centre Report, 2017). OECD/INFE (2017) reports that India lacks financial knowledge and some financial behaviour compared to the average of the G-20[8] countries and Asian economies. Few studies in a developing country setting highlight the benefits of financial literacy. Grohmann (2018) finds that higher financial literacy among the middle class in Thailand leads to better savings behaviour and borrowing patterns. Studies on emerging economies in Europe suggest that financial literacy is related to better retirement planning and diversification (Klapper and Panos, 2011). Financial literacy improves an individual's ability to face macroeconomic shocks (Klapper et al., 2013). Using field surveys, Cole et al. (2009) find that financial literacy positively predicts the demand for financial products in developing countries.

Chapter 2 contributes to the literature in three ways. First, we contribute to the limited but growing evidence that documents the benefits of financial literacy for household finance in

[6] Brazil, Russia, India, China and South Africa

[7] Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States

[8] Argentina, Australia, Brazil, Canada, China, European Union, France, Indonesia, India, Italy, Mexico, Japan, Korea, Germany, Russia, South Africa, Turkey, Saudi Arabia, the United Kingdom, and the United States.

the context of developing country settings. Second, earlier studies do not extensively explore any channel through which financial literacy can affect individuals' financial behaviour. Our study provides evidence that financial planning is one of the possible channels through which financial literacy can improve financial behaviour. Third, we provide a snapshot of the financial literacy landscape in India using nationally representative data after the introduction of Pradhan Mantri Jan Dhan Yojana (PMJDY) in 2014. Earlier, Indian studies were based on smaller surveys that were not nationally representative. The study indicates that in addition to easing the supply-side bottlenecks, improving financial literacy can increase the demand for financial products and inculcate good financial behaviour among individuals in India.

The remainder of the chapter is organised as follows. Section 2.2 discusses the literature review, and Section 2.3 proposes the conceptual framework and research question. Section 2.4 elaborates on the data and variables of the study, while section 2.5 explains the methodology employed in the chapter. Section 2.6 describes the results and Section 2.7 discusses the robustness tests. Section 2.8 highlights the possible channel, whereas section 2.9 presents some heterogeneous effects of the results. Finally, Section 2.10 discusses the result of the study.

2.2 Literature review

The extant literature suggests that financial literacy is significant in determining financial behaviour (Allgood and Walstad,2016; Hastings et al.,2013; Carpena et al.,2011; Hogarth et al.,2002). The handbook of the Organisation for Economic Co-operation and Development International Network on Financial Education (OECD/INFE 2016, 47) comprehensively defines financial literacy as "*A combination of awareness, knowledge, skill, attitude and*

behaviour, necessary to make sound financial decisions and ultimately achieve individual financial well- being[9]*".*

Low financial literacy and knowledge levels lead to suboptimal financial outcomes. Hogarth et al. (2003) observe that financial knowledge and learning experience consistently influence US households' financial behaviour patterns, including cash flow management, savings, and investment style. Further, papers find that a lack of understanding of finance and economics may hinder stock market participation (van Rooij et al.,2011; Christelis et al.,2010). Similarly, Yoshino et al. (2017) provide evidence that an individual's financial literacy affects savings behaviour and financial inclusion in Japan. Others find that financial literacy is related to retirement planning (Parker et al.,2012; Lusardi and Mitchell, 2007, 2008, 2011), wealth accumulation (Behrman et al.,2012), and proper portfolio diversification (Campbell,2006). Robb and Woodyard (2011) highlight a strong association between objective and subjective financial knowledge and overall financial behaviour (including setting emergency savings). Lusardi (2006) finds that financial literacy affects monetary behaviour and economic well-being. Similarly, many other studies document that financial literacy is crucial for financial well-being (Kamakia et al.,2017, Adam et al.,2017).

Another set of studies analyses the effect of financial literacy on debt behaviour. Agarwal et al. (2015) provide evidence for financial competence that drives the ability to make better decisions regarding borrowings. Further, studies explore that low levels of financial literacy are associated with high loan costs (Lusardi and Tufano, 2009) and poor mortgage choice

[9] OECD(2005): Financial literacy is the process by which financial investors improve their understandings of financial products and concepts; and through information, instruction and objective advice, develop skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help and to take other effective actions to improve financial well-being.

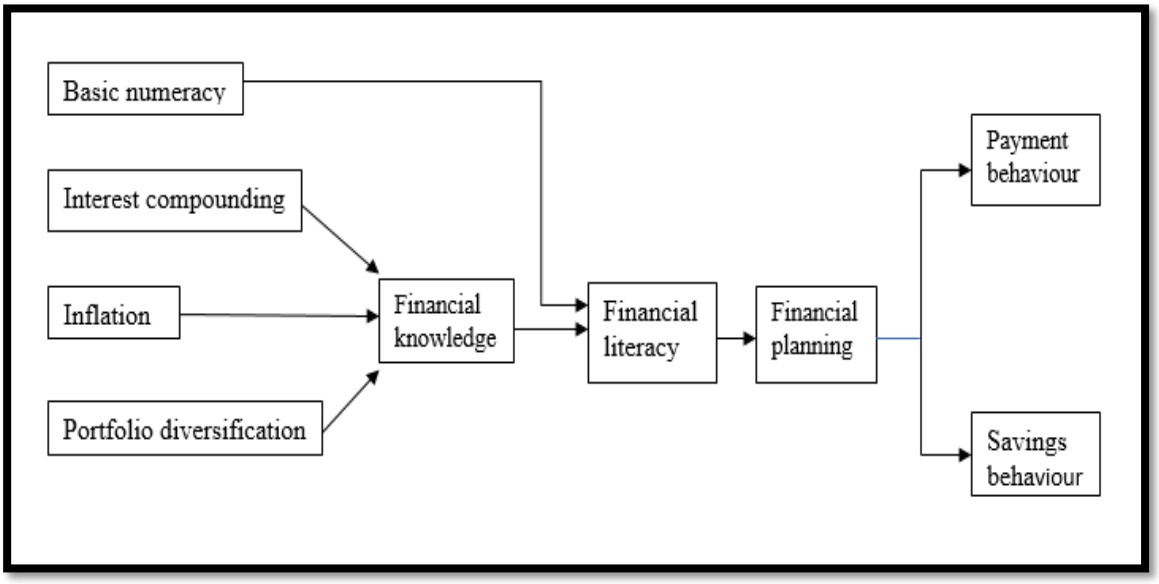
(Moore,2003). Individuals with money management courses appear to improve their behaviour regarding credit card bill payments (Mandell and Klein,2009). Further, Xu and Zia (2012) document that the effectiveness of financial literacy programs varies from high-income to low-income countries. Hence, studies also examine the role of financial literacy, especially in developing country settings. Primarily, these are based on small-scale surveys or randomised controlled trials. Grohmann (2018) finds that higher financial literacy improves financial decision-making in middle-class Asian households. The paper indicates that financially literate individuals are more likely to own assets and fixed deposits than savings accounts. In another study, Grohmann et al. (2018) find that financial literacy leads to higher financial depth through financial inclusion. Studies also find that financial education is associated with poverty reduction in low-income countries (Holzmann, 2010; Sebstad and Cohen, 2003). Additionally, Dalkilic and Kirkbesoglu (2015) identify a significant difference between the insurance awareness of Turkish students with and without financial literacy. On the contrary, other studies find financial literacy is insignificant for insurance demand or awareness (Lin et al.,2019). Mustafa et al. (2023) document that financial behaviour and financial literacy significantly contribute to sound retirement planning of individuals in developing countries like Malaysia.

2.3 Conceptual framework and research question

Financial literacy can affect the financial behaviour of individuals in several ways. A simple framework linking financial literacy and financial behaviour is given in Figure 2.1. We consider financial planning or goal-setting for the next few months as the possible channel for financial literacy. Personal financial planning may be defined as the preparation for an individual's or household's future financial needs efficiently. The theory of personal financial planning, originated by Modigliani and later on by Becker and Markowitz, reports financial planning as

the procedure that includes all items of financial interest, like cash flow, tax planning, retirement planning, risk management, and investment. Hershey et al. (2017) suggest that financial planning and savings behaviour are predicted based on three psychological factors: Perceived financial knowledge, planning, and future orientation, which are influenced by demographic factors like age, gender, and income. Therefore, the planning regarding the usage of money may act as a channel for the financial behaviour of the individuals, like savings or activities involved with clearance of due payment on time.

Figure 2.1: Conceptual framework



In the Indian context, few studies explore the contribution of financial literacy. For example, Agarwalla et al. (2015) examine the extent of financial literacy among working young of urban India. Studies explore that programs targeting financial literacy improve financial behaviour (Fernandes et al.,2014; Walstad et al.,2010). Carpena et al. (2011) find that financial literacy programs can improve awareness regarding financial instruments and behaviour; however, it does not affect an individual's ability to calculate and compare interest returns, insurance costs,

household income, and expenses. In contrast, Gaurav and Singh(2012) show that financial literacy is positively related to cognitive ability of the rural Indian farmers. Agarwal et al. (2015) find that financially literate ones are more interested in financial planning in the Indian context. Given the dearth of studies that use nationally representative data to examine the impact of financial literacy on financial behaviour in emerging economies in India, we intend to fill this gap in the literature by exploring the relationship between financial literacy and financial behaviour represented by two outcome measures, i.e., timely bill-payment and savings behaviour.

2.4 Data and variables

2.4.1 Data

This chapter uses the secondary data collected by the Financial Inclusion Insight (FII) survey. FII is a nationally representative survey conducted by the global research firm InterMedia and is supported by the Bill and Melinda Gates Foundation. The survey provides insights regarding the demand and use of financial instruments by individuals, along with responses to financial literacy questions who were at least 15 years old at the time of the survey. It also provides information regarding the socio-demographic characteristics of the respondents. FII surveys have been conducted in several countries, including India, Bangladesh, Pakistan, Uganda, Kenya, Tanzania, Nigeria, and Indonesia to track access and demand for financial services, specifically digital financial service (DFS), adoption measures, and use of it, identify drivers and barriers to further adoption of DFS, the assess the performance of mobile money agents; and produce forward-looking and actionable insights based on detail information to support product and service delivery and its development. Among the countries mentioned above, FII has surveyed India since 2014. We employ the India wave of the most recent Financial Inclusion Insight Survey conducted in 2018(FII-2018) for our analysis. FII-2018 covers 48,027

individuals across 28 states and union territories of India (except for Jammu and Kashmir, the union territories of Lakshadweep and Andaman and Nicobar). Studies exploring household finance and financial inclusion in India also widely used this data (Biswas, 2021; Ghosh, 2017).

2.4.2 Variables

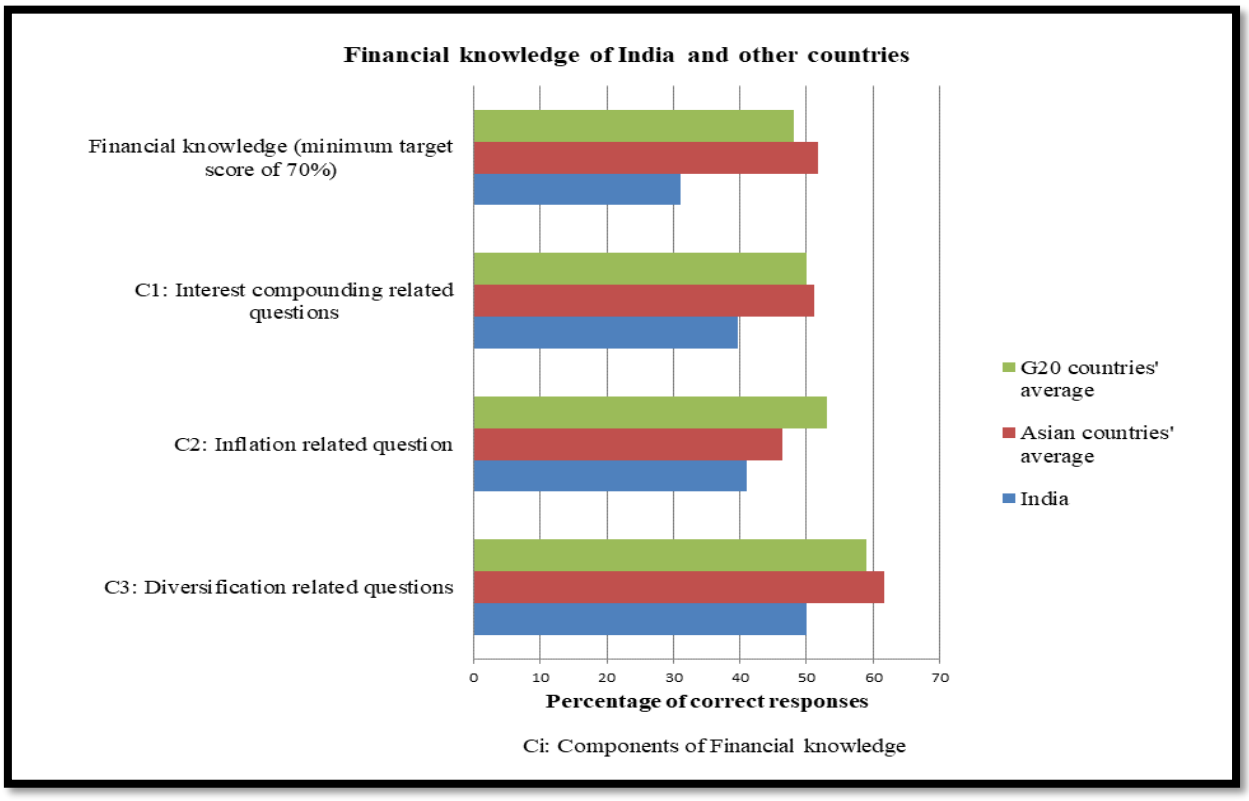
In this study, we capture an individual's financial behaviour with the help of two binary variables – *timely bill-payment behaviour and savings behaviour*. The *bill-payment behaviour* is defined as one if individuals pay bills on time in full and zero otherwise. *Savings behaviour* is coded as one if an individual saves or invests in any assets and zero otherwise. Our main interest variable is the financial literacy of the individuals. The FII-2018 survey administers the standard financial literacy questions proposed by the OECD[10] and is widely used in the literature (Lusardi and Mitchell, 2011, 2009)[11]. Carpena et al. (2011) suggest that financial literacy and mathematics training are necessary to improve financial awareness. In line with the suggestion, we define financial literacy as the combination of basic numeracy and financial knowledge. The basic numeracy questions capture an individual's ability to add, divide, multiply, and understand the concept of percentages. Further, three additional financial knowledge questions are related to money illusion (inflation), compound interest rate, and portfolio diversification. Several studies use responses to such questions to measure financial literacy (Morgan and Long,2020; Kim and Lee,2018; Grohmann et al.,2018; Yoshino et al.,2017; Klapper et al.,2015; Babiarz and Robb,2014; Van Rooij et al.,2011). Figure 2.2 depicts a comparative study of correct

[10] See Table A1.1 of the Appendix for the questions

[11] The financial literacy questions developed by Lusardi and Mitchell (2009) are the following: (1) Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, or less than $102?, (2) Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account? (3) Do you think that the following statement is true or false? “Buying a single company stock usually provides a safer return than a stock mutual fund.”

responses to the questions regarding interest compounding, inflation and diversification with the average of G-20 countries and Asian economies (OECD/INFE, 2017). For the main analysis, we define the financial literacy variable as the total score secured by the individuals in the financial literacy quiz. We assign one point for each correct response to the eight questions related to basic numeracy and financial knowledge (interest rate, inflation, and portfolio diversification). Hence, the financial literacy score in our study ranges from zero to eight. In our robustness section, we consider an alternate definition of financial literacy and re-estimate the models.

Figure 2.2: Comparative study of financial behaviour and financial knowledge
(Source: OECD/INFE Report,2017)



We control for potential confounders that may affect financial behaviour in line with the literature. In our model, we control for smartphone ownership, confidence in own financial

management skills, marital status, gender, age, educational status, economic status, employment status, religion, sector dummy (one for those from the urban sector), and district fixed effects. Table 2.1 provides the definition of the variables used in the study.

Table 2.1: Variable description

The following table represents the description of the variables used in the analysis.

Variable	Description
Outcome variables	
Financial behaviour variables	
Timely bill-payment behaviour	Dummy variable, 1 if the individual strongly agrees or somewhat agrees with the below-given statement, 0 if strongly disagrees, somewhat disagrees, or remains neutral. Statement: You pay your bills on time and in full.
Savings behaviour	Dummy variable, 1 if the individual strongly agrees or somewhat agrees with the below-given statement, 0 if strongly disagrees, somewhat disagrees or remains neutral. Statement: You have savings or assets that will keep you financially secure in the future.
Sound financial behaviour	Dummy variable, 1 if the timely bill-payment payment behaviour dummy and savings behaviour dummy takes the value one, and 0 otherwise.
Repayment	Dummy variable, 1 if the individual has repaid the money that one has owed through any means, and 0 otherwise.
Institutional savings	Dummy variable, 1 if the individual has savings in any formal institution in the last one year, and 0 otherwise.
Interest variables	
Financial literacy variables	
Financial literacy score	The total score secured by the individual in the financial literacy quiz.[12]
Financially literate dummy	Dummy variable, 1 if the individual responds to all questions correctly in the financial literacy quiz, 0 otherwise.
Financial knowledge score	The total score secured by the individual against the questions related to interest compounding, inflation and diversification in the financial literacy quiz.
Weighted financial literacy score	The total score secured by the individual by awarding unequal weight[13] for in the financial literacy quiz.

[12]See Table A1.1 for the questions asked in the quiz.

[13] Total weighted financial literacy score ranges from 0 to 4. Weights provided for questions related to different segments are given below:

Question related to-	Weights	Number of questior	Total score=(weight*number of questions)
Basic numeracy	0.25	4	1
Compound interest	0.5	2	1
Inflation	1	1	1
Diversification	1	1	1

Variable	Description
Control variables	
Smartphone	Dummy variable, 1 if an individual uses smartphone, 0 otherwise.
Confidence	Dummy variable, 1 if the individual strongly agrees or somewhat agrees with the following statement, 0 if strongly disagrees or somewhat disagrees or remains neutral. Statement: you have the skills and knowledge to manage your finances well.
Marital status	Dummy variable, 1 if the individual is married, 0 otherwise.
Male	Dummy variable, 1 if the individual is male, 0 for female.
Age	Age of the individual in years
Education: Graduation and above	Dummy variable, 1 if the individual completes graduation or above, 0 otherwise.
Poor	Dummy variable, 1 if the individual lives under $2.50 per day in 2005 PPI[14] in USD, 0 otherwise.
Occupation: Regular Salaried	Dummy variable, 1 if the individual is regular salaried, 0 otherwise.
Religion	Categorical variable: 1 for Hindu, 2 for Muslims,3 for Christians and others.
Urban	Dummy variable, 1 if the individual resides in the urban area, 0 for rural areas.
Farm	Dummy variable, 1 if the individual owns farmland and 0 otherwise.
Card	Dummy variable, 1 if the individual has Rupay, debit, ATM or credit card, 0 otherwise.
Age squared	Quadratic of the individual's age.
Financial planning	Dummy variable, 1 if the individual strongly agrees or somewhat agrees with the below-given statement, 0 if strongly disagrees, somewhat disagrees, or remains neutral. Statement: You have goals for the next few months for what you want to achieve with your money.
Instrument	
Share of graduates	Share of individuals in the town/ village who have completed at least graduation.

[14] PPI – A measurement tool wherein a set of country-specific survey questions are used to compute the likelihood that an individual's income is below a specific threshold.

2.5 Methodology

Given the binary nature of the outcome variables, the probit model is an ideal candidate for estimating the relationship between financial literacy and financial behaviour. However, the financial literacy variable is likely to be endogenous owing to the omission of important factors like innate ability or IQ, or mathematical ability that can simultaneously affect financial literacy and behaviour. On the other hand, endogeneity may occur from the reverse causality issue, referring to the fact that participating in any financial activity may enhance the individual's financial literacy. Therefore, the probit coefficients will be biased and inconsistent in the presence of endogenous variables. To address the concern of endogeneity, we employ an instrumental variable method in our study. An instrumental variable approach to estimate the causal effect of financial literacy on outcomes is widely used (Grohmann et al., 2018; Kim and Lee, 2018; Bucher-Koenen and Lusardi, 2011).

A variable will classify as an instrument if it is correlated with financial literacy but is otherwise uncorrelated with the financial behaviour variables. Lachance (2014) finds that the community network effect may influence an individual's level of financial literacy. Studies also suggest that social interaction in the neighbourhood can influence the attainment of skills and knowledge, but it is unlikely to affect the financial outcome of the individual (Kim and Lee, 2018; Bucher-Koenen and Lusardi, 2011). Using similar logic, we consider the share of graduates and above individuals in the neighbourhood (city or village level) as an instrument. Studies suggest that higher education is also positively correlated to financial literacy (Morgan and Long,2020; Grohmann,2018). Residing in a neighbourhood where more individuals have completed college education is likely to have a higher average financial literacy. Social interaction and community networks, in turn, are likely to be positively correlated with one's

own financial literacy but should be unrelated to the financial behaviour of an individual. Hence, we consider the following two-stage instrumental variable probit model for the analysis.

$$Financial\ literacy_{ind} = \beta_0 + \beta_1 Share\ of\ graduates_{nd} + \sum \beta_k X_{kind} + District_d + \varepsilon_{1ind} \quad (2.1)$$

$$L_{ind} = \delta_0 + \delta_1 \widehat{Financial\ literacy}_{ind} + \sum \gamma_k X_{kind} + District_d + \varepsilon_{2ind} \quad (2.2)^{15}$$

Equation (2.1) gives the first stage regression wherein we estimate a linear probability model of financial literacy on the instrument (share of graduates) and other control variables given by vector X_{kind}. ε_{1ind} corresponds to the random shocks to the financial literacy variable. A positive and significant β_1 indicates that the instrument is correlated with the financial literacy score. Equation (2.2) gives the second stage probit model wherein we obtain the log-likelihood of the financial behaviour variables (timely bill-payment behaviour and savings behaviour) as a function of predicted value of financial literacy obtained from equation (2.1) and the other controls. A positive and significant estimate of coefficient will imply that financial literacy is welfare-improving and is related to superior financial behaviour. Further, we consider robust standard errors to account for heteroscedasticity in our data.

2.6 Results

2.6.1 Descriptive statistics

Table 2.2 suggests that, on average, 96 percent of the individuals correctly answer the basic numeracy questions, and gradually, the proportion of correct responses decreases as we go for other questions. Specifically, 66 percent of the respondents can correctly answer the interest rate question, whereas 41 percent correctly answer the inflation question, and a mere 20 percent

[15] Equation 2.2 is equivalent to $\Pr(Y = 1 | X_{kind}) = f(\widehat{Financial\ literacy}_{ind})$

understand the importance of portfolio diversification. We find that correct responses regarding all concepts except diversification are more or less comparable to developed countries (Figure 2.2). Overall, only 3.3 percent of the respondents answered all questions correctly. Thus, except for basic numeracy, the level of financial literacy is not widespread among respondents, and they exhibit familiarity with only a few financial concepts. Table 2.2 represents financial literacy across several social and demographic groups. Our data shows that financial literacy is higher for respondents with smartphones, enough confidence in their financial management skills, higher education, male and non-poor, employed and residing in urban areas. This pattern is similar to those observed in other studies in the context of Asian economies (Morgan and Long,2020; Grohmann, 2018).

Table 2.2: Financial literacy across socio-demographic groups

The table below presents the proportion of individuals who have correctly answered the various financial literacy questions in across socio-demographic factors like employment status, education, age, marital status, gender, religion, area of residence, confidence on own financial skills and poverty status.

	(1)	(2)	(3)	(4)	(5)
	Basic numeracy	Interest	Inflation	Portfolio diversification	All eight
Smartphone					
Owner	99.8	78.7	46.3	26.2	5.5
Non-owner	95.2	63.7	39.4	19.1	2.8
Confidence					
Confident	97.3	70.7	44.1	22.2	4.1
Non-confident	94.9	62.6	37.7	18.8	2.5
Marital status					
Married	95.3	64.8	39.6	19.7	3.1
Unmarried	98.6	72.3	44.4	22.8	3.9
Gender					
Male	98.1	71.2	43.1	22.5	3.9
Female	93.7	60.9	37.9	18.0	2.6
Age					
Young	98.3	70.9	42.7	22.1	3.8
Old	94.8	63.7	39.5	19.4	2.9
Education					
Graduation	99.7	82.5	48.3	26.1	5.8

	(1)	(2)	(3)	(4)	(5)
	Basic numeracy	Interest	Inflation	Portfolio diversification	All eight
and above					
Below graduation	95.7	65.2	40.1	19.9	3.1
Economic status					
Poor	94.9	62.8	38.7	18.9	2.9
Non-poor	98.2	73.6	44.6	23.3	4.0
Occupation					
Non-regular salaried	97.2	67.9	42.5	21.8	3.4
Regular salaried	95.4	65.4	39.7	19.6	3.2
Religion					
Hindu	95.9	66.7	40.3	19.9	3.2
Muslim	96.5	62.7	39.9	20.9	3.5
Others	96.2	67.4	46.1	25.1	3.2
Area of residence					
Urban	97.6	70.0	43.3	21.3	3.7
Rural	95.2	64.5	39.4	19.9	3.0
Overall	95.9	66.3	40.6	20.3	3.3

Figure 2.3 shows that the adults with higher financial literacy scores have better financial behaviour (Figure 2.3). For instance, there is a massive difference between the proportion of individuals with timely bill-payment behaviour for the lowest and highest financial literacy scores. Likewise, the proportion of the sample saving for future security increases with the rise in financial literacy score. Overall, we observe that 55.5 percent of adults pay their bills on time, whereas 41 percent of individuals intend to save for future security. Additionally, we see that the financial behaviour of the individuals who answer only a few questions correctly and secure lower marks is poorer than the ones who answer a greater number of questions correctly and secure higher scores (Figure 2.3). Gradually, the behaviour is improved for individuals with increasing financial literacy scores.

Figure 2.3: Financial literacy and financial behaviour

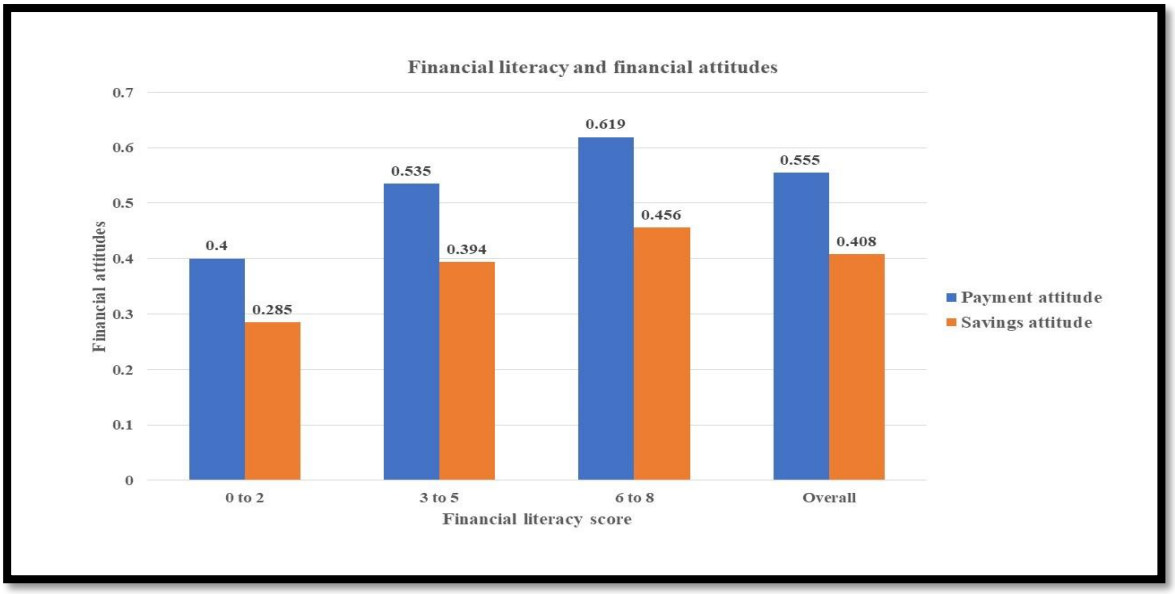


Table 2.3 presents the descriptive statistics for financial literacy and other explanatory variables. The average financial literacy score secured by the individuals is 4.8 out of 8. In our sample, around 17 percent own smartphones hence, have access to the internet and 45 percent people are confident regarding their own financial management skill. Based on the PPI measures mentioned in Table 2.1, 68 percent are poor on average. Columns 2 and 3 of Table 2.3 represent the means based on the median of financial literacy score. However, adults with higher financial literacy scores are likely to have higher educational attainment, confidence in their own financial management skills, employment status, and smartphone ownership. Moreover, a higher number of less financially literate individuals are poor. Further, we see that more number of adults with more financial literacy scores are regularly salaried compared to the counterparts. The descriptive statistics indicate that financial literacy is possibly related to better financial behaviour, which we explore further using a multivariate regression framework.

Table 2.3: Descriptive statistics

The following table presents the mean of the variables along with the standard deviation in parenthesis for the overall sample and also based on the financial literacy scores. The level of significance mentioned in the table is based on the t-test done to check the equality of means for financial literacy score below and above the median. Standard deviations are in parenthesis *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
	Overall	Financial literacy score below 5	Financial literacy score above 5
Financial literacy score	4.808	2.924	5.922***
	(1.785)	(1.267)	(0.884)
Smartphone	0.172	0.101	0.215***
	(0.378)	(0.301)	(0.411)
Confidence	0.451	0.380	0.493***
	(0.497)	(0.485)	(0.499)
Married	0.804	0.856***	0.774
	(0.397)	(0.351)	(0.419)
Male	0.519	0.429	0.574***
	(0.499)	(0.494)	(0.494)
Age	37.715	40.484***	36.079
	(15.643)	(16.534)	(14.852)
Education: Graduation and above	0.064	0.028	0.085***
	(0.245)	(0.166)	(0.435)
Poor	0.679	0.756***	0.633
	(0.467)	(0.429)	(0.482)
Occupation:			
Regular Salaried	0.334	0.314	0.346***
	(0.472)	(0.464)	(0.476)
Religion:			
Hindu	0.847	0.838	0.852***
	(0.360)	(0.368)	(0.355)
Muslim	0.099	0.112***	0.093
	(0.299)	(0.315)	(0.290)
Others	0.053	0.050	0.055***
	(0.224)	(0.218)	(0.228)
Urban	0.316	0.265	0.346***
	(0.465)	(0.441)	(0.476)
Observations	48,027	18,133	29,894

2.6.2 Main results

Table 2.4 reports the probit coefficients of the financial literacy variable for timely bill-payment behaviour and savings behaviour, respectively after controlling for other factors. The financial literacy variable is positive and significant in both the specifications, i.e., *timely bill-payment behaviour and savings behaviour* (Column 1-2). Additionally, by analysing marginal effects,

we find that a one-unit increase in financial literacy score leads to higher likelihood of tiemly bill-payment and savings behaviour by 1.9 and 1.4 percentage points, respectively.

Regarding control variables, we find that the individuals owning smartphones are more likely to have a better financial behaviour. Moreover, married and educated persons also like to exhibit positive financial behaviour. Further, the result indicates that individuals with confidence in their financial management skills are more likely to have good timely bill-payment behaviour and higher savings behaviour. On the other hand, regular salaried people have significantly better timely bill-payment behaviour than self-employed or casual labour, but we do not observe any significant relationship between regularity of salary and savings behaviour. Moreover, male adults exhibit better financial behaviour than female ones. Additionally, we find that poor ones are less likely to have good financial behaviour.

Table 2.4: Main results

The following table represents coefficients obtained from the probit regression of financial behaviour variables- behaviour towards timely bill-payment and savings - on financial literacy score after controlling for other factors. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)
	Timely bill-payment behaviour	*Savings behaviour*
Financial literacy score[16]	0.063***	0.051***
	(0.004)	(0.004)
Smartphone	0.139***	0.140***
	(0.020)	(0.020)
Confidence in own financial skill	0.995***	1.372***
	(0.014)	(0.015)
Married	0.196***	0.138***
	(0.019)	(0.020)
Male	0.085***	0.042***
	(0.014)	(0.015)
Age	0.003***	0.003***
	(0.000)	(0.001)
Education: Graduation and above	0.116***	0.125***
	(0.029)	(0.028)

[16] The average marginal effect of the variable financial literacy score is 0.017*** and 0.014*** for payment behaviour and savings behaviour respectively.

	(1)	(2)
	Timely bill-payment behaviour	*Savings behaviour*
Poor	-0.170***	-0.181***
	(0.016)	(0.017)
Occupation: Regular Salaried	0.026*	0.001
	(0.015)	(0.016)
Religion (Base: Hindu)		
Muslim	-0.030	-0.080***
	(0.023)	(0.025)
Others	0.011	0.003
	(0.034)	(0.035)
Urban	0.082***	-0.038**
	(0.016)	(0.017)
District fixed effects	Yes	Yes
Constant	-0.814***	-1.692***
	(0.091)	(0.108)
Observations	47,926	47,926

2.6.3 Endogeneity concerns

Table 2.5 presents the coefficients of two-stage instrumental variable probit models (IV-probit). In line with our first hypothesis, we find that financial literacy increases the likelihood of good timely bill-payment behaviour (Column 1). Further, financially literate adults are more likely to save or invest for the future (Column 2). Additionally, we check for the average marginal effects and find that financial literacy improves the likelihood of timely bill-payment and savings behaviour by 11.8 and 7.1 percentage points, respectively. These findings provide credence to our hypothesis and emphasise the need to invest in financial literacy in India to improve financial awareness.

With respect to controls, we observe that smartphone ownership is insignificant for timely bill-payment behaviour but positively related to savings behaviour. Studies find that confidence in financial knowledge among adults enhances financial decisions or outcomes (Allgood and Walstad, 2016; Babiarz and Robb, 2014). Similarly, we also find that individuals with confidence in their financial management skills significantly improve their timely bill-payment behaviour and savings behaviour. Next, we observe that married individuals are more

likely to have good financial behaviour. Additionally, our result suggests a positive and significant association between age and financial behaviour variables in line with other studies (Morgan and Long,2020; Thomas and Spataro,2018), indicating that older ones are more likely to exhibit better financial behaviour. Further, our result suggests a significant negative association of timely bill-payment behaviour with male individuals, recommending that female persons have better timely bill-payment behaviours. This result is in contrast with Babiarz and Robb (2014) but in line with Morgan and Long (2020) and Grohmann (2018). On the other hand, we do not find any significant association between savings behaviour and the gender of the individual. Unlike other studies, we do not see any significant relationship between education, economic status, and employment status with financial behaviour variables.

Table 2.5: Endogeneity concerns

The following table represents the IV-probit second stage (Columns 1 and 2) and first stage coefficients (Column 3) of financial behaviour variables - behaviour towards timely bill-payment and savings on financial literacy and other factors. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
	Timely bill-payment behaviour	*Savings behaviour*	*Financial literacy score (First stage)*
Financial literacy score[17]	0.405***	0.253*	
	(0.095)	(0.141)	
Share of graduates in the town/ village			0.667***
			(0.123)
Smartphone	0.057	0.099**	0.158***
	(0.037)	(0.040)	(0.020)
Confidence in own financial skill	0.726***	1.241***	0.260***
	(0.141)	(0.151)	(0.016)
Married	0.129***	0.112***	0.091***
	(0.036)	(0.031)	(0.021)
Male	-0.143**	-0.084	0.603***
	(0.072)	(0.092)	(0.016)
Age	0.010***	0.007**	-0.023***
	(0.002)	(0.003)	(0.001)
Education: Graduation and above	-0.052	0.032	0.406***
	(0.062)	(0.076)	(0.027)

[17] The average marginal effect of the variable financial literacy score is 0.118*** and 0.071*** for payment behaviour and savings behaviour respectively.

	(1)	(2)	(3)
	Timely bill-payment behaviour	*Savings behaviour*	*Financial literacy score (First stage)*
Poor	-0.012	-0.097	-0.357***
	(0.058)	(0.069)	(0.018)
Religion: Base: Hindu			
Muslim	0.016	-0.052	-0.107***
	(0.026)	(0.033)	(0.027)
Others	0.032	0.016	-0.063*
	(0.032)	(0.035)	(0.038)
Occupation: Regular salaried	0.031**	0.006	-0.025
	(0.014)	(0.015)	(0.017)
Urban	0.009	-0.069***	0.132***
	(0.030)	(0.026)	(0.019)
District fixed effects	Yes	Yes	Yes
Constant	-2.760***	-2.809***	5.898***
	(0.519)	(0.727)	(0.114)
F-statistics			30.184
Stock-Yogo critical value			16.30
Endogeneity test P value			0.009
Observations	47,926	47,926	47,926

Next, Column 3 gives the first stage output wherein we regress the financial literacy score on the neighbourhood graduates' share and other control variables. The coefficient of the instrument is positive and significant at the 1 percent level of significance, indicating that the correlation between the financial literacy variable and the instrument is not weak. The positive association between financial literacy and the share of individuals with a graduate degree in the neighbourhood can be attributed to community networks or peer effects. Further, the significant result of the Wald Chi-sq test obtained from IV-probit regression reinforces that the financial literacy variable is endogenous and that using an instrumental variable method is desirable. We also report the first stage F-statistics; the F-value is greater than the Stock-Yogo critical value[18] (10 percent maximal IV size), further suggesting that our estimation strategy does not suffer from a weak instrument problem.

[18] The estimate is obtained from instrumental variable two-staged least square regression.

2.7 Robustness checks

In this section, we present the robustness check results to ensure that the above-mentioned relationship is not driven by other important omitted variables in the system. For this, we consider the use of alternative techniques, alternate definitions of interest variable, alternate measures of dependent variables, and the inclusion of additional control variables and re-estimate the model.

2.7.1 Alternative estimation technique -Propensity score matching

The instrument used above to address endogeneity may not be relevant or fully exogenous. Therefore, to confirm our result and to address endogeneity, we use the alternative methodology known as Propensity Score Matching (PSM). Propensity score matching is a popular way to make causal inferences in a non-experimental setup (Dehejia and Wahba, 2002). We employ the propensity score matching technique proposed by Rosenbaum and Rubin (1983) with the single nearest neighbourhood to ensure the robustness of the model. We define a financially literate dummy, which takes value one for individuals with scores above the average in the financial quiz and zero otherwise. The treated households are matched with control households based on dependent ratio, age, gender, and education of household head, economic status, religion, caste, sector of residence, and districts. The matched sample consists of 36,148 households. We check the t-test of the financial behaviour of the individuals within this matched sample. Table 2.6 reports the average number of adults in the matched sample for both the financial behaviour specifications, and we observe that the percentage of adults in the treated group have better financial behaviour than of those in the control group, and the differences are significant at a 1 percent level of significance in both the specifications.

Table 2.6: Robustness checks -Alternative estimation technique

The following table presents the summary statistics of financial behaviour variables in the sample matched by Propensity Score Matching Method Based on median financial literacy score. Standard deviations are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
	Treated	Control	Difference	t-stat	No. of observations
Timely bill-payment behaviour	0.551	0.486	0.065***	12.479	36,148
	(0.004)	(0.004)	(0.005)		
Savings behaviour	0.393	0.339	0.054***	10.626	36,148
	(0.004)	(0.004)	(0.005)		

2.7.2 Alternative definitions of interest variable

2.7.2.1 Financially literate dummy

We consider an alternative definition of financial literacy score given by a financially literate dummy. This variable takes the value one if the individual answers all the questions related to numeracy, compounding interest rate, inflation, and diversification-related questions correctly (i.e., obtains the highest score of eight) and zero otherwise. Studies in the literature have considered this measure of financial literacy (Kim and Lee, 2018; Grohmann, 2018). Columns 1 and 2 of Table 2.7 indicate that a financially literate dummy improves timely bill-payment and savings behaviour, respectively. Hence, our main result is robust to using an alternate definition of interest variable.

2.7.2.2 Financial knowledge score

We consider an alternative definition of financial literacy score given by financial knowledge score. This variable is defined as the total scores secured by the individual for the questions related to the three sections provided by interest compounding, inflation, and diversification (HRS, 2004). This measure of financial literacy is used in the literature (Grohmann, 2018;

Agarwal et al., 2015). Columns 3 and 4 of Table 2.7 indicate that financial knowledge score improves timely bill-payment and savings behaviour, respectively. Hence, our main result is robust to using an alternate definition of interest variable.

2.7.2.3 Weighted financial literacy score

In the main analysis, we used equal weights for all the questions irrespective of the sections (basic numeracy, compounding interest rate, inflation, and diversification). Since there is no such specific definition of financial literacy measure, several studies use various techniques for defining the variable. Many studies suggest that basic numeracy skill is not as important as other sections for measuring financial literacy score (Grohman,2018; Agarwalla et al.,2015). Following the studies, we consider an alternative measure of financial literacy by assigning suitable weights according to their significance[19]. Columns 5 and 6 of Table 2.7 suggest that weighted financial literacy scores enhance the likelihood of prompt bill payment and savings behaviour, respectively. Therefore, our main result remains unaffected by the change in the definition of the interest variable.

[19] See Table 2.1 for the definition of weighted financial literacy score.

Table 2.7. Robustness checks-with alternative definitions of interest variable

The following table presents the IV-probit second stage coefficient of regressing financial behaviour variables on alternate definitions of financial literacy. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative definition of financial literacy					
	Timely bill-payment behaviour	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*
Financially literate dummy	4.177***	2.745*				
	(0.945)	(1.506)				
Financial knowledge score			0.705***	0.464*		
			(0.148)	(0.247)		
Weighted financial literacy score					0.836***	0.557*
					(0.169)	(0.291)
Smartphone	0.042	0.088*	0.037	0.086*	0.050	0.095**
	(0.042)	(0.048)	(0.041)	(0.048)	(0.038)	(0.044)
Confident	0.704***	1.212***	0.651***	1.186***	0.644***	1.183***
	(0.161)	(0.190)	(0.169)	(0.204)	(0.167)	(0.207)
Married	0.146***	0.126***	0.129***	0.115***	0.118***	0.110***
	(0.036)	(0.027)	(0.038)	(0.031)	(0.039)	(0.034)
Male	0.043	0.033	-0.070	-0.041	-0.100*	-0.061
	(0.032)	(0.030)	(0.053)	(0.067)	(0.058)	(0.076)
Age	0.002***	0.002***	0.007***	0.005***	0.008***	0.006***
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Education: Graduation and above	0.044	0.090*	-0.061	0.022	-0.032	0.041
	(0.045)	(0.049)	(0.062)	(0.082)	(0.054)	(0.072)
Poor	-0.116***	-0.161***	-0.034	-0.108*	-0.026	-0.103
	(0.038)	(0.038)	(0.053)	(0.064)	(0.053)	(0.067)
Rel: Base: Hindu						
Muslim	-0.034*	-0.081***	0.010	-0.053	-0.003	-0.061**
	(0.021)	(0.025)	(0.025)	(0.033)	(0.023)	(0.030)
Others	0.009	0.003	0.007	0.001	0.007	0.001
	(0.030)	(0.033)	(0.030)	(0.034)	(0.030)	(0.033)
Occupation: Regular salaried	0.040***	0.014	0.025*	0.004	0.021	0.001
	(0.013)	(0.017)	(0.013)	(0.015)	(0.014)	(0.015)
Urban	0.064***	-0.029*	0.037	-0.047***	0.024	-0.055***

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative definition of financial literacy					
	Timely bill-payment behaviour	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*
	(0.020)	(0.016)	(0.024)	(0.017)	(0.026)	(0.019)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.815***	-1.565***	-1.754***	-2.199***	-2.676***	-2.821***
	(0.113)	(0.106)	(0.250)	(0.346)	(0.419)	(0.652)
Observations	47,926	47,926	47,926	47,926	47,926	47,926

2.7.3 Alternative definitions of dependent variables

Next, we re-estimate the models by considering the alternative definition of the dependent variable. We define an indicator variable that takes the value one if the individual has both the features like positive timely bill-payment behaviour and good savings behaviour and zero otherwise. The second stage IV-probit coefficients in Column 1 of Table 2.8 suggest that the financial literacy score positively improves the alternate financial behaviour. Further, we also consider other measures that capture individuals' timely bill-payment and savings behaviour. For example, we consider repayment of owed money and recent savings with formal institutions as an alternate measure of timely bill-payment behaviour and savings behaviour, respectively. Columns 2 and 3 of Table 2.8 represent the regression results of these alternate outcome variables, and the results remain qualitatively unaffected. Table 2.8 again provides evidence regarding the consistency of our results.

2.7.4 Inclusion of additional control variables

We further check the robustness of our results by incorporating some additional control variables in our regression model. In our regression framework, we include farm ownership, ownership of credit/ debit cards, and large family as other control variables and re-estimate the model. Farm ownership and card ownership capture the economic status of the individual,

whereas a large family may capture the family's influence on one's financial behaviour. Columns 4 and 5 of Table 2.8 give the second stage coefficient of the financial literacy variable obtained on estimating IV-probit after including these control variables. Here, we observe a significant association of farm ownership with savings behaviour. In contrast, we do not find any significant association of financial behaviour with debit/credit card ownership and large families. However, the financial literacy variable is positively and significantly associated with both outcome variables, reinforcing our main result's intactness.

Table 2.8: Robustness checks -with alternative definitions of dependent variable and additional controls

The following table presents the IV-probit second stage coefficient of regression of financial behaviour variables on alternate definitions of financial behaviour variables (Columns 1-3) and additional control variables (Columns 4-5). Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
	Alternative measure of dependent variables			Additional controls	
	Sound financial behaviour	*Repayment*	*Institutional savings*	*Timely bill-payment behaviour*	*Savings behaviour*
Financial literacy score	0.396***	0.616***	0.379***	0.417***	0.293**
	(0.100)	(0.029)	(0.109)	(0.090)	(0.130)
Farm ownership				0.029	0.116***
				(0.027)	(0.035)
Card ownership				-0.061	-0.072
				(0.051)	(0.056)
Large family				0.001	0.002
				(0.019)	(0.020)
Smartphone	0.107**	0.091	0.293***	0.069***	0.106***
	(0.044)	(0.098)	(0.068)	(0.025)	(0.027)
Confident	1.076***	-0.163***	0.139**	0.710***	1.197***
	(0.191)	(0.021)	(0.062)	(0.136)	(0.159)
Married	0.106***	-0.064**	0.199***	0.131***	0.112***
	(0.035)	(0.025)	(0.046)	(0.033)	(0.029)
Male	-0.157**	-0.265***	-0.221***	-0.147**	-0.109
	(0.073)	(0.041)	(0.068)	(0.063)	(0.079)
Age	0.011***	0.012***	0.011***	0.010***	0.008***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Education: Graduation and above	-0.028	-0.119**	0.139	-0.050	0.022
	(0.066)	(0.059)	(0.090)	(0.050)	(0.063)
Poor	-0.060	0.121***	-0.042	-0.009	-0.080
	(0.066)	(0.040)	(0.066)	(0.055)	(0.065)

	(1)	(2)	(3)	(4)	(5)
	Alternative measure of dependent variables			Additional controls	
	Sound financial behaviour	*Repayment*	*Institutional savings*	*Timely bill-payment behaviour*	*Savings behaviour*
Religion: Base: Hindu					
Muslim	0.008	0.028	-0.068*	0.019	-0.032
	(0.029)	(0.035)	(0.036)	(0.024)	(0.030)
Others	-0.000	0.071*	0.028	0.033	0.017
	(0.035)	(0.043)	(0.033)	(0.031)	(0.035)
Occupation: Regular salaried	0.007	0.053**	0.099***	0.034**	0.018
	(0.015)	(0.023)	(0.018)	(0.014)	(0.015)
Urban	-0.062***	-0.083***	-0.025	0.019	-0.031
	(0.023)	(0.028)	(0.028)	(0.033)	(0.031)
District fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	-3.687***	-4.347***	-2.808***	-2.820***	-3.044***
	(0.413)	(0.244)	(0.572)	(0.459)	(0.609)
Observations	47,926	23,513	47,819	47,926	47,926

2.8 Financial planning as a possible channel

This section explores the possible pathway that may explain the positive effect of financial literacy on individuals' financial behaviour. Bucher-Koenen and Lusardi (2011) suggest that financial literacy may improve the likelihood of having a financial plan or setting financial goals. Financial planning can, in turn, affect other financial behaviour. Having a financial plan is an indicator that can explain superior financial behaviour among individuals with higher financial literacy scores. We regress financial planning on financial literacy score and other variables and observe that financial literacy is positively related to the probability of planning or setting goals for the future (Column 1 of Table 2.9). Even if we consider the alternate definition of financial literacy (dummy specification or other scores) or add additional control variables, the positive association between financial literacy and the likelihood of financial planning remains intact (Columns 2 to 5). A higher probability of financial planning at the individual level because of financial literacy can be one-way by which financial literacy improves individuals' financial behaviour in India. Therefore, one can infer that financial

planning or goal setting may act as a channel for improving financial behaviour. Agarwal et al. (2015) also find that causation flows from financial literacy to planning to wealth.

Table 2.9: Financial planning as a potential channel

The following table represents the second stage IV-probit coefficients obtained from regressing financial planning variables on financial literacy and other factors. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
	Financial planning	*Financial planning*	*Financial planning*	*Financial planning*	*Financial planning*
Financial literacy score	0.295**				0.294**
	(0.129)				(0.128)
Financially literate dummy		3.201**			
		(1.342)			
Financial knowledge score			0.537**		
			(0.220)		
Weighted financial literacy score				0.639**	
				(0.257)	
Farm ownership					0.014
					(0.026)
Card ownership					0.014
					(0.063)
Large family					-0.038**
					(0.017)
Smartphone	0.059	0.048	0.045	0.055	0.056**
	(0.037)	(0.042)	(0.042)	(0.038)	(0.023)
Confident	0.908***	0.888***	0.855***	0.850***	0.909***
	(0.132)	(0.158)	(0.172)	(0.174)	(0.126)
Married	0.211***	0.220***	0.209***	0.200***	0.209***
	(0.040)	(0.040)	(0.044)	(0.047)	(0.036)
Male	-0.065	0.069**	-0.016	-0.040	-0.066
	(0.090)	(0.034)	(0.068)	(0.076)	(0.082)
Age	0.005*	-0.000	0.003	0.004*	0.005*
	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)
Education: Graduation and above	0.005	0.074	-0.006	0.016	0.003
	(0.072)	(0.048)	(0.075)	(0.066)	(0.060)
Poor	-0.012	-0.091***	-0.029	-0.024	-0.001
	(0.061)	(0.030)	(0.053)	(0.055)	(0.056)
Religion (Base: Hindu)					
Muslim	-0.043	-0.077***	-0.045	-0.054*	-0.038
	(0.031)	(0.023)	(0.031)	(0.028)	(0.029)
Others	-0.053	-0.063*	-0.067**	-0.065**	-0.053
	(0.036)	(0.033)	(0.033)	(0.033)	(0.036)
Occupation: Regular salaried	0.090***	0.094***	0.083***	0.079***	0.089***
	(0.015)	(0.015)	(0.017)	(0.018)	(0.016)
Urban	-0.037	0.008	-0.013	-0.022	-0.033

	(1)	(2)	(3)	(4)	(5)
	Financial planning	*Financial planning*	*Financial planning*	*Financial planning*	*Financial planning*
	(0.027)	(0.015)	(0.019)	(0.021)	(0.030)
District fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	-2.165***	-0.769***	-1.484***	-2.193***	-2.166***
	(0.726)	(0.136)	(0.395)	(0.668)	(0.689)
Observations	47,926	47,926	47,926	47,926	47,926

2.9 Heterogeneous effects

The main result suggests the average impact of financial literacy for the individuals in the sample; however, the result may vary based on other characteristics. We examine the heterogeneous effect of financial literacy based on confidence regarding one's financial management skills, gender and area of residence by including an interaction term in the model and re-estimating it.

2.9.1 Confidence in own financial management skill

Several studies indicate that confidence in financial abilities is positively related to the likelihood of financial behaviour (Robb et al.,2015; Babiarz and Robb, 2014). In this section, we consider whether the effect of financial literacy on financial behaviour varies with the individual's confidence towards their financial management skill. To do that, we estimate the following IV-probit equation.

$$L_{ind} = \delta_0 + \delta_1 Financial\ literacy_{ind} + \delta_2 Financial\ literacy_{ind} * Confident_{ind} + \delta_3\ Confident_{ind} + \sum \delta_k X_{kind} + District_d + \varepsilon_{ind} \quad (2.3)$$

Columns 1 and 2 of Table 2.10 present the coefficients of the regression model, including the interaction term of financial literacy score with confidence in own financial management skills. A positive and significant interaction term indicates that improving financial literacy enhances financial behaviour to a large extent for individuals with confidence in their financial

management skills. This result aligns with Robb et al. (2015) and Babiarz and Robb (2014). It indicates that financial literacy complements an individual's confidence in their financial management skills.

2.9.2 Gender

Next, we consider whether the effect of financial literacy on financial behaviour varies with the individual's gender. Allgood and Walstad (2016) find that males have better financial behaviour regarding stock market participation and investment. Grohmann (2018) provides evidence that females find less difficulty paying off credit cards. Given this fact, we are interested in observing whether the positive effect of financial literacy varies based on gender. To do that, we estimate the following equation.

$$L_{ind} = \delta_0 + \delta_1 Financial\ literacy_{ind} + \delta_2 Financial\ literacy_{ind} * Male_{ind} + \delta_3\ Male_{ind} + \sum \delta_k X_{kind} + District_d + \varepsilon_{ind} \quad (2.4)$$

Columns 3 and 4 of Table 2.10 present the regression result of the model that includes an interaction term of financial literacy with gender variable searching the effect of financial literacy on the financial behaviour of individuals based on their gender. The result indicates that the interaction terms are positive and statistically significant, suggesting that financial literacy's impact on improving financial behaviour is significantly higher for males than females.

Table 2.10: Heterogeneous effects

The following table represents the second stage IV-probit coefficients obtained from regressing financial behaviour financial literacy and other factors, including an interaction term of financial literacy and confident dummy based on confidence in own financial management skill (Columns 1-2), gender (Columns 3-4), area of residence (Columns 5-6). Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Timely bill-payment behaviour	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*
Financial literacy score Confident*	0.186**	0.216**				
	(0.083)	(0.091)				
*Financial literacy score*Male*			0.133*	0.146*		
			(0.080)	(0.089)		
*Financial literacy score*Urban*					0.090	0.259**
					(0.117)	(0.124)
Financial literacy score	0.328***	0.113	0.343***	0.183	0.387***	0.182
	(0.108)	(0.168)	(0.082)	(0.121)	(0.109)	(0.159)
Smartphone	0.041	0.092**	0.041	0.081*	0.044	0.065*
	(0.036)	(0.039)	(0.043)	(0.047)	(0.035)	(0.038)
Confidence in own financial skill	-0.198	0.203	0.731***	1.240***	0.712***	1.203***
	(0.408)	(0.453)	(0.139)	(0.147)	(0.140)	(0.143)
Married	0.122***	0.113***	0.133***	0.115***	0.126***	0.109***
	(0.036)	(0.030)	(0.035)	(0.030)	(0.036)	(0.031)
Male	-0.144**	-0.051	-0.783*	-0.784	-0.144**	-0.074
	(0.072)	(0.098)	(0.426)	(0.484)	(0.073)	(0.094)
Age	0.010***	0.006	0.010***	0.006**	0.010***	0.006**
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Education: Graduation and above	-0.071	0.035	-0.049	0.037	-0.064	0.007
	(0.060)	(0.077)	(0.061)	(0.075)	(0.059)	(0.073)
Poor	-0.008	-0.116*	-0.020	-0.106	-0.005	-0.084
	(0.058)	(0.070)	(0.056)	(0.066)	(0.057)	(0.067)
Religion: Base: Hindu			0.032**	0.008	0.031**	0.006
Muslim	0.017	-0.057*	(0.014)	(0.016)	(0.014)	(0.015)
	(0.026)	(0.033)				
Others	0.026	0.006	0.015	-0.052	0.019	-0.042
	(0.031)	(0.036)	(0.026)	(0.033)	(0.026)	(0.032)
Occupation: Regular Salaried	0.034**	0.009	0.033	0.017	0.030	0.009
	(0.014)	(0.016)	(0.032)	(0.035)	(0.032)	(0.036)

	(1)	(2)	(3)	(4)	(5)	(6)
	Timely bill-payment behaviour	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*	*Timely bill-payment behaviour*	*Savings behaviour*
Urban	0.005	-0.066**	0.013	-0.065***	-0.434	-1.341**
	(0.029)	(0.028)	(0.029)	(0.025)	(0.571)	(0.603)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.412***	-2.104**	-2.459***	-2.458***	-2.673***	-2.416***
	(0.574)	(0.898)	(0.456)	(0.636)	(0.584)	(0.831)
Observations	47,926	47,926	47,926	47,926	47,926	47,926

2.9.3 Area of residence

Studies have highlighted a gap in financial literacy levels across urban and rural areas (Klapper and Panos, 2011). Along similar lines, we also examine whether the effect of financial literacy is concentrated in a particular sector by estimating the following equation, including the interaction term of financial literacy and the urban sector.

$$L_{ind} = \delta_0 + \delta_1 Financial\ literacy_{ind} + \delta_2 Financial\ literacy_{ind} * Urban_{ind} + \delta_3\ Urban_{ind} + \sum \delta_k X_{ind} + District_d + \varepsilon_{ind} \quad (2.5)$$

Results presented in columns 5-6 of Table 2.10 indicates that the impact of financial literacy on timely bill-payment behaviour is insignificant for urban individuals, whereas the association is positively significant for the savings behaviour of individuals residing in urban area. The awareness regarding financial savings instruments among urban individuals may amplify the positive effect of financial literacy on financial behaviour.

2.10 Chapter summary

The suboptimal financial behaviour and financial mistakes committed by individuals remain a major concern for policymakers across the globe and more so in a country like India, where a sizable proportion of the large population is still outside the ambit of formal finance. In this

chapter, we examine whether financial literacy is one way to improve financial behaviour in India using the nationally representative FII survey of 2018. We construct the financial literacy score by considering the standard set of questions prescribed by the OECD. Although above 90 percent of the individuals correctly answered the numeracy-related questions in our study, only 56 percent correctly responded to the diversification question, which is lower than that in developed countries. Therefore, it indicates that understanding the portfolio diversification concept is inadequate and needs to be focused.

Further, there is a disparity in the level of financial literacy across income, education level, and employment status. We employ an instrumental variable approach to account for the possible endogeneity related to the financial literacy variable. We find that more financially literate individuals are more likely to invest and exhibit good timely bill-payment behaviour. These results are robust to the use of alternative techniques, alternate definitions of interest and dependent variables, as well as including additional controls in the model. Moreover, we observe that a higher likelihood of financial planning is one of the ways through which financial literacy positively affects financial behaviour. Further, we find a more substantial effect for confident, male, and urban individuals.

Despite significant contributions, there are a few limitations of our study. First, due to the paucity of data on the amount paid or invested, we cannot comment on the extent to which financial literacy is related to optimal financial behaviour. Second, financial literacy based on objective test scores is insufficient to explain the behaviour toward financial activity. In addition to that, a subjective measure of perceived financial literacy is necessary to describe financial literacy more vividly (Allgood and Walstad, 2016). Therefore, our estimate of the financial literacy score is underestimated due to the absence of any standard regarding perceived financial

literacy. Third, due to a lack of longitudinal data, this study can't comment on whether the nature of the relationship between financial literacy and financial behaviour had changed after the government of India introduced the flagship financial inclusion program, Pradhan Mantri Jan Dhan Yojana (PMJDY,2014). Given that financial literacy has desirable effects in terms of financial behaviour, future research may explore whether financial literacy lowers the likelihood of becoming a victim of financial fraud.

Chapter 3

Household investment portfolio in the aftermath of a shock

Summary

This chapter examines the long-run impact of a flood on the household investment portfolio in coastal India. Considering multiple rounds of large-scale household surveys and employing a difference-in-difference methodology, the chapter finds that flood affects the investment portfolio of the affected households. The flood-affected households are less likely to invest in illiquid assets. They are more likely to hold liquid financial assets post-flood, pointing towards a rebalancing in the household investment portfolio. We find the robustness of our result by checking through propensity score matching, considering alternate treatment groups and alternate control groups. Additionally, we find that primarily the lower likelihood of the households investing in real estate and ornaments drives the former result, whereas the higher likelihood of having retirement funds drives the latter findings. Further, the reduction of illiquid asset holding is driven by real estate investment, and the increase in financial asset holding is driven by investment in retirement funds.

Keywords: Floods, assets, illiquid assets, financial assets, India

3.1 Introduction

The earlier chapter indicates that financial literacy can improve financial attitudes by analysing the regression model in a cross-sectional framework. However, what happens to a household investment portfolio when there is a shock? We answer this question in this chapter. The shocks can be of two types, i.e., idiosyncratic and covariate (OECD, 2009). The former affects an individual or household, whereas the latter affects a group, society, or community. In this regard, Dercon (2004) documents that the impact of covariate shocks is higher on household

welfare than that of the other one. Further, rural households in Thailand and Vietnam were found to maintain their standard of living in the face of idiosyncratic shock but not for the covariate shocks (Nguyen et al.,2022). The study highlights that the shocks lead the household to diversify land and labour in Vietnam and Thailand, respectively, after a covariate shock. Specifically, Chapter 3 assesses the effect of a covariate shock like a natural disaster on the household investment portfolio.

Climate change is one of the leading shocks facing the world population in the coming years. Global warming has increased the surface temperature by over one-degree celsius from 1850-1900 to 2011-2020 (IPCC Report, 2023[20]). The report highlights that a further increase in global temperature will likely result in a high risk of climate hazards, including higher frequency and intensity of floods in coastal regions, droughts, landslides, and heat waves. These catastrophic events cause sudden disruption in everyday life and widespread damage to property and livelihoods. Existing studies highlight that natural disasters are related to substantial economic losses (Khan et al.,2019) and environmental damages (Parida et al., 2021; Sangha et al.,2020; Botzen et al.,2019). Few studies at the household level also examine the effect of natural disasters on income and consumption (Patnaik et al.,2019), loss of assets (Baez et al.,2016), and adverse health impacts (Paterson et al.,2018).

Unfortunately, few regions and sub-populations are more vulnerable to these disasters than others. Given the geographical location, the Asia Pacific Region experiences over 60 percent of the world's natural disasters (Asia Pacific Disaster Report,2019). Emerging evidence suggests that the poor residing in less developed economies are more vulnerable to natural

[20] Sixth Assessment Report, Intergovernmental Panel on Climate Change. Visit https://www.ipcc.ch/report/ar6/syr/ for more details. (Accessed on March 31, 2023).

disasters even though they contribute the least towards climate change (Arouri et al., 2015; De Haen and Hemrich, 2007). It is important to note that the absolute impact of a natural disaster is higher in developed countries than in less developed economies; however, the relative share of loss to overall GDP can be substantially higher in less developed countries (Bui et al.,2014; Noy and Vu,2010; Albala-Bertrand,1993). For instance, the World Disaster Report (2015) documents that the total amount of estimated damage during 2005-2014 due to natural disasters in Asian countries (mainly developing) amounts to 7,49,690 million U.S. dollars, whereas for European countries (mainly developed), it stands around 1,45,767 million U.S. dollars. Noy (2009) documents that disasters appear to be costlier in developing countries than in developed ones because of higher population density. One possible reason might be the ability of developed countries to pursue public policies following adverse shocks that lower-income countries do not seem to enjoy and often end up in worse conditions. Studies (Thurlow et al.,2012; Jury,2002) argue that the economic footprint of climate variability is specifically significant for developing countries since they are less able to cope-up with environmental challenges.

All over the world, a high percentage of adults are financially illiterate but overconfident, which results in high investment in illiquid assets (e.g., real estate) (Kaplan et al.,2014), a shortage of enough financial resources to act as a buffer (Lusardi and Mitchell,2014; Lusardi et al.,2011). In the previous chapter, we have already seen that many adults in India lack financial literacy, which is alarming. As a result, people commit several investment mistakes. As an emerging economy, India is also characterised by 27.5 percent of the population below the poverty line (Census Report, 2011). The poor are more vulnerable to shocks like natural disasters catered by climate change, critical illness, war, riots, conflict, overall global market forces, and simultaneously idiosyncratic shocks like death and divorce.

Given this backdrop, the objective of this study is to primarily examine the impact of coastal flooding on household investment portfolios in India several years after the flood. Specifically, we consider the Tamil Nadu flood of 2015 in the southern part of the country as a case study. The question deals with the asset allocation decision of the affected households and the extent to which coastal flood affects households' holdings of liquid and illiquid assets several years after the advent of a flood.

Floods can have short-term as well as long-term impacts on household investment portfolios. In the long run, floods can affect household investment portfolios in several ways. Firstly, if the flood is severe, there could be potential damage to property and immovable assets. This can permanently reduce the fixed assets' worth and teach households to reduce the further uptake of illiquid assets. Next, flood-affected households may become wary of investing in immovable property as these assets are severely affected by floods. Secondly, a shock experience may enlighten the households to attach a higher probability of a further crisis, thereby maintaining enough financial resilience. Moreover, the risk preference of the households may be changed after the shock experience and allows households to opt for more financial investment to earn higher returns. In a nutshell, a shock experience like a flood may lead households to reassess their portfolio allocation by reducing the weight of illiquid assets and holding assets more in liquid form so that the assets can be protected during any disaster as well as one can quickly liquefy the assets in need. Finally, on the positive side, households may save for emergencies by investing more in liquid assets.

In 2015, Tamil Nadu, a southern state of India, witnessed incessant rainfall during November-December due to the formation of a depression over the southwest Bay of Bengal leading to a strong El Nino, which caused a devastating flood in the Coromandel coastal districts

of Tamil Nadu. As a result of this flood, more than 400 people died while all the hospitals stopped performing,18 lakhs were displaced, and all the power supplies were suspended (Bandyopadhyay et al.,2021). Moreover, economic losses of about 3 billion USD made this flood the costliest disaster of 2015 in India and the eighth most expensive all over the world (Narasimhan, 2015). This extreme (exogenous) flood allows us to study the effect of flood on household investment portfolios using appropriate methodological tools.

Using the exogenous Tamil Nadu flood of 2015, we employ the difference-in-difference methodology to examine the impact of the flood shock. To do that, we consider the flood-affected districts as a treated group. Based on rainfall measures reported by the National Institute of Disaster Management (Table A3.1), we identify the top 8 affected districts, i.e., Tiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, and Nagapattinam in the state of Tamil Nadu; Puducherry and Karaikal in the union territory of Pondicherry and classify them as treated group. The rest of Tamil Nadu districts (except those sharing a border with the treated group) are considered the control group.

Chapter 3 makes key contributions to three strands of literature. Firstly, this study contributes to the growing household finance literature in emerging economies (Beyer et al.,2022; Patnaik et al.,2019; Bui et al.,2014) and underscores their vulnerabilities, especially in the aftermath of natural disasters. Secondly, our study contributes to the literature on studies on climate change and household behaviour (Zhang et al.,2021; Zhang,2016). We extend this literature by providing evidence on how high-frequency natural disasters like floods can impact the investment portfolio of households in high-risk coastal regions. Thirdly, our study also contributes to the literature on the long-run impacts of climate change. Even though studies have focused on the short-run impact of floods on household financial behaviour (Beyer et

al.,2022; Patnaik et al., 2019), our study is among the early ones to examine the long-term impact of a flood on both sides of the balance sheet of the affected households.

Chapter 3 is organised as follows. Section 3.2 discusses the literature review, and Section 3.3 proposes a conceptual framework and research questions. Section 3.4 elaborates on the Tamil Nadu flood of 2015, whereas Section 3.5 illustrates the data and variables. Section 3.6 elaborates on the methodology, Section 3.7 represents the results, Section 3.8 describes some robustness checks, and Section 3.9 and Section 3.10 discuss some additional analyses, including portfolio rebalancing and types of assets, respectively. Finally, Section 3.11 discusses the findings of the chapter.

3.2 Literature review

3.2.1 Effect of shocks on investment behaviour

Studies provide evidence that shock can potentially change behaviour. For example, Onuma et al. (2017) provide evidence that experiencing earthquakes increases the preparedness of households though the extent of the impact varies. Moreover, Smith and Frankenberger (2018) show that the resilience capacity reduces the negative effects of shocks on food security. Shocks impact income, consumption and reduce welfare, especially in developing countries (Pradhan and Mukherjee,2018; Arouri et al.,2015; Porter, 2012). Berkowitz and Qiu (2006) provide evidence that health shock significantly decreases total household financial health and leads households to reassess the composition of their financial assets.

3.2.2 Effect of natural disaster on household outcomes

Several studies have examined the impact of natural disasters on household behaviour. Moreover, studies (Onuma et al.,2021; Yao et al.,2019) document that the impact of natural

disasters varies based on their severity and the time frame. For example, Gallagher and Hartley (2017) observe a reduced total debt level in the aftermath of the Katrina hurricane in the United States. Following the disasters, the affected households exhibited an increased delinquency rate, a spike in credit card borrowing, and declined credit scores in a few years. In line with the study, Deryugina et al. (2018) exhibit that Katrina Hurricane is associated with reduced income and increased unemployment and insurance claims. Beyer et al. (2022) find decreased outstanding borrowing for household consumption and increased debt for housing and medical purposes in the short run after the Kerala flood in May 2018. They also observe a reduction in income and expenditure of the households and an increase in post office savings, and a decrease in other savings instruments like bank deposits and gold. Similarly, Patnaik et al. (2019) highlight an overall reduction in income from two months to one year after the flood in Chennai, but in contrast, it finds that household expenditure exhibits a sharp increase till six months and then registers a significant fall. In the long run, there is evidence of a decline in consumption and income in the post-flood period (Baez et al.,2016; Arouri et al.,2015). Dercon (2004) shows a significant long-term impact of rainfall shock on household consumption. Bui et al. (2014) report a substantial reduction in per capita income and expenditure of the households that have faced any natural disaster within the last five years in Vietnam. Masiero and Santarossa (2020) provide evidence of a sharp increase in household expenditure after twelve years of flood shock. On the other hand, a recent study by Johar et al. (2022) find no impact on household income but a substantial impact on the financial hardship of Australian households in the post-disaster period. Further, Keerthiratne and Tol (2018) explore that natural disaster significantly decreases household income inequality in Sri Lanka but does not substantially impact household consumption. Using high-frequency data from India for 2001-12, Tamuly and Mukhopadhyay (2022) find that natural disaster negatively impacts household consumption but positively

impacts the value of net assets, health insurance uptake, etc. On the other hand, Liu et al. (2022) document that natural disasters in China substantially reduce the likelihood of households participating in stock markets and other risky asset markets. Sheldon and Zhan (2019) provide evidence for a reduced level of homeownership in the U.S. market in the second year following the disaster. Further, using household-level survey data from rural Bangladesh, Barua and Banerjee (2020) show that climate shocks negatively impact household well-being regarding total consumption. Additionally, they find that the impact of shock on non-food consumption expenditure is more significant than on food expenditure. From a macro perspective, studies observe a boost in economic growth during the post-disaster period (Noy and Nualsri,2007; Skidmore and Toya,2002; Albala-Bertrand,1993) through enhanced human capital investment and factor productivity as a long-term footprint of natural disasters. In contrast, few studies (Parida et al.,2021; Botzen et al.,2019) report a reduction in economic growth as one of the long-term effects of devastating natural disasters. On the other hand, few recent studies focusing on the economic impacts of U.S. hurricanes find underestimated fiscal costs of natural disasters (Deryugina, 2017), increased migration (Mahajan and Yang, 2020), etc.

3.3 Conceptual framework and research question

Experiential learning theory suggests that the best way to learn lessons is by actually having experiences. Henceforth, the experience of natural disasters is expected to influence the attitude of the households toward their financial activity. Recently, the pandemic shock of Covid-19 has taught firms and households harsh lessons pertaining to the necessity of keeping financial buffers (Van Dalen and Henkens,2020). Moreover, earlier studies infer that catastrophe experience affects an individual's attitude to risk. For example, a household experiencing a natural hazard may attach a higher probability of experiencing another disaster in the future (Brown et al.,2018; Gallagher,2014). For example, using the case study of the Australian flood 2011, Page et al.

(2014) find a change in the risk-taking behaviour of flood-affected homeowners just after the disaster. They find that the victim households are likely to opt more for risky gambling than a sure payment after the shock, and the concept of prospect theory explains this idea. Further, the precautionary savings theory suggests that expected risk and a household's precautionary savings are positively correlated. According to precautionary savings theory, risk depresses consumption and increases the wealth accumulation. However, the savings rate depends on risk expectations and the households' risk preferences (Gunning et al.,2010). Hence, a change in the risk perception of the households due to the flood may lead them to save more and invest in financial assets. Given the conceptual framework, we posit the following research question: What is the effect of natural disasters like floods on the investment portfolio of households?

3.4 Tamil Nadu flood of 2015

In November-December 2015, south India, especially Tamil Nadu experienced incessant rain brought about by the northeast monsoon due to the formation of a depression over southwest Bay of Bengal leading to a strong El Niño which resulted into severe floods. A leading daily, Times of India,[21] reported, "*With estimates of damages and losses ranging from nearly Rs. 200 billion to over Rs. 1 trillion, the floods were the costliest to have occurred in 2015, and were among the costliest natural disasters of the year*." Chennai Metropolitan City, the capital of Tamil Nadu, witnessed heavy rainfall of above 1000 mm in November 2015, coupled with a high-speed storm, which led to the fall of more than 900 trees (GCC, 2017[22]). Moreover, another depression was formed over Tamil Nadu triggered by El Nino at the end of November, which resulted in additional rainfall. Studies suggest that the gradual increase in temperature might

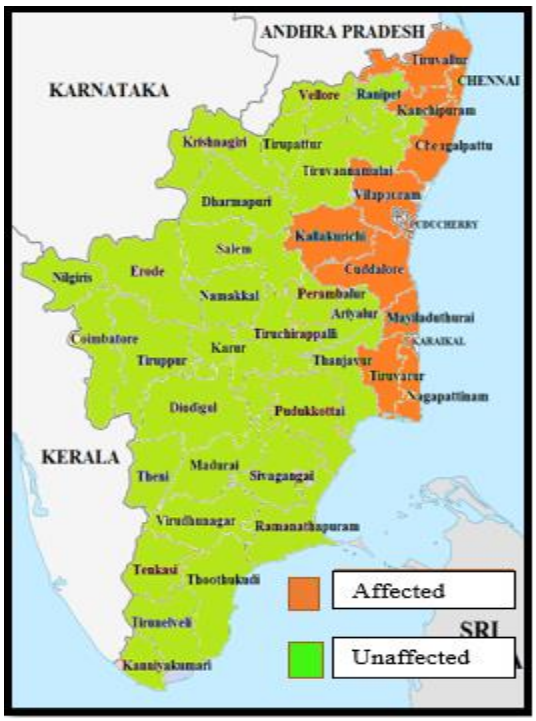
[21] https://timesofindia.indiatimes.com/topic/chennai-floods
(Accessed on May 5, 2023)
[22] GCC(2017). GCC Disaster management plan. Greater Chennai Corporation (https://www.scribd.com/document/543240186/Chennai-Gcc-Disaster-Management-Plan-2017#).

have resulted in incessant rainfall in the coastal area of Tamil Nadu and Pondicherry during November 2015. In Chennai itself, 165 out of 200 wards went underwater. During the period, power supply, schools, airports, and railway services were disrupted. Even the emergency services like hospitals also ceased functioning. The prolonged period of torrential rain led to the overflowing of waterbodies. The Government of India announced Chennai as a disaster zone (Bremner,2015). About 30 percent of the Chennai households went through an economic loss of Rs.2 lakhs to Rs.20 lakhs (Narasimhan et al.,2016), and the industrial sector faced a loss of around 14,000 crores (Express News Service,2015[23]).

According to the report on the Chennai flood,2015 by the Disaster Management Support Division under ISRO, we consider 8 districts with the highest rainfall during the period 1.10.2015 to 9.12.2015 as our treatment group (Table A3.1 in Appendix) i.e., Tiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, and Nagapattinam in the state of Tamil Nadu; Puducherry and Karaikal in the union territory of Pondicherry were severely affected by the flood (Figure 3.1), and over 400 deaths were reported in the affected districts. Due to power cuts, 18 patients were reported dead in hospital ventilation. Further, around 3 million flood-affected families experienced partial or complete damage to their residences, and 1.8 million people were shifted elsewhere.

[23]https://www.newindianexpress.com/cities/chennai/2015/dec/27/Flood-hit-Industrial-Belts-Clamour-for-Aid-861032.html

Figure 3.1: Affected districts of Tamil Nadu and Pondicherry



In Kancheepuram district, the buildings up to the second floor were fully submerged in the areas around Tambaram, Chengalpattu, taluk. During the first week of December, people ran out of electricity and transport facilities. The only thing they were provided was the food packet supplied by the helicopter. Next, in Cuddalore district, 8 villages at Kurinjipadi Taluk, namely, Maruvai, Parathampattu, Arangamangalam, T.V.Nallur, Adoor agaram, Boothampadi, Kalkunam, and Kundiyamallur were severely affected (District Disaster Management Plan Cuddalore,2021[24]). The overflow of the Paravanar river led the village to become marooned, and people were temporarily shifted elsewhere. The district administration provided necessities such as rice, food, clothes etc. during that period. Veeranam tank foreshore was inundated, and 720 acres of agricultural land were affected in the Cuddalore district. In Villupuram district, around 4,500 people were evacuated from the flood-affected areas. Rainwater was inserted into the Buckingham canal, overflowing the Puducherry-Chennai East Coast Road at

[24] https://tnsdma.tn.gov.in/app/webroot/img/document/Ariyalur-DDMPpercent20-percent202021.pdf

Palathu-Mudakku near Marakkanam, where water remained stagnant up to four feet high (New Indian Express, December 3,2015[25]). In Pondicherry, the town named Ariyanpukkam was severely hit by the incessant rainfall. In Pondicherry, the public works department incurred loss of around 120.89 crores, municipal administration suffered damage of Rs.48.66 crore, agriculture by 7.2 crores, power by 3.14 crore and revenue of 2.48 crore (Times of India, December 3, 2015[26]). Overall, households across all the affected districts were submerged during the flood period and experienced a great loss in terms of lives, cattle, agricultural land, crops, and other assets.

3.5 Data and variables

3.5.1 Data

This study uses multiple rounds of All-India Debt and Investment Survey (AIDIS) data. The AIDIS Survey originated by the All-India Rural Credit Survey which was conducted by the Reserve Bank of India (RBI) from November 1951 to August 1952 in 75 selected districts across the country. The survey was canvassed on Debt and Investment of the households in urban and rural areas periodically since its 26th round (1971-72). The objective of the survey was to look into the credit demand from rural households and the supply of credit-by-credit agencies – institutional and non-institutional, to design banking policies. To collect the data, a random sample of households is selected through a scientific design covering the entire geographical area of the country except for the inaccessible islands of Andaman and Nicobar Islands are interviewed. The third survey onward National Statistics Office (NSSO) under the

[25] https://www.newindianexpress.com/states/tamil-nadu/2015/dec/03/Villupurams-Cup-of-Woes-Overflows-851192.html

[26] http://timesofindia.indiatimes.com/articleshow/49938116.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

Ministry of Statistics and Program Implementation took over the responsibility of conducting the All-India Debt and Investment Surveys across the urban and rural areas in its 26th round (1971-72), 37th round (1981-82), 48th round (1992), 59th round (2003) and 70th round (2013) before 77th round (2019). The survey provides basic information on the households' assets, liabilities, capital expenditure, and other socio-demographic features, including educational attainment and occupation across India's states and union territories. Specifically, the objective of the survey is to gather information regarding the stock of assets, capital formation, the incidence of indebtedness and other indicators for the urban and rural economy, which will help in developing specifically the credit structure and also to obtain further relevant information needed for the purpose of planning and development. Here, we employ the last three rounds of the AIDIS which were implemented as a part of the 59^{th}, 70^{th} and 77^{th} NSS rounds in the years 2003, 2013 and 2019, respectively.

In the 59th round, AIDIS covered 1,43,285 households covering all of Indian states and union territories except (i) interior villages of Nagaland located beyond five kilometres of any bus route, (ii) villages in Andaman and Nicobar Islands and (iii) Leh (Ladakh) and Kargil districts of Jammu and Kashmir which remain inaccessible throughout the year. This round comprises 64 percent of households from rural areas and the rest from the urban sector. The value of assets and liabilities of the households are calculated as of 30.6.2002, the value of capital expenditure of the households during the agricultural year 2002 – 03 (July 2002 – June 2003), cash loan and repayments made by the them, sale, and loss of assets of the households during the mentioned period (2002 – 03) was collected through the Debt and Investment Schedule (Schedule 18.2). The Schedule (Schedule 18.2) was campaigned in a sample of randomly selected 14 households from each block/village. The field workers visited two times to each of the sample households during the survey, with a frequency of 4-8 months. Two

separate inquiry schedules were employed to collect data during the two visits. The first visit was conducted from 1.6.2002 to the survey date, whereas the second visit took place from January 1,2003 to June 30,2003. Out of 1,43,285 households, AIDIS-2003 covered 1,39,039 households during both visits.

In the 70th round of NSSO, AIDIS-2013 covered 1,10,800 households. Schedule 18.2 interviewed 62,135 households from rural India and 48,665 from urban India in Visit 1, and the survey was conducted from January to July 2013. In visit 2, 61,650 households from rural India and 46,771 from the urban sector were interviewed from July to December 2013. The assets and liabilities of the households are valued as of June 30,2012. Unlike the previous round, AIDIS-2013 does not consider household durables and monthly consumer expenditure information. In this round, Telangana state's estimates of assets and liabilities are separately available for the first time.

In the 77th round of NSSO, AIDIS-2019 interviewed 1,16,461 households covering all 36 states and union territories of India. Schedule 18.2 was campaigned in 69,455 rural households and 47,006 urban households in Visit 1 from January to August 2019. In visit 2, 68,291 households from the rural sector and 44,781 from urban areas were interviewed respectively from September to December 2019. All the estimates of assets and liabilities are reported for a fixed reference date, viz. June 30,2018.

Merging all the three rounds of All India Debt and Investment Survey data mentioned above, we consider only the households surveyed in the state of Tamil Nadu and Pondicherry for our study, which yields a sample of 26,629 households from 30 districts of Tamil Nadu and 4 districts of Pondicherry. For the merging purpose, we map the newly formed districts of Tamil Nadu i.e., Tiruppur and Krishnagiri, which are available in AIDIS-2012-13 and AIDIS-2018-19 rounds with Coimbatore and Dharmapuri districts, respectively, in AIDIS-2002-03. The

sample includes 7,434 households from AIDIS-2018-19, 7,290 households from AIDIS-2012-13, and 11,905 households from AIDIS-2002-03. We adjust to deflate the values using the consumer price index (CPI)[27] of the corresponding years considering 2010 as the base year.

3.5.2 Variables

We consider illiquid and liquid financial assets as outcome variables in the study. To measure illiquid and liquid financial asset holdings, we consider two indicators of the asset measures. Illiquid1 is a binary variable that takes the value one if the household owns land, buildings, and jewellery and zero otherwise. Illiquid2 is a continuous variable defined as the natural logarithm of the amount of money invested in land, buildings, and jewellery by the household on the survey date. Similarly, Financial1 is a binary variable that takes the value one if the household owns financial assets, including deposits, retirement savings, mutual funds, bonds, shares, etc., and zero otherwise. Financial2 is the logarithm of the value of deposits, retirement savings, mutual funds, bonds, shares, etc., held by households.

As mentioned in Section 3.4, we identify the eight districts as severely affected, which form our treatment group and the unaffected districts of Tamil Nadu and Pondicherry form the control group for the study. Notably, we exclude the districts bordering the treated districts from our analysis as these districts may be argued to be exposed to the flood as they may have social ties with households of the affected districts, or the flood may change the risk perception of neighbouring districts and hence may confound our results. To capture the effect of flood, we define a variable 'flood' that takes the value one if the districts in Tamil Nadu and Pondicherry were affected by the Tamil Nadu flood 2015 and zero otherwise (refer to Figure 3.1). Further, we define a variable 'post' that takes the value of one for 2019, i.e., for all the households

[27] The CPI data is taken from Work Development Indicator provided by World Bank.

surveyed from AIDIS-2019, and zero otherwise, i.e., those surveyed in AIDIS-2013 and AIDIS-2003. In other words, this variable represents the households a few years after the flood.

In line with the literature, we also control for various socioeconomic factors that are likely to affect the financial outcomes of the household. Studies indicate that the household head's age, employment status, marital status, family income, and the number of dependent children in the family influence the financial behaviour of households (Tamuly and Mukhopadhyay,2022; Beyer et al.,2022). Additionally, in the Indian context, studies find that the household head's gender, caste, religion, and residential area are essential predictors of household asset ownership (Rampal and Biswas,2022; Lahiri and Biswas, 2022). Likewise, we control for the dependency ratio, age, educational status, gender of the household head, caste, religion, and area of residence, in our framework. Table 3.1 describes the variables used in the study along with the mean of the variables.

Table 3.1: Variable description

The following table represents the description of the variables used in the analysis.

Variables	Description
Outcome variables	
Illiquid assets:	
Illiquid1	Dummy variable, 1 for having illiquid assets (land, buildings and ornaments),0 otherwise.
Illiquid2	The logarithm of Illiquid asset value.
Types of illiquid assets (Households for which Illiquid1 takes value 1)	
Real estate1	Dummy variable, 1 for the households owning immovable assets e.g., land and buildings and 0 otherwise.
Real estate2	The logarithm of the amount invested in land and building.
Ornaments1	Dummy variable, 1 for the households owning ornaments and 0 otherwise.
Ornaments2	The logarithm of amount invested in ornaments.
Financial assets:	
Financial1	Dummy variable, 1 for having financial assets (deposit, PF, shares, bonds, mutual funds etc.),0 otherwise
Financial2	Logarithm of financial assets value.

Variables	Description
Deposit1	Dummy variable,1 for households participating in the following types of deposits and 0 otherwise. Deposits: savings and term deposits in commercial bank, post-office and cooperative bank, other financial fixed income sources (NSC, KVP, savings bond), deposits with non-banking finance companies, micro-finance institutions and self-help groups and other financial savings
Deposit2	Logarithm of amount invested in all types of deposits.
Retirement fund1	Dummy variable,1 for households participating in following types of retirement planning fund and 0 otherwise. Retirement planning fund: Provident fund, Pension fund, and other types of contributories and annuity scheme.
Retirement fund2	Logarithm of amount invested in all types of retirement funds.
Interest variables	
Post	Dummy variable,1 if the year is 2018,0 for 2003 and 2013.
Year	Dummy variable,1 if year is 2013,0 for 2003
Flood	Dummy variable, 1 for the flood affected districts of Tamil Nadu and Pondicherry,0 for other districts of Tamil Nadu except the districts which are sharing border Tamil Nadu with the districts of the treatment group. Affected districts of: Tamil Nadu: Tiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, Nagapattinam Pondicherry: Puducherry, Karaikal
High	Dummy variable, 1 for the highly affected districts of Tamil Nadu,0 for other districts of Tamil Nadu except the districts which are sharing border Tamil Nadu with the districts of the treatment group. Tamil Nadu: Tiruvallur, Chennai, Kancheepuram, Villupuram.
Alternative Flood	Dummy variable, 1 for the flood affected districts of Tamil Nadu and Pondicherry,0 for other districts of Tamil Nadu. Affected districts of: Tamil Nadu: Tiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, Nagapattinam Pondicherry: Puducherry, Karaikal
Control variables	
Age	Logarithm of age of the head of the household.
Dependency ratio	The ratio of total number of dependents (old and children) to total household size.
Gender: Male	Dummy variable,1 for male head of the household and 0 otherwise.
Education	Highest educational attainment of the household head. Categorical variable, 1 for illerterate,2 for primary and 3 for secondary and above.
Total assets	Logarithm of total value of the assets. Total value of the assets consists of value of physical assets and financial assets.

Variables	Description
	Physical assets: Land, building, ornaments, livestock and poultry, transport equipment, agricultural machinery and implements owned, non-farm business equipment owned.
	Financial assets: Deposits in bank (commercial/RRB/POSB/co-operative), and non-bank institutions (finance companies, co-operatives, self-help group, micro-finance institutions) other fixed income deposits (NSC, KVP, savings bond), retirement funds (PF/Pension funds/NPS), other financial savings, other receivables, mutual funds, shares, bonds etc.
Religion	Categorical variable,1 for Hindu,2 for Muslims,3 for others.
Caste	Categorical variable, 1 for General, 2 for SC-ST and 3 for other backward class.
Occupation: Regular salaried	Dummy variable,1 if the household is regular salaried,0 for others.
Sector: Urban	Dummy variable,1 if the household is in urban sector and 0 for others.

3.6 Methodology

We rely on a difference-in-difference approach to examine the causal effect of the Tamil Nadu flood 2015 on household investment portfolios and estimate the following regression model. Difference-in-Difference approach is widely used in economics and finance literature to tease out the causal effect of exogenous shocks/policy (Beyer et al.,2022; Tamuly and Mukhopadhyay, 2022).

$$L_{hdt} = \partial_0 + \partial_1 Flood_d + \partial_2 Year_t + \partial_3 Flood_d * Year_t + \sum \partial_k X_{khdt} + District_d + Year_t + \varepsilon_{hdt} \quad (3.1)^{28}$$

$$y_{hdt} = \beta_0 + \beta_1 Flood_d + \beta_2 Post_t + \beta_3 Flood_d * Post_t + \sum \beta_4 X_{khdt} + District_d + Year_t + \varepsilon_{hdt} \quad (3.2)$$

Where L_{hdt} denotes the log-likelihood of asset uptake and y_{hdt} denotes the logarithmic value of the respective assets discussed above. As mentioned earlier, 'Flood' captures whether the

[28] Equation 3.1 is equivalent to $\Pr(Y_{hdt} \mid X_{kdht}) = f(Flood_d, Post_t)$

districts were affected by the flood in 2015, 'Post' variable captures one if the household is surveyed post the Tamil Nadu flood 2015, i.e., in the year 2019 and zero otherwise. Finally, Flood*Post takes the value one if the surveyed household is from the flood-affected districts, whether the household was surveyed as a part of AIDIS-2019, and zero otherwise. These households constitute the treated group post-treatment, and in both the equations mentioned above, β_3 will capture the impact of the flood on outcome variables after partialling out the effect of being located in flood-affected districts (given by β_1) as well as surveyed in 2019 (β_2). β_3 gives the effect of flood on the flood-affected households in the aftermath of the flood relative to those not affected by the flood. X_{hdt} gives the set of control variables, $District_d$ are the district-fixed and ε_{hdt} captures household-level idiosyncratic shocks.

We employ the probit regression method when the outcome variables are given by the indicator variables – Illiquid1 and Financial1. On the other hand, when we use the continuous variables – Illiquid2 and Financial2 as outcome variables for the analysis, we estimate a linear regression model using the ordinary least squares method.

3.7 Results

3.7.1 Descriptive statistics

Table 3.2 indicates that a higher proportion of the treated and control groups held illiquid and financial assets in the post-period than in the pre-treatment period. However, the increase in illiquid asset holding for the treated group is lower by 0.1 percentage points than for the control group, whereas, for financial assets, the increase is much higher for the treated group than for the control group. Further, the value of illiquid assets is higher in the pre-treatment period for the treated households, and the reverse is observed for the control group. On the other hand, the value of financial assets is higher for both groups in the post-treatment period.

Table 3.2: Descriptive statistics

The table below presents the mean of the variables for treatment and control groups in both the pre-treatment and post-treatment period. Standard deviations are in parenthesis. The level of significance mentioned in the table is based on the t-test done for checking the equality of means for pre and post flood for each group. Standard deviations are in parenthesis *** p<0.01, ** p<0.05, * p<0.1.

	Treatment		Control		Overall sample
	Pre	Post	Pre	Post	
Illiquid1	0.928	0.933	0.961	0.967***	0.956
	(0.260)	(0.250)	(0.193)	(0.179)	(0.205)
Illiquid2	8.256***	7.899	8.059***	7.900	8.049
	(1.991)	(1.862)	(1.549)	(1.587)	(1.673)
Financial1	0.674	0.958***	0.744	0.969***	0.802
	(0.469)	(0.200)	(0.436)	(0.171)	(0.399)
Financial2	4.519***	3.990	3.797***	3.247	8.722
	(1.989)	(1.884)	(2.035)	(1.408)	(1.891)
Dependency ratio	0.310***	0.296	0.359***	0.349	0.339
	(0.298)	(0.291)	(0.322)	(0.317)	(0.309)
Age	44.995	46.922***	48.371	49.464***	47.940
	(15.471)	(15.073)	(14.918)	(13.864)	(14.791)
Gender: Male	0.847	0.869***	0.799	0.815*	0.822
	(0.359)	(0.338)	(0.400)	(0.389)	(0.383)
Education:					
Illiterate	0.193***	0.169	0.289	0.229	0.260
	(0.394)	(0.375)	(0.453)	(0.420)	(0.439)
Primary	0.194	0.339***	0.256	0.451***	0.294
	(0.395)	(0.473)	(0.436)	(0.498)	(0.456)
Secondary and above	0.613***	0.492	0.455	0.320	0.445
	(0.487)	(0.500)	(0.498)	(0.467)	(0.497)
Total assets	7.951***	7.865	7.978***	7.895	7.957
	(2.493)	(2.060)	(1.825)	(1.683)	(1.949)
Religion:					
Hindu	0.891	0.862	0.852	0.901***	0.882
	(0.311)	(0.344)	(0.355)	(0.299)	(0.323)
Muslims	0.052	0.056	0.079	0.037	0.061
	(0.221)	(0.231)	(0.270)	(0.189)	(0.239)
Others	0.057	0.081	0.069	0.062	0.057
	(0.232)	(0.273)	(0.254)	(0.240)	(0.232)
Caste:					
General	0.075	0.084*	0.058	0.007	0.046
	(0.263)	(0.277)	(0.233)	(0.081)	(0.210)
SC-ST	0.258	0.299***	0.185	0.283***	0.226
	(0.438)	(0.458)	(0.388)	(0.426)	(0.418)
Others	0.666*	0.616	0.757	0.755	0.727
	(0.472)	(0.486)	(0.429)	(0.430)	(0.445)
Occupation: Regular salaried	0.372***	0.350	0.256	0.289	0.279
	(0.483)	(0.477)	(0.436)	(0.453)	(0.448)
Sector: Urban	0.651***	0.595	0.525	0.493	0.509
	(0.476)	(0.491)	(0.499)	(0.500)	(0.499)
No. of observations	5,564	2,317	9,943	3,663	26,629

3.7.2 Main results

Table 3.3 presents the difference-in-difference regression marginal effects, which give the effect of the flood on the investment portfolio of the households. Column 1 indicates that the flood led to a fall in the likelihood of holding illiquid assets (IIlliquid1) by 1.7 percentage points. On the other hand, the coefficient of the interaction term is significant and positive for the Financial1 indicator (column 3). Table 3.3 shows that households are 9.4 percentage points more likely to hold liquid financial assets years after the flood. On turning to the value of assets, we again observe a similar pattern (columns 2 and 4), wherein the average value of illiquid assets is lower by 7.1 percent for treated households post-flood, and the value of financial assets held by treated households increased on average by 26.5 percent in the aftermath of the flood. These results are largely in line with the experiential and the predictions of the precautionary savings theories. Experiencing flood, the possible damage to physical assets, and increased awareness regarding the usefulness of financial assets at the time of need may explain these results. These findings are related to the impact of the flood on a household investment portfolio, to an extent, in line with the findings of Beyer et al. (2022), where they find that Kerala floods leads to a fall in gold investments and a rise in post office savings by the treated households after the flood.

Table 3.3: Main result

The table below presents the marginal effects of probit (columns 1 and 3) and OLS (Columns 2 and 4) regression of illiquid assets and financial assets on flood-affected households and other socio-demographic characteristics. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
	Illiquid1	Illiquid2	Financial1	Financial2
*Flood*Post*	-0.017***	-0.071***	0.094***	0.265***
	(0.005)	(0.012)	(0.016)	(0.055)
Flood	0.010**	-0.091***	-0.042**	0.188*
	(0.005)	(0.016)	(0.018)	(0.097)
Post	-0.021***	-0.005	0.297***	-0.655***
	(0.004)	(0.007)	(0.007)	(0.035)
Dependency ratio	0.012***	0.060***	-0.050***	-0.257***
	(0.003)	(0.008)	(0.009)	(0.047)
Age	0.000***	0.000**	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.001)
Gender: Male	-0.010***	-0.058***	0.025***	0.074**
	(0.002)	(0.006)	(0.007)	(0.035)
Education: Base: Illiterate				
Primary education	0.003	-0.022***	0.062***	0.213***
	(0.002)	(0.006)	(0.007)	(0.035)
Secondary education and above	-0.008***	-0.090***	0.114***	0.778***
	(0.002)	(0.007)	(0.008)	(0.039)
Total assets	0.019***	1.048***	0.058***	0.369***
	(0.001)	(0.002)	(0.001)	(0.008)
Religion: Base: Hindu				
Muslims	0.002	0.024**	-0.019*	-0.160***
	(0.003)	(0.012)	(0.011)	(0.054)
Others	-0.010***	-0.006	0.022**	0.054
	(0.004)	(0.012)	(0.011)	(0.054)
Caste: Base: General				
SC-ST	0.011**	0.092***	-0.075***	-0.468***
	(0.005)	(0.017)	(0.013)	(0.069)
Others	0.008*	0.073***	-0.053***	-0.389***
	(0.004)	(0.016)	(0.012)	(0.062)
Occupation: Regular salaried	-0.005***	-0.036***	0.039***	0.644***
	(0.002)	(0.006)	(0.005)	(0.030)
Sector: Urban	-0.001	-0.093***	0.054***	0.533***
	(0.002)	(0.005)	(0.006)	(0.030)
Year fixed effects	-0.027***	0.030***	0.081***	-0.396***
	(0.003)	(0.006)	(0.006)	(0.036)
District fixed effects	Yes	Yes	Yes	Yes
R-squared	0.720	0.963	0.314	0.312
Observations	20,976	20,230	20,976	15,224

With respect to control variables, we find that the households with more dependents hold a higher amount of illiquid assets and less amount of financial assets. Moreover, our result suggests that the higher the age of the household head, the more the uptake and holding of the

illiquid assets, whereas age has no significant relationship with financial asset holding. Next, we find that the households with more educated heads of the family are less likely to invest in illiquid assets and more likely to invest in financial assets. Further, the result indicates a positive, strong association between the economic status given by the logarithm of total assets and participation in both the types of assets and also for the value of assets. Noticeably, the marginal effect of economic status for financial assets is higher than that of illiquid assets, indicating that improving the financial status increases the household's participation in the financial market to a greater extent. Additionally, compared to non-regular salaried households, regular salaried households invest less in illiquid assets and more in financial assets. Further, our result indicates that urban households are more likely to participate in the financial market. The availability of financial instruments in urban areas allows households to participate in the financial market.

A critical assumption while using the difference-in-difference framework is that the difference in outcomes between the treated and the control groups does not change over time in the pre-flood period, also known as the parallel trends assumption. To ascertain the validity of this assumption, we consider a sample that constitutes the unaffected households, i.e., households belonging to Tamil Nadu and Pondicherry but in the pre-flood years. In other words, we restrict our sample only to AIDIS 59th and 70th rounds and estimate the below equations:

$$L_{hdt} = \partial_0 + \partial_1 Flood_d + \partial_2 Year_t + \partial_3 Flood_d * Year_t + \sum \partial_k X_{khdt} + District_d + \varepsilon_{hdt} \quad (3.3)$$

$$y_{hdt} = \partial_0 + \partial_1 Flood_d + \partial_2 Year_t + \partial_3 Flood_d * Year_t + \sum \partial_k X_{khdt} + District_d + \varepsilon_{hdt} \quad (3.4)$$

In the above specifications, if the estimate δ_3 turns out to be insignificant, we argue that the outcomes of households in the flood-affected districts are not statistically different from those

from the flood-unaffected districts in the pre-flood years. The other variables are the same as those in equation (3.1). Table 3.4 shows the test result suggesting a statistically insignificant interaction term for the Illiquid1, Illiquid2, and Financial2.

Table 3.4: Parallel trend check

The table below represents the result for checking the parallel trend assumption. It provides the coefficient of probit (column 1 and 3) and OLS (Column 2 and 4) regression of assets on the interactive term of flood dummy and pre flood year dummy and other socio-demographic factors. The model measures the change in household investment behaviour from 2003 to 2013. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1) *Illiquid1*	(2) *Illiquid2*	(3) *Financial1*	(4) *Financial2*
*Flood*Year*	0.291	-0.016	0.455***	0.057
	(0.184)	(0.012)	(0.054)	(0.078)
Flood	0.090	-0.066***	-0.297***	0.014
	(0.252)	(0.019)	(0.086)	(0.139)
Year	-0.994***	0.051***	0.208***	-0.425***
	(0.116)	(0.007)	(0.032)	(0.043)
Dependency ratio	0.537***	0.051***	-0.157***	-0.220***
	(0.128)	(0.010)	(0.042)	(0.066)
Age	0.008***	0.000	0.001	0.001
	(0.003)	(0.000)	(0.001)	(0.001)
Gender: Male	-0.464***	-0.055***	0.105***	0.040
	(0.099)	(0.007)	(0.032)	(0.049)
Education: Base: Illiterate	0.167	-0.026***	0.251***	0.190***
Primary education	(0.108)	(0.007)	(0.031)	(0.049)
	-0.333***	-0.094***	0.502***	0.829***
Secondary education and above	(0.105)	(0.008)	(0.033)	(0.050)
Total assets	0.825***	1.036***	0.258***	0.404***
	(0.030)	(0.002)	(0.007)	(0.011)
Religion: Base: Hindu				
Muslims	0.143	0.028**	-0.091*	-0.116*
	(0.142)	(0.014)	(0.050)	(0.066)
Others	-0.397***	0.010	0.070	0.088
	(0.145)	(0.013)	(0.052)	(0.070)
Caste: Base: General				
SC-ST	0.441**	0.094***	-0.377***	-0.493***
	(0.178)	(0.020)	(0.064)	(0.083)
Others	0.343**	0.075***	-0.266***	-0.383***
	(0.156)	(0.018)	(0.059)	(0.072)
Occupation: Non-regular salaried	-0.086	-0.036***	0.174***	0.670***
	(0.081)	(0.007)	(0.026)	(0.039)
Sector: Urban	-0.099	-0.103***	0.265***	0.715***
	(0.090)	(0.006)	(0.027)	(0.040)
District fixed effects	Yes	Yes	Yes	Yes
R-squared	0.744	0.967	0.225	0.318
Observations	14,996	14,431	14,996	9,434

3.8 Robustness checks

3.8.1 Alternative estimation method -Propensity score matching

Our main result is based on a pooled cross-sectional database. One can argue that the result may be biased since similar households are not surveyed in each of the rounds. Therefore, to verify the consistency of our result, we re-estimate our main model in the subsample matched by propensity score matching (PSM) in a single neighbourhood. The detail of PSM is discussed earlier in Chapter 2 (refer to Section 2.7.1). The treated households are matched with control households based on dependent ratio, age, gender, and education of household head, economic status, religion, caste, and sector of residence. The matched sample consists of 4,364 households. Results presented in Table 3.5 suggest a significant reduction in illiquid assets (column 1) and a significant increase in financial asset holding (column 3) of the affected households in the aftermath of a flood. Similarly, the results are consistent for the amount of assets (columns 2 and 4) as well. Therefore, PSM reinforces our main result.

Table 3.5: Robustness Check-Alternative estimation method

The above table presents the marginal effects from probit (Columns 1,3 and 5) and OLS regression (Columns 2,4 and 6) of assets of the households in the sample matched by propensity score matching. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

	(1)	(2)	(3)	(4)
	Illiquid1	*Illiquid2*	*Financial1*	*Financial2*
*Flood*Post*	-0.021**	-0.061**	0.071***	0.316**
	(0.010)	(0.024)	(0.023)	(0.125)
Flood	0.051	-0.121***	-0.045	0.133
	(0.032)	(0.033)	(0.028)	(0.209)
Post	-0.008	-0.037*	0.256***	-0.589***
	(0.008)	(0.020)	(0.028)	(0.100)
Dependency ratio	0.011	0.079***	-0.041***	-0.442***
	(0.008)	(0.019)	(0.015)	(0.093)
Age	0.000	0.001***	-0.000	0.002
	(0.000)	(0.000)	(0.000)	(0.002)
Gender: Male	-0.014***	-0.058***	0.025*	0.128*
	(0.004)	(0.016)	(0.013)	(0.070)
Education: Base: Illiterate				
Primary education	-0.009*	-0.005	0.032**	0.360***
	(0.005)	(0.013)	(0.013)	(0.072)
Secondary education and above	-0.015***	-0.096***	0.062***	0.952***
	(0.004)	(0.015)	(0.013)	(0.079)

	(1)	(2)	(3)	(4)
	Illiquid1	*Illiquid2*	*Financial1*	*Financial2*
Total assets	0.022***	1.075***	0.038***	0.352***
	(0.001)	(0.004)	(0.003)	(0.015)
Religion: Base: Hindu				
Muslims	0.002	0.033	0.018	-0.353***
	(0.006)	(0.025)	(0.018)	(0.110)
Others	-0.010	-0.063**	0.005	0.167*
	(0.008)	(0.032)	(0.016)	(0.100)
Caste: Base: General				
SC-ST	0.013	0.092***	-0.087***	-0.526***
	(0.008)	(0.031)	(0.017)	(0.118)
Others	0.002	0.059**	-0.082***	-0.442***
	(0.008)	(0.028)	(0.016)	(0.107)
Occupation: Regular salaried	-0.013***	-0.063***	0.045***	0.923***
	(0.004)	(0.014)	(0.009)	(0.059)
Sector: Urban	-0.006	-0.073***	0.025**	0.392***
	(0.005)	(0.012)	(0.010)	(0.060)
Year fixed effects	-0.036***	0.015	0.042***	-0.374***
	(0.013)	(0.017)	(0.009)	(0.096)
District fixed effects	Yes	Yes	Yes	Yes
R-squared	0.657	0.954	0.348	0.367
Observations	3,965	4,504	4,634	4,007

3.8.2 Alternate treatment group

We redefine our treatment group by considering only the highly affected districts (Tiruvallur, Chennai, Kancheepuram, Villupuram), keeping control group districts intact, and re-estimate our model. We define the variable 'High' by considering one for highly affected districts (mentioned earlier) and zero otherwise. Table 3.6 presents the result for this alternate sample. We find that the households in the highly affected reduced their participation in illiquid assets (column 1) and increased participation in financial assets (column 3) after the flood. The results remain also unchanged when considering the illiquid and liquid assets' value (columns 2 and 4).

Table 3.6: Robustness Checks-Alternative treatment group

The following table presents the marginal effects from probit (Columns 1 and 3) and OLS regression (Columns 2 and 4) of the investment portfolio of the households considering highly affected areas as the treated group for the flood dummy as the alternative interest variable. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
	Illiquid1	*Illiquid2*	*Financial1*	*Financial2*
*High*Post*	-0.015***	-0.088***	0.115***	0.322***
	(0.004)	(0.015)	(0.021)	(0.063)
High	0.010**	-0.085***	-0.039**	0.176*
	(0.004)	(0.017)	(0.019)	(0.099)
Post	-0.022***	-0.001	0.290***	-0.642***
	(0.004)	(0.007)	(0.007)	(0.036)
Dependency ratio	0.013***	0.056***	-0.044***	-0.227***
	(0.003)	(0.009)	(0.010)	(0.050)
Age	0.000***	0.001***	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.001)
Gender: Male	-0.010***	-0.060***	0.025***	0.056
	(0.002)	(0.007)	(0.007)	(0.037)
Education: Base: Illiterate				
Primary education	0.004**	-0.021***	0.061***	0.210***
	(0.002)	(0.006)	(0.008)	(0.037)
Secondary education and above	-0.007***	-0.085***	0.109***	0.761***
	(0.002)	(0.007)	(0.008)	(0.040)
Total assets	0.020***	1.047***	0.059***	0.376***
	(0.001)	(0.002)	(0.001)	(0.009)
Religion: Base: Hindu				
Muslims	0.003	0.019	-0.017	-0.107*
	(0.003)	(0.013)	(0.012)	(0.056)
Others	-0.011***	-0.003	0.024**	0.037
	(0.004)	(0.012)	(0.011)	(0.055)
Caste: Base: General				
SC-ST	0.009*	0.086***	-0.065***	-0.486***
	(0.005)	(0.019)	(0.014)	(0.073)
Others	0.006	0.070***	-0.040***	-0.400***
	(0.004)	(0.018)	(0.013)	(0.066)
Occupation: Regular salaried	-0.003*	-0.029***	0.034***	0.593***
	(0.002)	(0.006)	(0.006)	(0.031)
Sector: Urban	-0.000	-0.094***	0.054***	0.525***
	(0.002)	(0.005)	(0.006)	(0.031)
Year fixed effects	-0.029***	0.041***	0.058***	-0.364***
	(0.004)	(0.006)	(0.006)	(0.038)
District fixed effects	Yes	Yes	Yes	Yes
R-squared	0.720	0.962	0.300	0.308
Observations	18,431	17,768	18,431	13,426

3.8.3 Alternate control group

Next, we define a variable named 'Alternative flood' by considering the alternate control group, including the districts that share borders with the affected districts in the main model and re-

estimate the model. Table 3.7 provides the result. Again, as expected, we do not find any qualitative change in our results for both the types of asset participation variables (columns 1 and 3) and values (columns 2 and 4), ensuring that the main findings are not sensitive to the selection of control groups.

Table 3.7: Robustness Check-Alternative control group

The above table presents the marginal effects from probit (Columns 1,3 and 5) and OLS regression (Columns 2,4 and 6) of assets of the households considering an alternative flood dummy by taking the alternate control group as the alternative interest variable. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

	(1)	(2)	(3)	(4)
	Illiquid1	*Illiquid2*	*Financial1*	*Financial2*
*Alternative flood*Post*	-0.010***	-0.060***	0.078***	0.169***
	(0.003)	(0.011)	(0.018)	(0.052)
Alternative flood	0.038**	-0.061*	0.027	-0.637***
	(0.016)	(0.035)	(0.039)	(0.232)
Post	-0.023***	-0.018***	0.314***	-0.578***
	(0.003)	(0.006)	(0.006)	(0.030)
Dependency ratio	0.010***	0.056***	-0.054***	-0.279***
	(0.002)	(0.007)	(0.008)	(0.042)
Age	0.000***	0.001***	0.000	0.002**
	(0.000)	(0.000)	(0.000)	(0.001)
Gender: Male	-0.009***	-0.055***	0.023***	0.062**
	(0.001)	(0.005)	(0.006)	(0.031)
Education: Base: Illiterate				
Primary education	0.001	-0.020***	0.062***	0.238***
	(0.002)	(0.005)	(0.006)	(0.031)
Secondary education and above	-0.008***	-0.087***	0.118***	0.782***
	(0.002)	(0.006)	(0.007)	(0.034)
Total assets	0.018***	1.047***	0.060***	0.369***
	(0.000)	(0.002)	(0.001)	(0.007)
Religion: Base: Hindu				
Muslims	0.001	0.022**	-0.013	-0.130***
	(0.002)	(0.011)	(0.010)	(0.048)
Others	-0.009***	-0.006	0.025**	0.090*
	(0.003)	(0.011)	(0.010)	(0.052)
Caste: Base: General				
SC-ST	0.010**	0.089***	-0.075***	-0.450***
	(0.004)	(0.016)	(0.012)	(0.064)
Others	0.007**	0.068***	-0.049***	-0.401***
	(0.004)	(0.015)	(0.011)	(0.058)
Occupation: Regular salaried	-0.003**	-0.026***	0.028***	0.611***
	(0.001)	(0.005)	(0.005)	(0.027)
Sector: Urban	-0.002	-0.089***	0.054***	0.521***
	(0.002)	(0.005)	(0.005)	(0.027)
Year fixed effects	-0.024***	0.023***	0.088***	-0.411***
	(0.003)	(0.005)	(0.005)	(0.032)
District fixed effects	Yes	Yes	Yes	Yes
R-squared	0.731	0.965	0.323	0.308
Observations	26,072	25,188	26,072	18,838

3.9 Portfolio rebalancing

Our main analysis suggests that possibly flood-affected households are rebalancing their investment portfolio after the flood. To explore this further, we consider the sub-sample of households holding liquid and illiquid assets. In our sample, 77 percent of households participate in both physical and financial asset markets. Re-estimating the results for this sub-sample, we find that the amount of illiquid assets held by affected households decreased by 3.2 percent (column 1 of Table 3.8), and the value of financial assets held increased by 24.7 percent in the post-flood period (column 2 of Table 3.8). Hence, as predicted, we conclude that the flood led to the affected households' rebalancing of the investment portfolio after the shock. As per the experiential learning theory, after experiencing a flood, these households may reduce illiquid asset holdings and increase investments in financial assets, given their lower transaction costs, higher liquidity, and usefulness during the crisis period.

Table 3.8: Portfolio rebalancing

The table below presents the marginal effects OLS regression in the subsample of two types of asset holders to check the rebalancing of the portfolio. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)
	Illiquid2	*Financial2*
*Flood*Post*	-0.032**	0.247***
	(0.014)	(0.055)
Flood	-0.108***	0.219**
	(0.021)	(0.099)
Post	0.048***	-0.672***
	(0.008)	(0.036)
Dependency ratio	0.057***	-0.233***
	(0.010)	(0.048)
Age	0.001***	0.001
	(0.000)	(0.001)
Gender: Male	-0.055***	0.068*
	(0.008)	(0.036)
Education: Base: Illiterate		
Primary education	-0.011	0.217***
	(0.008)	(0.036)
Secondary education and above	-0.082***	0.771***
	(0.009)	(0.039)
Total assets	1.077***	0.389***
	(0.002)	(0.009)
Religion: Base: Hindu		

	(1)	(2)
	Illiquid2	*Financial2*
Muslims	0.025*	-0.164***
	(0.015)	(0.054)
Others	-0.004	0.044
	(0.014)	(0.055)
Caste: Base: General		
SC-ST	0.074***	-0.469***
	(0.020)	(0.070)
Others	0.064***	-0.390***
	(0.018)	(0.064)
Occupation: Regular salaried	-0.045***	0.651***
	(0.007)	(0.030)
Sector: Urban	-0.099***	0.527***
	(0.006)	(0.030)
Year fixed effects	0.074***	-0.418***
	(0.008)	(0.036)
District fixed effects	Yes	Yes
R-squared	0.953	0.311
Observations	14,897	14,897

3.10 Types of assets

Our main analysis suggests that households are less likely to hold illiquid assets and more likely to hold financial assets in the post-flood period. This section explores which of the instruments in each of these categories primarily drive the result. For illiquid assets, we consider two categories, i.e., real estate (land and buildings) and ornaments. We define real estate1 and real estate2 variables, where the former captures the real estate ownership and the latter gives the real estate value, respectively. Likewise, ornaments uptake is defined by the dummy variable ornaments1, whereas the ornaments2 variable gives the value of ornaments. In our sample, around 76 percent illiquid asset holders hold real estate whereas 95 percent of illiquid asset holders hold ornaments (Table A3.2 in Appendix). We re-estimate the effect of the flood by considering the types of illiquid assets for the subsample of households holding illiquid assets. The results presented in Table 3.9 suggest that the treated households are less likely to hold both real estate (column 1) and ornaments (column 3) in the post-flood period by over 3 percentage points, whereas, we find that the value of real estate falls for the treated households (column 2); however, the value of ornaments held by the treated households remains unchanged

after the flood. Therefore, the fall in the value of illiquid assets appears to be driven by the fall in real estate value among treated households.

Further, we consider two types of instruments within financial assets, i.e., deposits and retirement funds. The variable deposit includes all the savings and term deposits in commercial banks, cooperative banks, post-office, other financial fixed income sources (NSC, KVP, savings bond), micro-finance institutions, self-help groups, deposits with non-banking finance companies and other financial savings. On the other hand, retirement funds include provident funds, pension funds, and other types of contributory funds and annuity schemes. We define deposit1 and deposit2 to capture whether households have deposits and the value of deposits, respectively. Similarly, we define retirement fund1 and retirement fund2 variables and re-estimate the results. Note that this regression is estimated for the households owning financial assets (80.2percent of households). Among these households, 96 percent have deposit funds, whereas only 14 percent own retirement funds (Table A3.2). Column 5 of Table 3.9 suggests that households in the treated group are not more likely to hold deposits in the post-flood period. This result is unsurprising as the post-flood period is almost five years after implementing the Government of India's flagship financial inclusion program PMJDY (2014), which targeted universal bank account ownership. Interestingly, the uptake of retirement funds for treated households increased by 8.4 percentage points (column 7) in the post-flood period. Hence, the higher likelihood of owing financial assets in the post-flood period by the treated households appears to be driven by a higher likelihood of having retirement funds. It also suggests that in the aftermath of a natural disaster, households' financial behaviour may improve, and they may start investing in long-term financial assets instead of illiquid ones. We observe that the value of deposits and retirement funds held by treated households after the flood is higher on average (columns 6 and 8).

Table 3.9: Types of assets

The table below presents the marginal effects of probit (Columns 1,3,5 and 7) and OLS (Columns 2,4,6 and 8) regression for different types of assets. Columns 1-4 present the regression results for types of illiquid assets, and columns 5-8 present the results for types of financial assets. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Real estate1	*Real estate2*	*Ornaments1*	*Ornaments2*	*Deposit1*	*Deposit2*	*Retirement fund1*	*Retirement fund2*
*Flood*Post*	-0.034***	-0.054***	-0.024**	0.034	-0.013	0.343***	0.084***	0.638***
	(0.009)	(0.010)	(0.009)	(0.031)	(0.034)	(0.049)	(0.013)	(0.176)
Flood	-0.002	0.039**	0.009	-0.523***	-0.006	-0.140	0.032*	-0.315
	(0.014)	(0.017)	(0.010)	(0.050)	(0.011)	(0.087)	(0.019)	(0.203)
Post	-0.124***	-0.047***	0.031***	0.687***	0.087***	-0.396***	-0.133***	-1.194***
	(0.006)	(0.006)	(0.004)	(0.020)	(0.012)	(0.030)	(0.007)	(0.156)
Dependency ratio	0.039***	0.053***	-0.031***	-0.151***	0.013*	-0.082**	-0.083***	-0.426***
	(0.006)	(0.008)	(0.006)	(0.025)	(0.007)	(0.042)	(0.010)	(0.124)
Age	0.001***	0.001***	-0.001***	-0.004***	0.000	0.002**	-0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.003)
Gender: Male	-0.008	-0.051***	0.013***	0.081***	-0.001	0.025	0.013*	0.232**
	(0.005)	(0.007)	(0.004)	(0.019)	(0.005)	(0.032)	(0.008)	(0.094)
Education: Base:Illiterate								
Primary education	-0.065***	-0.034***	0.036***	0.235***	-0.006	0.184***	0.023***	0.014
	(0.005)	(0.006)	(0.004)	(0.020)	(0.005)	(0.032)	(0.007)	(0.127)
Secondary education and above	-0.142***	-0.084***	0.037***	0.515***	-0.002	0.557***	0.094***	0.501***
	(0.006)	(0.007)	(0.005)	(0.021)	(0.005)	(0.034)	(0.008)	(0.115)
Total assets	0.126***	1.065***	0.004***	0.411***	0.006***	0.300***	0.023***	0.436***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.007)	(0.002)	(0.020)
Religion: Base: Hindu								
Muslims	-0.013*	0.006	0.007	0.087***	0.009	-0.113**	-0.029***	-0.197
	(0.007)	(0.011)	(0.007)	(0.030)	(0.007)	(0.046)	(0.011)	(0.128)
Others	-0.001	-0.005	-0.021***	0.000	0.013**	-0.020	0.015	0.043
	(0.007)	(0.011)	(0.008)	(0.029)	(0.006)	(0.046)	(0.009)	(0.095)
Caste: Base:								

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Real estate1	*Real estate2*	*Ornaments1*	*Ornaments2*	*Deposit1*	*Deposit2*	*Retirement fund1*	*Retirement fund2*
General								
SC-ST	0.139***	0.070***	-0.017*	-0.403***	-0.021***	-0.604***	0.041***	-0.126
	(0.012)	(0.014)	(0.009)	(0.037)	(0.007)	(0.061)	(0.011)	(0.114)
Others	0.078***	0.046***	0.003	-0.170***	-0.018***	-0.432***	0.011	-0.318***
	(0.011)	(0.013)	(0.008)	(0.034)	(0.005)	(0.057)	(0.009)	(0.099)
Occupation: Regular salaried	-0.018***	-0.008	0.008**	0.029*	-0.030***	0.095***	0.256***	0.629***
	(0.004)	(0.005)	(0.003)	(0.015)	(0.004)	(0.025)	(0.006)	(0.111)
Sector: Urban	-0.173***	-0.023***	0.025***	0.270***	0.003	0.356***	0.011*	0.152
	(0.005)	(0.006)	(0.003)	(0.016)	(0.004)	(0.026)	(0.006)	(0.095)
Year fixed effects	-0.139***	-0.135***	0.019***	1.099***	0.021***	-0.538***	-0.048***	-0.755***
	(0.005)	(0.007)	(0.003)	(0.017)	(0.004)	(0.031)	(0.006)	(0.064)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.637	0.964	0.111	0.564	0.186	0.237	0.317	0.340
Observations	20,230	15,147	20,230	19,182	15,224	14,512	15,224	2,273

3.11 Chapter summary

The suboptimal financial behaviour and investment mistakes committed by households remain a major concern for policymakers across the world and more so in a country like India, where a sizable proportion of the assets is still invested in the form of real estate and gold. Moreover, being a developing economy where a large number of households work in the informal sector, the vulnerability of Indian households is too high when facing any shock. According to experimental learning theory, experience teaches people the best lesson. In this chapter, we investigate the long-term impact of the Tamil Nadu flood of 2015 on household investment portfolios. Using multiple rounds of large-scale household surveys, we find that the flood leads households to reassess the weightage of the types of assets in their portfolio. In the aftermath of the flood, the treated households are less likely to hold illiquid assets and more likely to hold liquid financial assets. Among illiquid assets, treated households are less likely to hold both real estate and ornaments. On the other hand, the higher likelihood of holding financial assets among treated households is driven by retirement funds. Further, we find that the value of illiquid assets fell, whereas the value of the liquid financial assets held by the treated households increased in the post-flood period. The value of real estate drives the fall in the value of illiquid assets, whereas the increased value of financial assets held by treated households in the post-flood period is driven by the increased deposits and the value of retirement funds. The results are mainly in line with the experiential learning theory. Hence, our study suggests that covariate shocks like floods potentially affect households' investment behaviour and may lead households to rebalance their investment portfolio.

Chapter 4

Housing and financial investments

Summary

This chapter empirically analyses how housing and financial investment are correlated, i.e., directly or inversely. To do that, we frame our research question as follows: 'How the housing and the financial investment of the households of urban India are correlated?'. We use the nationally representative All-India Debt and Investment Survey conducted in India in 2019 for our analysis. We consider two housing measures, i.e., homeownership and home value, to examine the correlation between housing and investment in financial assets. We use an instrumental variable approach to account for the possible endogeneity associated with the housing variable. We find that 63 percent of households own residential buildings. The average value of housing assets is 9.7 lakhs. Our analysis suggests that housing is negatively related to the share of financial assets supporting the crowding-out effect in the urban India context. We find that the committed expenditure on account of housing crowds out financial investments in India. Our results are robust to alternate estimation methods, including the propensity score matching method, alternate definitions of interest variables, alternate outcome variables, and the inclusion of additional control variables. Further, the substitution effect is more striking for younger and poorer households with low labour income. Moreover, households with a high dependency ratio have less substitution effect. Further, this is among the few studies that provide insights regarding how housing is related to financial investment in an emerging economy context.

Keywords: Homeownership, Home value, Financial investment, Substitution

4.1 Introduction

The previous chapter provides evidence that households rebalance their asset investment portfolio following a shock using a pooled cross-sectional database. Now, we would like to understand whether a relationship between financial and physical assets relies on cross-sectional data in a static framework. Specifically, we consider the role of housing in influencing the financial assets of the household. The efficient portfolio allocation between physical and financial assets allows households to enjoy returns with moderate risks and sufficient liquidity. Studies in several country contexts indicate that the correlation between housing and financial investment is ambiguous. One set of studies concludes that housing substitutes financial investment because of the cost associated with homeownership (Zou and Deng, 2019; Cocco,2005). In contrast, another set of studies indicates a possibility that homeowners with large home values are wealthy households; hence, they are expected to invest more in financial assets (He et al.,2019; Cardak and Wilkins, 2009). Further, housing may provide collateral enabling households to borrow from institutional sources, enhancing financial investment through improved trust and awareness regarding financial institutions.

Housing is one of the most significant assets owned by households over their lifetime. Home is regarded both as an investment asset and consumption good and sometimes referred to as a status good (Wei et al., 2017). This atypical attribute drives the housing demand to a large extent, even in most advanced economies. Studies have highlighted that the often investment in housing tends to be greater than the optimal investment one would obtain using the conventional mean-variance criterion (Cocco, 2005; Flavin and Yamashita, 2002). Overinvestment in housing is a problem since a house is an illiquid asset, indivisible with high transaction costs, and it becomes difficult to readjust the weight of housing in the portfolio in

the wake of changing economic conditions. Once the household chooses to invest in a house, they have to incur two types of risk: house price risk and committed expenditure risk (Fratantoni, 1998). The former refers to the uncertainty related to the price at which the homeowner will be able to sell the house in the future. On the other hand, committed expenditure risk constitutes committing to pay mortgage payments in a world with uncertain future labour income. Further, Fratantoni (1998) observes that the expenditure risk associated with housing can significantly impact the household's portfolio composition by reducing the share of risky assets in the portfolio. Later, Fratantoni (2001) showed that accounting for housing in investment decisions can explain the equity premium puzzle in the United States, i.e., why a meagre percentage of households invest in risky assets given superior historical returns in the equity market. However, an influential study by Chetty et al. (2017) find that even though having high mortgage debt substitutes investment in risky financial assets, an increase in home equity, defined as the value of the home net of outstanding mortgage, is related to the rise in allocation to risky investments.

A considerable number of households in India are still without adequate housing. According to the "Global Strategy for Shelter to the Year 2000" catered by the United Nations, "adequate housing" is defined as "adequate privacy, adequate space, adequate security, adequate lighting and ventilation, adequate basic infrastructure and adequate location about work and basic facilities-all at a reasonable cost." Further, the lack of proper infrastructure puts an extra cost burden on households, especially in urban area, e.g., in the absence of a proper toilet at home, they have to pay for using the public toilet. Moreover, we observe that even though 93 percent of households in rural India own homes only 63 percent of urban households are homeowners (All India Debt and Investment Survey,2019) indicating that the issue of

'inadequate housing' is more concerning for urban households. Further, a nationally representative survey known as 'Longitudinal Ageing Study in India (LASI)-2018[29]' reports that less than 30 percent of urban Indian households inherited or received their home from the government. In contrast, over 50 percent of rural houses inherit or receive a home from the government. Therefore, many households in urban India purchase homes either by self-finance or through housing loans. Both these ways of financing housing impose a constraint on the household budget. Moreover, the rapid urbanisation in India puts an added concern for 'inadequate housing'(Teotia,2014). According to the Technical Group on Urban Housing Shortage for the 12th Plan (TG-12) established by the Ministry of Housing and Urban Poverty Alleviation for the purpose of estimating the urban housing shortage in the country for 2012-2017, the total number of households without adequate housing in Indian cities stands at 18.78 million. Therefore, examining the effect of housing in urban India is worthwhile, as urban India is characterised by severe housing poverty[30] (National Building Organisation Report, 2012). The Government of India launched the Pradhan Mantri Awas Yojana in 2015, an urban flagship mission to provide affordable housing to the urban poor and address the issue of housing poverty. From a policy viewpoint, providing a home to the homeless is a necessary and desirable policy. However, one can argue that the costs related to maintaining and repairing poor-quality homes may be burdensome for poor households. In that case, poor households may face a more stringent budget constraint instead of enjoying the benefit of homeownership due to the associated maintenance costs. Hence, ownership of poor-quality homes could also be burdensome because

[29] https://www.iipsindia.ac.in/content/LASI-data

[30]Housing poverty is defined as lack of adequate housing. It includes basic amenities such as electricity, water supply, sanitation, and even sewage management. Source: https://www.orfonline.org/research/housing-poverty-in-urban-India-the-failures-of-past-and-current-strategies-and-the-need-for-a-new-blueprint-48665/#_edn8 (Accessed on July 25, 2022)

of the high repair and maintenance costs. Overall, the urban housing poverty in India and low participation in financial markets make it worthwhile to revisit the relationship in the urban Indian context.

There are at least two ways through which housing can affect the financial asset holding of households. First, homeownership is associated with committed expenditure from regular property tax payments, maintenance costs proportional to house size, and mortgage payments (Flavin and Yamashita, 2002; Fratantoni, 2001). This can potentially reduce the household's ability to invest in liquid financial assets or substitute financial investments. On the other hand, one may expect that the homeowners for whom the house is not mortgage financed either because they had excess cash (wealthy households) and bought the home entirely using their funds or have inherited the home have high home equity. An increase in home equity should then crowd in financial investments (Chetty et al., 2017). On the other hand, homeownership and considerable home value may allow households to borrow for investing in financial assets by providing the collateral facility. Ex-ante, we believe that the committed expenditure associated with housing may dominate the home equity effect since many low-income households own a house, albeit of poor quality, and a significant fraction of the households are engaged in non-white collar jobs and have uncertain future income.

Chapter 4 makes two key contributions to the literature. First, our study contributes to household finance literature by showing committed expenditure on account of housing substitutes financial investments of urban households. Second, our study also contributes to the housing literature, especially in the context of urban India. Several papers have examined the determinants of homeownership in India (Das et al., 2019; Mukherji, 2015); however, to the best of our knowledge, this is one of the first studies to examine how housing is related to the

financial investment behaviour of the households in urban India. Our study highlights a significant trade-off between housing and investments in liquid financial assets.

The remainder of the chapter is organised as follows. Section 4.2 discusses the literature review, Section 4.3 proposes the conceptual framework and research question, while Section 4.4 explains data and variables. Section 4.5 describes the methodology. Section 4.6 discusses the results, Section 4.7 presents the robustness checks of the study, and Section 4.8 elaborates on the analysis for all types of financial assets. Section 4.9 discusses some heterogeneous effects, and finally, Section 4.10 discusses the findings of the study.

4.2 Literature review

A large body of literature, especially in advanced economies, has explored how housing decisions affect investment behaviour at the household level. Existing literature searching for the association between housing and financial investment provides two contrasting pieces of evidence. The first set of studies considers homeownership as the interest variable and provides evidence that homeownership substitutes risky asset-holding of the household (Yamashita, 2003; Heaton and Lucas,2000; Fratantoni, 1998). These studies propose that the risks related to house price and the committed expenditure majorly drive the substitution effect of homeownership. Fratantoni (1998) shows that mortgage commitment related to homeownership leads households to reduce risky asset holding, but families hold financial assets safely to meet the committed expenditure. Simultaneously, based on information from the United States, Chetty et al. (2017) and Fratantoni (1998) exhibit that a rise in housing investment drives households to bring down their risky asset holdings fundamentally because of their higher exposure to mortgage commitment risks. Moreover, Chetty and Szeidl (2010) document that house price risks have a

minor contribution to portfolio choices of the households than the mortgage commitment risks. Similarly, Cocco (2005) provides evidence for reduced stock holding as an impact of housing price risk by constructing an intertemporal investment decision model, including labour income risk and fixed cost for equity market participation. Additionally, empirical studies find a negative association between housing wealth and risky asset holding (Chetty et al., 2017; Yao and Zhang, 2005; Yamashita, 2003; Flavin and Yamashita, 2002). Using the data collected by health, ageing, and retirement survey in 2004 of multiple European countries, Cho (2014) provides evidence for three major findings, i.e., firstly, homeowners, especially in the bank-based economy, have a lower likelihood of participating in the stock market whereas those from a market-based economy do not have a significant impact on financial market participation. Secondly, Cho (2014) finds that homeowners are likely to invest a lower proportion of their financial assets in risky components than renters. Third, households with considerable home value are reluctant to invest more in the stock market. Likewise, Arrondel and Savignac (2009) explain how the increase in the housing to net worth ratio crowds out the investment in the stock market given total financial wealth with the help of the equity premium puzzle. Further, some studies in China (Zou and Deng,2019; Zhou et al.,2017) find a negative relationship between housing and financial market participation. On the other hand, Shum and Faig (2006) report an insignificant relationship between exposure to real estate and financial asset holding. They argue that the complexity associated with housing, like high illiquidity with the provision of shelter despite the generation of stream of liquidity needs (mortgage, property tax, utility payments, maintenance costs), explains the ambiguity in the relationship. Curcuru et al. (2010) and Kullmann and Siegel (2005) provide evidence for a significant and negative association between real estate and stock investment in the U.S. context. Further, Gopalakrishnan et al. (2019) show that investment in

both real estate and financial assets increases after a shock, though the change in real estate is insignificant. Additionally, they provide evidence that households' financial investment decreases and real estate investment increases for the households experiencing two shocks, suggesting that households often invest in financial assets to fund their real estate investments.

In contrast, Cardak and Wilkins (2009) document a positive relationship between homeownership and risky asset holding, reflecting a wealth effect. More recently, Liu (2020) also shows that housing investment induces households to participate in the stock market but reduces the proportion of stockholding for Chinese households. Given the ambiguity in the existing empirical literature, we test this in the urban Indian context. Further, Pelizzon and Weber (2009), using a life-cycle model, find that the highest share of financial portfolio inefficiency exists for the households who are long in their position or "over-housed"[31] and at the same time, the rate of stock market participation is high among this group, even though the amount of investment is not enough for them to hedge all the risks related to housing.

4.3 Conceptual framework and research question

Housing can affect financial investment in two ways. Firstly, housing in terms of homeownership is associated with committed expenditure that includes property tax payment along with the cost of maintenance and repair against physical depreciation of the house to ensure that the physical quality of the house remains intact (Flavin and Yamashita,2002; Fratantoni,1998). Hence, the high homeownership rate of Indian households across all wealth quintiles and poor-quality homes is likely to impose high costs on the households. Further, related to the size of the house, ceteris paribus, owning a bigger house is related to higher committed expenditure (Fratantoni, 2001).

[31] When the future need of housing is declining and death probability is high.

Therefore, committed expenditures associated with housing can substitute for financial investment.

On the other hand, there is a possibility that the households with homeownership and higher home value seems to be wealthy. Hence, a higher home equity may result in increased investment in financial assets. Moreover, the house can be collateral for institutional borrowing to invest in financial assets. Therefore, housing may positively affect financial investment through its wealth effect.

Based on the theoretical predictions discussed above, housing and financial investments may have a positive or negative correlation. However, among the households in our sample, those with outstanding debt, only 0.2 percent borrowed for financial investment, whereas around 43 percent borrowed for housing purposes (AIDIS Report,2019). Therefore, the families with homes that are not mortgage financed either have dissaved or used all the excess cash to purchase the home, possibly leaving them with a low stock of wealth and entirely relying on current income for meeting consumption needs. Hence, the high homeownership rate, irrespective of the home quality and the associated costs, may dominate the wealth effect of housing since many households are in the low-income category and are engaged in the informal sector with considerable income uncertainty.

4.4 Data and variables

4.4.1 Data

We primarily employ the most recent 77th round of the National Sample Survey on All India Debt and Investment Survey (AIDIS) conducted under NSSO from January to December 2019 for analysis. It aims to provide information regarding the assets and liabilities held by

households in India along with other household characteristics, including educational attainment, occupational profile, expenditure, and location of residence, among others. In our analysis, we use the data based on a survey visit-1 that tracks 3,995 blocks covering 47,006 households in the urban area across all the twenty-eight states and eight union territories. The assets and liabilities of the households are valued as of 30.6.2018.

Additionally, we collect the district-level crime data from the annual report published by the National Crime Records Bureau (NCRB) for 2017. Under the Ministry of Home Affairs (Government of India), NCRB is an Indian government agency in charge of collecting and analysing information regarding crime data as defined by the India Penal Code (IPC) and Special and Local Laws (SLL). The organisation reports the district-wise number of IPC crimes every year under each category. NCRB was established in 1986 to act as a repository of information on crime and criminals to cooperate the crime investigators based on the recommendations of the Tandon Committee, National Police Commission. NCRB report contains statistical data on cognisable crimes reported at police stations, like theft, burglary, and dacoity, followed by assault, kidnapping, and sexual offences, including rape.

4.4.2 Variables

The outcome variable in this chapter is the share of financial assets, defined as the ratio of financial asset value to the total value of the household's assets. The household assets include physical assets like land, buildings, jewellery, agricultural machinery and implements, livestock, all transport equipment, non-farm business equipment, and financial assets like receivables of loans advanced in cash or kinds, shares or debentures in companies and co-operative societies, deposits in bank or post-office or with individuals. Studies in other settings

use the ratio of stock shares to liquid wealth (Chetty et al., 2017; Cocco, 2005) or the stock holding as a fraction of a household's net worth (Yao and Zhang,2005). In the Indian context, given the negligible participation of households in the stock market (on average, 1 percent – 2 percent of households), we do not consider the share of risky assets as our main outcome variable and instead consider the share of a liquid financial asset as the outcome variable.

Our interest variable housing is considered by two measures – homeownership and home value. The homeownership variable is a dummy that takes 1 for residential building owners and zero for non-owners. Several earlier studies used this measure in the past (Cardak and Wilkins,2009; Yao and Zhang,2005; Fratantoni,1998). Further, He et al.(2019) consider homeownership and the logarithmic value of home equity as the interest variable. Likewise, we define our second measure, home value, as a logarithm of one plus the value of the residential building of urban households.

We control for various confounders in our model that are likely to affect the share of financial assets at the household level. Xiao (1996) identifies the life cycle variables such as the household head's age, employment status, marital status, family income, and the number of dependent children in the family, which influence the financial asset ownership of the household. Hence, similar to other studies, we control for household characteristics like household indebtedness, size, monthly consumption expenditure, and variables like age, education, and occupation of the household head in our analysis (Zou and Deng, 2019; Chetty et al., 2017; Cocco, 2005; Flavin and Yamashita, 2002). In this chapter, the economic status or income of the household is proxied by monthly per capita consumption expenditures (MPCE) since the income data is unavailable. Additionally, in line with the findings of Rampal and Biswas (2022), we take a few socio-demographic features of the Indian households, like

religion, caste, and state fixed effects that are predictors of demand for liquid financial assets, as controls in our analysis. Table 4.1 defines the variables used in our study.

Table 4.1: Variable description

The following table represents the description of the variables used in the analysis.

Variables	Descriptions
Outcome variables	
Share of financial assets	Proportionate value of financial assets out of the total value of assets owned by the household. The total value of the assets consists of the value of physical and financial assets. Physical assets: Land, building, ornaments, livestock and poultry, transport equipment, agricultural machinery and implements owned, non-farm business equipment owned. Financial assets: Deposits in the bank (commercial/RRB/POSB/co-operative), and non-bank institutions (finance companies, co-operatives, self-help group, micro-finance institutions) other fixed income deposits (NSC, KVP, savings bond), retirement funds (PF/Pension funds/NPS), additional financial savings, other receivables, mutual funds, shares, bonds etc.
Share of financial assets out of net worth	Proportionate value of financial assets out of total value of assets owned by the household net of its total outstanding loan.
Share of deposits	Proportionate value of deposit assets (including bank and non-bank deposits, other fixed income securities, deposits in other financial instruments, etc.) out of total value of financial assets owned by the household.
Share of Retirement funds	Proportionate value of assets for retirement (provident fund, pension fund, other annuity schemes) out of total value of financial assets owned by the household.
Share of other financial assets	Proportionate value of other financial assets (mutual funds, shares, bonds debenture, receivables from loans, etc.) out of total value of financial assets owned by the household.
Interest variables	
Homeownership	Dummy variable, 1 if household owns a residential building that is used as any of the following (described below) and 0 otherwise. Residential building used as dwelling by household members Other residential building within the village/town Other residential buildings outside the village/town
Home value	Log of total value (in INR) of the residential building owned by the household (as of 30.6.2018).

Variables	Descriptions
Share of housing	Proportionate value of housing out of the total value of assets owned by the household.
Home equity	The logarithm of home equity (home value net of outstanding mortgage loan).
Control variables	
Dependency ratio	Standardised value of dependency ratio (old and child) in the households
Age	Age of the household head.
Gender: Male	Dummy variable, 1 for male household head and 0 otherwise.
Education	Highest educational attainment of the household head. Categorical variable, 1 for illiterate, 2 for primary and 3 for secondary and above.
MPCE	Logarithmic value of usual monthly per capita consumer expenditure of the household.
Religion	Categorical variable,1 for Hindu,2 for Muslims,3 for others.
Caste	Categorical variable, 1 for general, 2 for SC-ST and 3 for other backward class.
Occupation: Regular salaried	Dummy variable, 1 if the household is regular salaried,0 for others.
Sector: Urban	Dummy variable, 1 for urban sector and 0 for rural areas.
Age-squared	Quadratic of the age of the household head.
Expenditure-squared	Quadratic of the usual monthly consumption expenditure of the household.
Farmland	Dummy variable, 1 for the households owns farmland (in rural or urban areas) and 0 otherwise.
Instrument variable	
Crime per thousand	District wise the total number of crimes in 2017 reported by the Crime Bureau of India per thousand population (Census,2011).

4.5 Methodology

To examine the relationship between housing and share of financial assets, we estimate a linear regression model given by equation (1) below:

$$y_{hd} = \beta_0 + \beta_1 Housing_{hd} + \sum \gamma_k X_{khd} + District_d + \varepsilon_{hd} \quad (4.1)$$

Where y_{hd} is the share of financial assets for household h in district d and $Housing_{hd}$ are the two measures of housing – homeownership and home value for household *h* in district d. X_{khd} ,

the household characteristics mentioned in Table 4.1, $District_d$ are the district fixed effects, and ε_{hd} captures household-level idiosyncratic shocks. A negative β_1 will indicate a substitution effect of housing for the financial investment of households.

However, studies have highlighted that housing variables can be potentially endogenous owing to omitted variables (Zou and Deng, 2019; Chetty et al., 2017). For instance, omitted factors like financial sophistication and expected future labour income of the households may simultaneously affect the decision to own a home and share of financial assets. Also, households that expect a high future labour income may end up owning larger homes leading to a positive correlation between the homeownership or home value and the unobserved income. Hence, the estimate will be biased upwards. Endogeneity may also be driven by selection bias arising from the risk preference of the household. For example, people who like to purchase a home with a relatively high home price index may have a higher risk tolerance than others. These households may invest a higher share of their wealth in financial assets, especially risky ones. In line with several previous studies (Zou and Deng, 2019; Chetty et al.,2017), we employ the instrumental variable method in section 4.5.3 to address the potential Endogeneity concerns.

We consider – the number of total IPC crimes per thousand populations as an instrument in our analysis. Few empirical studies find a negative correlation between homeownership and crime (Disney et al., 2020; Haurin et al.,2002). Moreover, Ceccatto and Wihelmsson (2020) provide evidence for lower housing prices in a place with a high concentration of crime. Therefore, the likelihood of homeownership, as well as the value of the home, are anticipated to be low in crime-intensive areas, and this, again, is unlikely to affect the financial decision at the household level directly. In our dataset, we also observe a negative correlation between

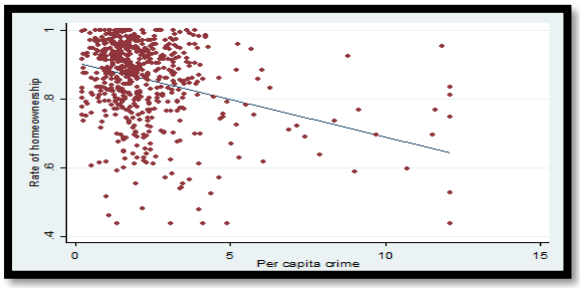
crime and homeownership[32] (Figure 4.1). Hence, the univariate analysis points toward a negative association. However, we estimate the model in a multivariate framework using a two-stage least square method given by the below equation:

$$Housing_{hds} = \alpha_0 + \alpha_1 z_{1ds} + \sum \gamma_k X_{khds} + State_s + \varepsilon_{1hds} \quad (4.2)$$

$$y_{hds} = \delta_0 + \delta_1 \widehat{Housing}_{hds} + \sum \partial_k X_{khds} + State_s + \varepsilon_{2hds} \quad (4.3)$$

Equation (4.2) gives a first stage, where z_{1ds} denotes the crime rate per thousand population in district *d* and state *s*. In the first stage, the housing outcome is estimated as a linear function of the instrument and other factors using the ordinary least square method (OLS). A negative and significant α_1 will indicate that the instrument satisfies the relevance condition. Equation (4.3) estimates the second-stage linear regression model wherein we estimate the share of financial assets as a function of the predicted value of housing obtained from equation (4.2). Again, a significant and negative value of δ_1 will suggest a crowding-out effect of housing on the share of financial assets. However, we also report the Wald F-stat obtained from a weak identification test. If the value exceeds the Stock-Yogo critical value, then it suggests that the instrument is not weak in a statistical sense.

Figure 4.1: Homeownership with crime rates (district level)



[32] The coefficient of correlation between crime rate and homeownership is -0.76

4.6 Results

4.6.1 Descriptive statistics

Table 4.2 represents the descriptive statistics of our sample. Column 1 indicates that households invest approximately 15 percent of their total assets in liquid financial assets (cash in bank accounts, savings and fixed deposits with banks and non-banking finance companies, shares in companies or co-operatives, debentures, mutual funds, etc.) whereas, 63 percent of households own residential buildings or homes mainly for dwelling purposes. The average value of housing assets is 9.7 lakhs. The mean dependency ratio stands at 30 percent, and the mean age of the household head is 47 years. On average, only 39.5 percent are regularly salaried. Almost half of the households' heads have completed secondary education; their average age is 47 years, and around 85percent of the household heads are male.

Columns 2 and 3 of Table 4.2 provide the means of the variables based on homeownership. We observe that the share of financial assets of homeowners is lower by a great extent compared to non-homeowners, and the difference is statistically significant at a 1 percent level of significance. Further, descriptive statistics show that the mean age of household heads is 52, which is higher for homeowners. Almost 86 percent of homeowners' family heads are male, significantly higher than non-homeowners. We find that household heads of non-homeowners are more educated than homeowners. Additionally, the non-homeowners belong to higher economic status than the homeowners. Finally, we observe that, compared to non-homeowners, fewer households with homes are salaried regularly, i.e., homeowners are mostly self-employed or casual labourers.

Table 4.2: Descriptive statistics

The following table presents the mean of the variables along with the standard deviation in parenthesis for the overall sample and also based on the homeownership. The level of significance mentioned in the table is based on the t-test done to check the equality of means for homeowners and non-homeowners (columns 2 and 3). Standard deviations are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
	Overall	Homeowners	Non-homeowners
Share of financial assets	0.148	0.034	0.353***
	(0.273)	(0.115)	(0.367)
Home-ownership(dummy)	0.634	-	-
	(0.482)		
Home value	8.549	13.478	-
	(6.568)	(1.255)	
Dependency Ratio	0.303	0.334***	0.250
	(0.279)	(0.272)	(0.283)
Age	46.961	51.757***	38.642
	(15.186)	(13.438)	(14.434)
Gender: Male	0.848	0.859***	0.831
	(0.358)	(0.348)	(0.375)
Education:			
Illiterate	0.159	0.182***	0.121
	(0.366)	(0.386)	(0.326)
Primary	0.316	0.316	0.317
	(0.465)	(0.465)	(0.465)
Secondary	0.524	0.502	0.562***
	(0.499)	(0.500)	(0.496)
MPCE	8.143	8.084	8.246***
	(0.569)	(0.565)	(0.561)
Religion:			
Hindu	0.795	0.783	0.817***
	(0.404)	(0.412)	(0.387)
Muslims	0.143	0.150***	0.129
	(0.350)	(0.357)	(0.335)
Others	0.062	0.067***	0.054
	(0.242)	(0.250)	(0.226)
Caste:			
General	0.378	0.397***	0.344
	(0.485)	(0.489)	(0.475)
SC-ST	0.196	0.187	0.212***
	(0.397)	(0.389)	(0.409)
Other backward class	0.426	0.416	0.444***
	(0.496)	(0.493)	(0.497)
Occupation: *Regular salaried*	0.395	0.370	0.439***
	(0.489)	(0.483)	(0.496)
Observations	47,006	32,601	14,405

4.6.2 Main results

Table 4.3 represents the results of estimating equation (4.1). Column 1 provides the result of the ordinary least square regression model of the share of financial assets on homeownership and other socio-economic factors. The result suggests that compared to non-owners, homeowners have 27.6 percent less share of financial assets on average, ceteris paribus. Given the sample average of 15 percent share of financial investments for the households, for homeowners, it corresponds to a 1.8-percentage point fall in the share of financial assets in their portfolio. Similarly, an increase in home value is also negatively related to the share of financial assets at a 1 percent significance level (column 2). The findings point toward a possible substitution effect of housing for financial investments. This result is in line with the findings of Gopalakrishnan et al. (2019), but their study considers only the uptake of financial assets, whereas our research examines the relation between housing and the share of financial assets.

Concerning control variables, we observe that the households with higher dependency ratios are negatively and significantly associated with financial investment. Next, our result provides a negative relationship between the age of the household head and the share of financial assets, i.e., the financial investment reduces with the increase in the age of the household head. Additionally, we find that higher education and economic status proxied by MPCE are significant financial asset investment factors. Moreover, the minor groups concerning religion invest less than Hindu households in financial assets. In contrast, scheduled caste/scheduled tribes are found to invest more in financial assets than the portion invested by the general category. Our result suggests that regular salaried households are better investors for financial assets due to the certainty of their earnings.

Table 4.3: Main result

The following table presents coefficients obtained from ordinary least square regression of the share of financial assets on housing and other socio-demographic factors. Columns 1 and 2 provide coefficients for models with all control factors and district-fixed effects. Robust standard errors are in parentheses*** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)
	Share of financial assets	*Share of financial assets*
Homeownership	-0.276***	
	(0.003)	
Home value		-0.020***
		(0.000)
Dependency ratio	-0.041***	-0.040***
	(0.004)	(0.004)
Age	-0.001***	-0.001***
	(0.000)	(0.000)
Gender: Male	-0.006**	-0.005*
	(0.003)	(0.003)
Education: Base: Illiterate		
Primary	-0.004	-0.000
	(0.003)	(0.003)
Secondary and above	0.013***	0.022***
	(0.003)	(0.003)
MPCE	0.043***	0.052***
	(0.002)	(0.002)
Religion: Base: Hindu		
Muslim	-0.007**	-0.007**
	(0.003)	(0.003)
Others	0.004	0.005
	(0.004)	(0.004)
Caste: Base: General		
SC/ST	0.016***	0.012***
	(0.003)	(0.003)
Other backward class	0.001	-0.001
	(0.002)	(0.002)
Occupation: Regular salaried	0.028***	0.029***
	(0.002)	(0.002)
District fixed effects	Yes	Yes
Constant	0.064**	-0.027
	(0.025)	(0.023)
R-squared	0.366	0.395
Observations	46,640	46,640

4.6.3 Endogeneity concerns

One cannot interpret the above results as causal if the housing variables are endogenous. As discussed in Section 4 above, endogeneity of housing is likely, and hence, studies have adopted an instrumental variable approach to alleviate endogeneity concerns. Similar to the approach in

the literature (Zou and Deng, 2019; Chetty et al., 2017), we employ the instrument variable two-staged least square (IV-2SLS) method using district level crime rate as an instrument, and the results are presented in Table 4.4. Columns 1 and 2 of Table 4.4 present the second-stage coefficients obtained from estimating equation (4.3). As the instrument variable used here is defined at the district level, we cannot consider the district-fixed effects as control; instead, we control for state-fixed effects. Again, homeownership and home value have a negative and significant relationship with the share of financial assets. Column 1 indicates that the share of financial assets reduces by 22.7 percentage points when owning a home, whereas a 10 percent higher value of housing is associated with a 1.8 percentage point lower share in financial assets (column 2). Further, the first stage regression coefficient of the IPC crime rate is negative and significant at usual significance levels, indicating that the instrument is relevant. Further, the F-statistic is greater than the Stock-Yogo critical value, suggesting that our instrument is not weak. Additionally, we have checked for endogeneity by Woolridge's robust score test, which provides an insignificant chi-sq value reported in the table indicating the exogeneity of the variable 'housing'. However, though OLS and IV-2SLS both yield unbiased estimates, but the former is efficient.

Both OLS and IV-2SLS estimates provide evidence for the substitution effect of housing on the share of financial assets. We anticipate that the committed expenditure that includes regular maintenance and payment of housing-related property taxes drives this substitution effect. Further, the negative relationship with housing value suggests that maintenance cost is likely to increase with the size of the home proxied by value in this case. Overall, we find evidence for the substitution effect of housing on financial investments. The results align with

the findings of studies in other countries (Zou and Deng, 2019 in China; Chetty and Szeidl, 2007; Cocco, 2005; Yamashita, 2003; Fratantoni, 1998 in the USA).

Regarding control variables, monthly consumer expenditure used as a proxy of household income is positively correlated with the share of financial assets. This finding aligns with previous studies (Zou and Deng, 2019; Chetty et al., 2017). Moreover, our result suggests that households with higher dependency ratios and old household heads invest less in financial assets. Further, similar to Campbell (2006), our result indicates that educated households invest more in financial assets. However, we find that households with a male head of the family are comparatively less likely to invest a higher share in financial assets than female-headed households. In contrast, regular salaried households invest a higher portion of their assets in financial assets.

Table 4.4: Endogeneity concerns

The following table represents the coefficients from instrument variable two-staged least square regression of share of financial assets on housing and other socio-demographic factors. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)
	Share of financial assets	*Share of financial assets*
Homeownership	-0.227***	
	(0.035)	
Home value		-0.018***
		(0.003)
Dependency ratio	-0.044***	-0.043***
	(0.004)	(0.004)
Age	-0.002***	-0.002***
	(0.000)	(0.000)
Gender: Male	-0.012***	-0.010**
	(0.004)	(0.004)
Education: Base: Illiterate		
Primary	-0.004	0.000
	(0.003)	(0.003)
Secondary and above	0.013***	0.023***
	(0.004)	(0.005)
MPCE	0.044***	0.052***
	(0.003)	(0.003)
Religion: Base: Hindu		
Muslim	-0.008***	-0.008***
	(0.003)	(0.003)

	(1)	(2)
	Share of financial assets	*Share of financial assets*
Others	-0.001	0.000
	(0.004)	(0.004)
Caste: Base: General		
SC/ST	0.015***	0.011***
	(0.003)	(0.003)
Other backward class	0.002	-0.000
	(0.002)	(0.002)
Occupation: Regular salaried	0.031***	0.031***
	(0.003)	(0.003)
State fixed effects	Yes	Yes
Constant	0.049	-0.017
	(0.035)	(0.027)
R-squared	0.362	0.368
Observations	44,535	44,535
First stage statistics		
IV: Reported IPC Crimes per thousand	-0.018***	-0.221***
	(0.001)	(0.016)
Wald F-stat	229.78	183.74
Stock-Yogo critical value (10 percent maximal IV size)	16.38	16.38
State fixed effects	Yes	Yes
Endogeneity test Chi sq value	0.134	0.445
Observations	44,535	44,535

4.7 Robustness checks

4.7.1 Alternative estimation method -Propensity score matching

We consider propensity score matching (PSM) as an alternative estimation method to establish a causal relationship in observational studies. Rosenbaum and Rubin (1983) suggest that PSM can be employed to match the treated and control groups. Our analysis matches the homeowners with non-owners based on observable covariates, including the nearest neighbourhood matching method without replacement. Comparing the share of financial assets across these two groups, we infer that homeowners invest a lower percentage of assets in the financial market (Panel A of Table 4.5). Further, Zou and Deng (2019) show that households with higher housing values are associated with lower participation in the financial market compared to those with low home values. Likewise, we match the households with high and low home values (with respect to median home value) based on observable covariates in the nearest

neighbourhoods and find that the share of financial assets across the treated group is lower in the matched sample; hence, the conclusion remains unchanged (Panel B of Table 4.5). Therefore, the PSM reinforces the substitution effect of housing for urban Indian households.

Table 4.5: Alternative estimation method -Propensity Score Matching

The following table represents the share of financial assets based on a sample matched by propensity score matching through nearest neighbour matching without replacement. Standard deviations are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Based on homeownership as treatment

	(1)	(2)	(3)	(4)	(5)
	Treated	Control	Difference	t-statistic	No. of observations
Share of financial assets	0.040 (0.001)	0.337 (0.003)	-0.297*** (0.003)	98.33***	28,444

Panel B: Based on high and low home value as treatment

	(1)	(2)	(3)	(4)	(5)
	Treated	Control	Difference	t-statistic	No. of observations
Share of financial assets	0.040 (0.000)	0.337 (0.003)	-0.298*** (0.002)	133.85***	41,654

4.7.2 Alternative definitions of interest variables

4.7.2.1 Proportionate value of home

In this section, we intend to re-estimate our result by considering an alternative definition of our interest variable housing. Like other studies (Zou and Deng,2019; Cho,20**1**4; Yamashita,2003), we measure housing by the proportional home value out of total household assets and re-estimate the OLS model. Columns 1-2 of Table 4.6 represent the regression result and confirm that the substitution effect remains consistent even after considering the alternative housing measure.

4.7.2.2 Home equity

Home equity is defined as the home value net of outstanding loans taken for housing. A set of studies investigate the relationship between home equity and risky asset holdings of households (He et al.,2019; Chetty et al.,2017). The studies find that home equity has a positive wealth effect on financial asset investment. We re-estimate our result by considering another measure of housing, i.e., the logarithm of home equity (the home value net of outstanding housing debt). Columns 3-4 of Table 4.6 represent the results of both methods and reinforce our results. This result is in line with Zhou et al. (2017) but in contrast to some other studies (He et al.,2019; Chetty et al.,2017).

Table 4.6: Robustness checks -Alternative definitions of variables and additional controls

Columns 1-2 presents coefficients obtained from the regression models (OLS) using the alternate measure of interest variable. Columns 3-4 present coefficients obtained from the regression models (OLS) using alternative dependent variable. Columns 5-6 present the results for the original model, including additional control variables when the interest variable is homeownership whereas home value. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative interest variable		*Alternative dependent variable*		*Inclusion of additional controls*	
	Share of financial assets	*Share of financial assets*	*Share of financial assets out of net worth*	*Share of financial assets out of net worth*	*Share of financial assets*	*Share of financial assets*
Share of housing	-0.348***					
	(0.004)					
Home equity		-0.021***				
		(0.000)				
Homeownership			-0.229***		-0.154***	
			(0.084)		(0.004)	
Home value				-0.018***		-0.012***
				(0.006)		(0.000)
Age-squared					0.000***	0.000***
					(0.000)	(0.000)
Expenditure squared					-0.000	-0.000
					(0.000)	(0.000)
Farmland					-0.147***	-0.146***
					(0.004)	(0.004)

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative interest variable		*Alternative dependent variable*		*Inclusion of additional controls*	
	Share of financial assets	*Share of financial assets*	*Share of financial assets out of net worth*	*Share of financial assets out of net worth*	*Share of financial assets*	*Share of financial assets*
Dependency ratio	-0.038***	-0.040***	0.058	0.058	-0.077***	-0.077***
	(0.004)	(0.004)	(0.061)	(0.061)	(0.004)	(0.004)
Age	-0.003***	-0.001***	-0.001	-0.000	-0.014***	-0.014***
	(0.000)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)
Gender: Male	-0.022***	-0.004	0.075*	0.078*	0.006**	0.007**
	(0.003)	(0.003)	(0.042)	(0.043)	(0.003)	(0.003)
Education: Base: Illiterate						
Primary	-0.009***	0.000	-0.007	-0.004	-0.004	-0.002
	(0.003)	(0.003)	(0.043)	(0.043)	(0.003)	(0.003)
Secondary and above	0.001	0.022***	0.011	0.020	0.011***	0.017***
	(0.003)	(0.003)	(0.042)	(0.044)	(0.003)	(0.003)
MPCE	0.049***	0.053***	0.196**	0.203**	0.039***	0.044***
	(0.002)	(0.002)	(0.089)	(0.089)	(0.002)	(0.002)
Religion: Base: Hindu						
Muslim	-0.001	-0.007**	-0.086	-0.087	-0.007**	-0.007**
	(0.003)	(0.003)	(0.071)	(0.071)	(0.003)	(0.003)
Others	-0.005	0.005	0.053	0.054	0.001	0.001
	(0.005)	(0.004)	(0.061)	(0.061)	(0.004)	(0.004)
Caste: Base: General						
SC/ST	0.019***	0.011***	0.126**	0.121**	0.015***	0.012***
	(0.003)	(0.003)	(0.062)	(0.061)	(0.003)	(0.003)
Other backward class	0.002	-0.001	0.208**	0.206**	0.002	0.001
	(0.003)	(0.002)	(0.102)	(0.102)	(0.002)	(0.002)
Occupation: Regular salaried	0.036***	0.027***	0.072	0.072	0.034***	0.034***
	(0.002)	(0.002)	(0.052)	(0.051)	(0.002)	(0.002)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.016	-0.031	-1.304	-1.370*	0.416***	0.365***
	(0.028)	(0.023)	(0.821)	(0.809)	(0.027)	(0.027)
R-squared	0.313	0.399	0.018	0.018	0.435	0.437
Observations	46,640	45,043	46,671	46,671	46,640	46,640

4.7.3 Alternative definition of dependent variable

Next, we check our result by considering an alternative measure of the dependent variable of our main regression model. Here, we take a share of financial assets out of net worth instead of total assets. Cocco (2005) uses the idea of net worth in his model. Net worth is the total value of asset net of total outstanding debt. The result presented in columns 3-4 of Table 4.6 provide evidence that the substitution effect of housing on financial assets is consistent, even considering the alternative measure of the outcome variable.

4.7.4 Inclusion of additional control variables

In line with a few studies, we incorporate the household head's age squared (He et al., 2019), usual monthly expenditure squared (Cardak and Wilkins, 2009), and farmland ownership as additional controls in our model and re-estimate using OLS methods. Notably, the square of age captures the experience of the individual. Moreover, people borrow at a young age when their income is low and save later at their mature age when the income is high. Therefore, the behaviour is non-linear, and it is captured by expenditure squared. Further, we use farmland ownership as an additional economic status indicator. Columns 5-6 of Table 4.6 suggest that the housing measures, i.e., homeownership and home value, are negatively related to lower financial investment. Hence, our results are congruent to the inclusion of the additional variables.

4.8 Types of financial assets

Our main result discussed in Section 4.5.2 provides evidence that housing in terms of homeownership and home value substitutes investment in financial assets. Further, we examine the financial asset types that primarily drive the result. We create the variables including share of deposit (deposit in bank and non-bank intuitions, government bonds, and other financial

instruments), share of retirement fund (pension fund, provident fund, annuity schemes), and share of other financial assets (risky assets and other receivables). Considering the three types of assets as the outcome variables, we re-estimate the OLS model, and the results are tabulated in Table 4.7. Results suggest that homeownership negatively affects all types of investments individually (columns 1, 3, and 5). However, the substitution effect of homeownership for deposit assets appears to be strongest. Similarly, home value is negatively related to all three types of financial investments (columns 2,4 and 6). However, the coefficient of home value for the regression of deposits asset is around 6 times of the coefficient obtained from the regression of retirement funds on home value. Therefore, one may infer that deposit assets are one of the main drivers of the observed substitution effect of housing on financial investment.

Table 4.7: Types of financial assets

The following table presents coefficients obtained from ordinary least square regression of share of deposit assets (columns 1-2), retirement funds (columns 3-4), and other financial assets on housing and other socio-demographic factors. Robust standard errors are in parentheses*** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Share of deposits		*Share of retirement fund*		*Share of other financial assets*	
Homeownership	-0.239***		-0.044***		-0.004***	
	(0.003)		(0.002)		(0.001)	
Home value		-0.017***		-0.003***		-0.000***
		(0.000)		(0.000)		(0.000)
Dependency ratio	-0.032***	-0.032***	-0.010***	-0.010***	0.001	0.001
	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
Age	-0.002***	-0.001***	0.000***	0.000***	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gender: Male	-0.017***	-0.017***	0.011***	0.011***	0.001*	0.001*
	(0.003)	(0.003)	(0.001)	(0.001)	(0.000)	(0.000)
Education: Base: Illiterate						
Primary	-0.005*	-0.002	-0.003***	-0.003**	-0.000	-0.000
	(0.003)	(0.003)	(0.001)	(0.001)	(0.000)	(0.000)
Secondary and above	-0.000	0.008***	0.007***	0.008***	0.000	0.000
	(0.003)	(0.003)	(0.001)	(0.001)	(0.000)	(0.000)
MPCE	0.021***	0.029***	0.021***	0.023***	0.002***	0.002***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
Religion: Base: Hindu						

	(1)	(2)	(3)	(4)	(5)	(6)
	Share of deposits		*Share of retirement fund*		*Share of other financial assets*	
Muslim	-0.002	-0.002	-0.004***	-0.004***	0.000	0.000
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Others	0.005	0.005	-0.001	-0.001	-0.001	-0.001
	(0.004)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)
Caste: Base: General						
SC/ST	0.005*	0.001	0.013***	0.012***	-0.001*	-0.001*
	(0.003)	(0.003)	(0.002)	(0.002)	(0.000)	(0.000)
Other backward class	-0.003	-0.005**	0.005***	0.004***	-0.001	-0.001
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
Occupation: Regular salaried	-0.024***	-0.023***	0.052***	0.052***	-0.001***	-0.001***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.184***	0.106***	-0.097***	-0.111***	-0.014***	-0.016***
	(0.020)	(0.020)	(0.018)	(0.017)	(0.003)	(0.003)
R-squared	0.358	0.357	0.181	0.183	0.027	0.027
Observations	45,075	45,075	45,075	45,075	45,075	45,075

4.9 Heterogeneous effects

In this section, we explore whether the substitution effect of housing and financial investment varies with the socio-demographic characteristics of households. Current income is a main factor affecting participation in financial markets and demand for financial instruments (Zou and Deng, 2019; Fagerenge et al., 2017; Calvet and Sodini, 2014). Cocco (2005) finds that poor households with a lower leftover income invest less in risky financial instruments. All homeowners have to bear committed expenditures related to housing even though younger households have lower current incomes than older households. Similarly, poorer families who are homeowners have lower current incomes than non-poor homeowners. Younger and poorer homeowners face tighter liquidity constraints than younger or poor non-homeowners and older and non-poor homeowners. On the other hand, households with higher dependency ratios also face stringent budgets. Still, dependents have a high requirement for money in the future as the children need money for higher education, and older are more likely to need money to face

future health issues. Therefore, it is interesting to investigate the effect of housing on financial investment for households with a high dependency ratio.

4.9.1 Age

The life-cycle theory states that people borrow at an early age when their income is low and save later during a high-income period. Therefore, we intend to examine whether the impact of housing on the share of financial assets varies based on the age of the household head. We consider variable young by classifying the households with a head of the family below the median age (46) and use the following model (equation 4.4) to test the heterogeneity of effect with age:

$$y_{hd} = \delta_0 + \delta_1 Housing_{hd} + \delta_2 Housing_{hd} * young_{hd} + \delta_3 Young_{hd} + \sum \partial_k X_{khd} + District_d + \varepsilon_{hd} \quad (4.4)$$

Columns 1-2 of Table 4.8 provide the result highlighting a significant interaction term; hence, the substitution effect of housing is more pronounced for young households. At an early stage, people earn less but must bear committed expenses related to owning a house. Hence, limited disposable income at a young age crowd out financial investments to a greater extent. Our result is congruous with Cocco (2005).

4.9.2 Economic status

Poorer households having low-income flow are less likely to participate in the financial markets. Hence, to check whether the substitution effect is higher for low-income households, we define a dummy poor as one for the first quartile of households in terms of total assets and zero otherwise and an interaction term between poor and housing dummies and estimate the following regression:

$$y_{hd} = \delta_0 + \delta_1 Housing_{hd} + \delta_2 Housing_{hd} * Poor_{hd} + \delta_3 Poor_{hd} + \sum \partial_k X_{khd} + District_d + \varepsilon_{hd} \quad (4.5)$$

Columns 3 and 4 of Table 4.8 present the OLS coefficients. In both the specifications, we observe that the coefficients of the interaction terms are negative and significant, suggesting that the tight budget constraint appears to be driving the results, which is in line with the findings of Cocco (2005). Hence, we can infer that poverty amplifies the substitution phenomenon related to housing.

Table 4.8: Heterogeneous effects

The following table presents coefficients obtained from ordinary least square regression of the share of financial assets on housing and other socio-demographic factors. Columns 1 to 2 give heterogeneous results for young households based on age prescribed by OECD; Columns 3 and 4 present results of the heterogeneous effect of poor. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Share of financial assets	*Share of financial assets*	*Share of financial assets*	*Share of financial assets*	*Share of financial assets*	*Share of financial assets*
*Homeownership *young*	-0.061***					
	(0.006)					
*Home value*young*		-0.005***				
		(0.000)				
Young	0.011*	0.013**				
	(0.006)	(0.006)				
*Homeownership *poor*			-0.097***			
			(0.007)			
*Home value*poor*				-0.011***		
				(0.001)		
Poor			0.126***	0.128***		
			(0.006)	(0.006)		
Homeownership Higher dependency dummy*					0.115***	
					(0.005)	
Home value Higher dependency dummy*						0.008***

	(1)	(2)	(3)	(4)	(5)	(6)
	Share of financial assets	*Share of financial assets*	*Share of financial assets*	*Share of financial assets*	*Share of financial assets*	*Share of financial assets*
						(0.000)
Higher dependency dummy					-0.129***	-0.125***
					(0.006)	(0.006)
Homeownership	-0.240***		-0.188***		-0.330***	
	(0.005)		(0.005)		(0.004)	
Home value		-0.018***		-0.014***		-0.024***
		(0.000)		(0.000)		(0.000)
Dependency ratio	-0.027***	-0.026***	-0.040***	-0.039***	0.039***	0.038***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
Age	-0.002***	-0.002***	-0.001***	-0.001***	-0.002***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gender: Male	-0.005*	-0.004	-0.000	0.000	-0.002	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Education: Base: Illiterate						
Primary	-0.004	-0.000	-0.003	-0.001	-0.003	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Secondary and above	0.012***	0.021***	0.018***	0.023***	0.012***	0.021***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
MPCE	0.042***	0.050***	0.048***	0.053***	0.039***	0.048***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Religion: Base: Hindu						
Muslim	-0.006**	-0.007**	-0.009***	-0.009***	-0.007**	-0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Others	0.004	0.005	0.003	0.004	0.003	0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Caste: Base: General						
SC/ST	0.015***	0.011***	0.015***	0.013***	0.015***	0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Other backward class	0.001	-0.001	0.002	0.000	-0.000	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Occupation: Regular salaried	0.028***	0.029***	0.032***	0.032***	0.031***	0.032***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.118***	0.034	-0.083***	-0.139***	0.149***	0.060***
	(0.026)	(0.025)	(0.025)	(0.023)	(0.025)	(0.023)
R-squared	0.398	0.400	0.408	0.411	0.407	0.408
Observations	46,640	46,640	46,640	46,640	46,640	46,640

4.9.3 Dependency ratio

The households with a higher dependency ratio, i.e., a higher number of older people and children, are more likely to face tighter budget constraints. At the same time, one can argue that households with more number of children need to save money for children's education, whereas households with older adults need to save money for meeting health expenditures. We create a variable as a '*Higher dependency dummy'* defined as equal to one for households with a dependency ratio above the median (0.33) and zero for those below the median. Therefore, to check for the dominating effect, we estimate the following regression:

$$y_{hd} = \delta_0 + \delta_1 Housing_{hd} + \delta_2 Housing_{hd} * Higher\ dependent\ dummy_{hd} + \delta_3 Higher\ dependent\ dummy_{hd} + \sum \partial_k X_{khd} + District_d + \varepsilon_{hd} \quad (4.6)$$

Table 4.8 presents the result. Column 5-6 suggests that the interaction term between housing variables and a higher dependent dummy is positive and significant at a 1 percent level of significance, suggesting that the substitution effect of housing on financial investment is less for households with a higher dependency ratio. The requirement for money for health and education costs may induce these households to invest in liquid financial assets and reduce the substitution effect of housing.

4.10 Chapter summary

A considerable part of the financial portfolio of the Indian household consists of physical assets, i.e., real estate and gold. Housing occupies a significant portion of the portfolio among the real estate components. Our study emphasises that the presence of housing in the portfolio is likely to affect the financial behaviour of households. Using nationally representative survey data and controlling for socioeconomic variables, this chapter shows that housing substitutes the share

of financial assets in urban India. To alleviate endogeneity concerns, we instrument housing with district-wise crime per thousand populations. Our result remains robust to additional sensitivity checks, including employing alternate estimation methods like the propensity score matching method and considering alternate measures of housing and share of financial assets. Further, including additional control variables in the model provides consistent results. Additionally, the effect is more striking for younger and poorer households and less for households with a high dependency ratio. Hence, committed expenditure related to housing is one of the multitudes of reasons contributing to the widening gap in financial outcomes among the poor and non-poor.

Chapter 5

Role of internet density in risk management practices of households

Summary

The current chapter empirically analyses the relationship between internet density and risk management practices of Indian households. Using nationally representative data, we find that internet density is related to improved insurance demand. The results remain robust to the use of alternate estimation techniques, alternate interest variables, and the inclusion of additional control variables. The findings suggest that income is one of the channels through which internet density can improve household insurance demand. Moreover, the relationship appears less for households with young and male heads. However, we find a similar relationship between internet density for urban and rural households. The study underscores the role of internet density in improving risk management practices among households in India.

Keywords: Internet density, Insurance uptake, Insurance demand, Income

5.1 Introduction

The previous chapters deal with the various aspects of the households' investment behaviour. The current chapter deals with one of the crucial aspects of household finance, i.e., risk management practice. There are few ways through which households can mitigate their financial risk such as portfolio diversification, investment in risk-free assets, uptaking insurance etc. Among all, Chapter 5 analyses the overall insurance demand of the household and how it is related to internet density. Insurance products are one of the major instruments that can be used to safeguard life, health, and assets during unprecedented circumstances. Insurance helps reduce households' vulnerability to health, weather, and income shocks. Adopting risk

management practices at the household level in developing economies is crucial since the economies are more vulnerable to shocks due to the high population working in the informal sector, income uncertainty, and lack of social security. Insurance is broadly categorised into life and non-life. Life insurance shields households from falling back to poverty in case of the untimely death of the primary earner. In case of accidental death, the sum assured component of a life insurance product supports the insured's family. On the other hand, non-life insurance products like health insurance improve the accessibility of quality healthcare for households. The health scheme's coverage makes it easy to take prompt medical action during an emergency despite its cost. On the other hand, crop insurance shields farmers from crop loss during natural calamities and other events. Motor insurance covers the damage to vehicles in case of any undesired event. Overall, insurance is a vital financial product that a family can have such that they can smoothly cope with the loss in a crisis.

Additionally, households can view insurance as a long-term savings instrument for retirement or other major life events. Consumers shy away from insurance products due to a poor understanding of associated benefits. For example, social anxiety or xenophobia (fear of the unknown) hinders consumers from purchasing insurance (Brighetti et al.,2014). Higher education and access to reliable information can help improve the understanding of the benefits related to insurance products and increase their uptake. Additionally, education enables individuals to purchase optimal insurance quantity rather than be underinsured.

Given the significance of insurance for risk management, policymakers are interested to understand ways to improve insurance uptake at the household level. International evidence suggests several means to improve the risk management practice of households, such as higher income, education, and urbanisation (Hwang and Gao,2003), banking sector development

(Beck and Webb,2003), social connection (Cai et al.,2015), etc. This chapter intends to analyse whether internet density is a way to enhance the risk management practice of households. The extant literature on internet density suggests that it creates awareness and positively influences household behaviour through its direct and indirect effects in developing economies. There is a large body of literature in several country settings that provide evidence that broadband density is related to higher gross domestic product (Gruber et al., 2014; Thompson and Garbacz, 2011; Koutroumpis,2009), employment (Atasoy 2013; Forman et al., 2012; Kolko,2012; Kandilov and Renkow,2010), labour productivity (Bertschek and Niebel, 2016), firm's productivity (Mack and Faggian, 2013) and firm performance (Canzian et al.,2019), household outcomes (Whitacre et al.,2014), etc. However, the effect of information and communication technology (ICT) in developed and developing economies can be very different (Roztocki and Weistroffer, 2008).

Internet density can affect insurance demand in two ways. Firstly, higher internet density in an area may enable information transmission and improve awareness regarding the need for risk management products like insurance through peer effect. Internet as a learning tool for social development is based upon two theories (Carreno,2014). Firstly, theory of conversation which postulates that the interaction among people through internet gathers various types of experiences to a technological platform by creating a specific social nature. Secondly, the theory of situated knowledge which states that internet adheres interchange of thoughts and ideas among users who may are from different cultures but with similar interest and that leads to gradual cultural insertion. Therefore, according to the theories, peer effect plays a significant role for improving the financial behaviour of the households. On the other hand, evidence suggests that internet use is related to higher income (Chunfang et al.,2023; Siaw et al.,2020; Ma et al.,2020B). Using the data from Ghana, Siaw et al.(2020) find that internet use increases the income of household as

well as farm by enhancing the capital acquisition, information and adaption of agricultural technology. Similarly, employing household-level survey data from rural China, Ma et al. (2020B) show that smartphone use is significantly related to high farm, off-farm, and household incomes. They identify the benefits of smartphones, including reduced transaction cost, information regarding job opportunities and farm input use, etc., which as the main drivers of improved income. Further, using China family studies data for 2014,2016 and 2018, Chunfang et al. (2023) find that internet use significantly increases household consumption which can be used as a proxy for household income. Therefore, internet density can improve household income, thereby improving the demand for insurance. Hence, higher internet density in the neighbourhood may result in better risk management practices.

Chapter 5 makes multiple contributions. First, this study contributes to the household finance literature by exploring for a positive association between internet density and the insurance demand of households in developing economies. Second, this chapter empirically shows a channel through which internet density can improve insurance demand. Thirdly, although the theoretical literature on micro factors is well-developed, the empirical evidence for developing economies like India is still scant. This study contributes to the field of insurance literature, analysing the micro determinants of insurance in the developing economies context. Finally, the study underscores the importance of ICT for development.

The remaining chapter is organised as follows: Section 5.2 provides the literature review, Section 5.3 discusses the progress in ICT, and Section 5.4 proposes a conceptual framework and posits the research question. Section 5.5 describes the data and variables, Section 5.6 elaborates on the methodology, Section 5.7 discusses the results of the study, and Section 5.8 presents a few robustness checks. Section 5.9 analyses a channel through which

internet density may influence insurance behaviour. Further, Section 5.10 presents the types of insurance. Next, Section 5.11 shows some heterogeneous effects of the results, and finally, Section 5.12 discusses the findings and concludes the study.

5.2 Literature review

5.2.1 Insurance

The extant literature highlights the significance of risk management practice and its determinants. Using prospect theory, Schmidt (2015) finds that insurance uptake increases with an increase in loss probability but it does not necessarily change with the extent of loss. The behavioural explanation suggests that households attaching a low probability to significant catastrophic events are less likely to buy insurance. Several empirical studies find that more years of education result in higher consumption of insurance (Shi et al., 2015; Arun et al., 2012). Shi et al. (2015) document that both the human capital protection and asset allocation motives significantly explain the life insurance purchase in China. It also shows a positive correlation between social connection and life insurance demand. Arun et al. (2012) also show a bequest motive for micro life-insurance demand in Sri Lanka. The result suggests a convincing need for improvement in the micro-life insurance sector, especially for the sake of poor households. Li et al. (2007) find that demand for life insurance increases with the number of dependants and level of education, whereas it is negatively related to life expectancy and social security expenditure. In contrast, Apergis and Poufinas (2020) show that the global financial crisis reduces the general insurance demand, especially in high-income regions, and the high-dependency ratio reduces the insurance demand in Asian households. The study additionally explores that life insurance is a significant driver for OECD countries, whereas demand for general insurance is higher in Asian economies. Further, based on cohort analysis, Chen et al.

(2001) provide evidence for a gender effect along with a life-cycle impact on life insurance demand in US households. On the other hand, based on the economy of 68 countries in 1961-2000, Beck and Webb (2003) find that macroeconomic indicators like inflation, per capita income, banking sector development, and regional and institutional indicators are the primary predictors of life insurance consumption. Kjosevski (2012) identifies a few macroeconomic factors, such as per capita GDP, inflation, health expenditure, educational attainment, and the rule of law as the determining factor for insurance. In addition to macroeconomic factors, Hwang and Gao (2003) find a positive but significant impact of income, education, and urbanisation on the participation of households in the Chinese insurance market. Moreover, studies provide evidence for a positive relationship between the source of reliable information and insurance uptake and its quantity. Cai et al. (2015) show that people who have friends who attend financial training have higher likelihood to purchase insurance. The peer effect is positive and significant for the diffusion of knowledge. Further, another study by Shi et al. (2015) find that households with large informal social networks are more likely to have insurance. Platteau and Ugarte (2016) also find that members of the same self-help group are more likely to have insurance. Butler (2021) explores that access to information through a high-speed internet connection and the ability to get out of the home escalates the amount spent on insurance purchases by US homeowners.

5.2.2 Information and communication technology

In the digital era, the adoption of ICT can act as a channel of information dissemination. Several papers have analysed the contribution of ICT in improving welfare outcomes of households, such as agricultural outcomes (Campenhout et al., 2020; Kaila and Tarp, 2019; Fu and Akter, 2016), agricultural productivity and income growth (Ma et al.,2020A; Niebel,2018; Donati and

Sarno,2013), income diversification (Leng et al., 2020), access to credit (Tchamyou et al.,2019; Pellegrina et al., 2017); women empowerment (Pei and Chib, 2020; Gu et al.,2020) and nutrition (Sekabira and Qaim, 2017), off-farm work participation in rural households (Kılıçaslan and Töngür, 2019; Hartje and Michael, 2017), income diversification (Leng et al.,2020) and financial market access (Tchamyou et al.,2019; Pellegrina et al., 2017), subjective well-being (Lohmann 2015; Chan,2015). Kılıçaslan and Töngür (2019) provide evidence for the potential of ICT for stronger employment generation opportunities. Next, Hartje and Michael (2017) find improved labour mobility measured in terms of the number of commuters as an impact of smartphone ownership. Chan (2015) suggests that both voice and online communication through the mobile phone are positively related to many indicators of bonding and bridging capital and subjective well-being. Similarly, employing variation over time in a panel of European households, Lohmann (2015) finds that specific material aspirations are better in areas with advanced ICT infrastructure. Employing the data collected through the China Labour-force Dynamics Survey project and the two-staged treatment effect model, Leng et al. (2020) empirically show that ICT adoption positively and significantly impacts income diversification. Specifically, the study emphasises the income benefit for low-income and rural households. Similarly, Ma et al. (2020A) provide evidence that internet use improves income and expenditure, especially for rural households. However, the benefit of ICT is not limited to households only; studies provide evidence for other fields as well. For instance, Fu and Akter (2016) find that mobile intervention in agricultural extension service is related to improved quality, quantity, and speed of service delivery. Further, it shows that farmers benefit in terms of better knowledge and awareness regarding new agricultural practices. Similarly, Donati and Sarno (2013) document that firms can exploit productivity gains due to ICT investment. On the other hand, using bank-firm level data collected by the 9th UniCredit Survey conducted in 2012,

Pellegrina et al. (2017) find that banks consider the firms with ICT access as innovative, thereby, offer them better credit access. Other than that, several studies provide evidence for a positive and significant association between ICT adoption and women empowerment (Pei and Shib,2020; Ahmed et al.,2006). In contrast, Gu et al. (2020) do not find any significant impact of ICT on the empowerment of women in China. On the other hand, Ma and Zhu(2021) show that internet use is related to the enhanced willingness of residents to participate in garbage classification programs. Further, based on a panel dataset of 62 countries between 2001-2012, Mushtaq and Bruneau (2019) find a positive association between ICT diffusion and financial inclusion which in turn reduces poverty and inequality. Similar to other ICT instruments, broadband connection density puts a bright footprint on economic development. For instance, using country-level panel data of the US and instrument variables, Forman et al. (2012) find that business investment in internet technology is related to significant growth in wage and employment. Their analysis suggests around 6 percent growth in employment as a result of internet density which is 42 percent of US population. Similarly, Kolko (2012) provides evidence of substantial growth in employment rate and average salary with the increase in the number of broadband providers in the US market while taking the population growth rate in control from 1992 to 1996 but finds no significant impact of the same during 1999-2006. Atasoy (2013) shows that broadband connection leads to growth in employment at the US market. He further explores that the improved employment was driven by the enhanced scale of the labour demand of the firms and growth in the labour force. On the other hand, Gruber et al. (2014) conclude that public subsidies are necessary for reaping the benefit of a broadband connection since the private companies do not provide the proper infrastructure. Although ample literature investigating the impact of internet density on macroeconomic factors using country-level data is available, only a few studies examine the effects of internet infrastructure on the household

level in developed country settings. For example, Whitacre et al. (2014) provide evidence for the positive impact of broadband connection at home and rural economic development. Using cross-country level data, they find households in countries with better internet density experience rise in income and fall in unemployment rate, whereas countries without sound internet density suffer from lower growth and development opportunities. On the other hand, in the context of Senegal, Masaki et al. (2020) explore that the rapid expansion of broadband internet infrastructure in the country led to a sharp increase in total consumption and a significant reduction in the poverty status of the households. They find the effect striking in urban households, households with male and young heads. Similarly, Bahia et al. (2020) show that mobile broadband internet is related to higher consumption and reduced poverty in the households of Nigeria.

The discussion above suggests that there is dearth of literature in Indian context. This chapter examines how internet density is related to the insurance demand of Indian households. To the best of our knowledge, this is the first study available that has analysed the association between insurance demand of households with internet density using large-scale, nationally representative data.

5.3 Progress of ICT in India

The progress of ICT is not limited to voice telephone only. Broadband internet technologies, like cable internet or Digital Subscriber Line (DSL), have provided scopes for data transmission all over the world. In recent years, the introduction of so-called next-generation broadband networks has facilitated much higher speed internet. The invention of the fourth generation (4G) mobile internet technology, Long Term Evolution (LTE), in the year of 2010 improved substantial speed through wireless telecommunications networks. The internet has affected

various aspects of the economy and financial behaviour in the last three decades. Internet technology has reached the developing world much faster than other technologies, and the global inequality in internet use is lower than global income inequality (World Development Report, 2016). Around 48 percent of the households in developing nations had internet access in 2019 (ITU, 2019[33]), whereas the internet density of India stands at 52 percent in 2022 (IAMAI report,2022[34]). India is one of the major nations in the world with a large population that is still offline. In fact, in 2018, only 23.8 percent of Indian households had internet access (ITU, 2019).

5.4 Conceptual framework and research question

Internet density can affect insurance demand in two ways. The first channel shows that the availability of information provided by the insurance companies through internet, such as the benefits of buying insurance and factual information regarding the policy, may increase the awareness of the households regarding insurance and, thus, in turn, drive the insurance demand of the population residing in an area with high internet density through peer effect. Increased internet density leads households to connect with community networks and interact with others. Social interaction may have a peer influence on households to improve financial behaviour. Social learning theory (Bandura,1977) suggests that attitudes are developed through family, neighbours, media, peers, and other social resources. According to the theory, individuals residing in a social community interact with each other and influence themselves in terms of decision-making and behaviour. Evidence suggests that social interactions in the

[33] https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[34]https://www.iamai.in/sites/default/files/research/Internetpercent20inpercent20Indiapercent202022_Printpercent20version.pdf

neighbourhood affect the adoption of new technology (Conley and Udry, 2010), and social spillover positively affects the adoption of clean fuel (Srinivasan & Carattini, 2020). Further, several previous studies indicate that the community network effect improves individuals' skills and attitudes (Lahiri and Biswas,2022; Sedai et al., 2021; Kim and Lee,2018; Lachance,2014). The neighbourhood of one's place and the persons residing within a town or village are generally similar in terms of culture, caste, religion, and other observable characteristics. We expect that the community-level share of individuals having internet connections will positively affect one's decision to use the internet through peer effect. Therefore, increased internet density may make households more likely to imitate peers who have purchased insurance. Further, the information available to one household is easily spread to other ones in the area through social connectivity, and it enables everyone to be aware of the insurance products and their benefits. For example, an internet connection introduces households to alternate modern insurance distributors. Currently, the distribution of insurance products is dominated by bancassurance or financial agents/ brokers in developing economies. However, with the emergence of insurance tech companies, consumers can compare and buy insurance products online. An example of such a company is BIMA, launched in 2010, serving several countries in Africa and Asia. BIMA is an insurance intermediary that uses mobile technology to sell products in markets with low penetration.

The second potential channel may be the enhanced income as a consequence of the higher use of the internet. The internet allows people to search for various jobs and provides many opportunities to earn more. Studies suggest that internet use is related to higher income (Chunfang et al.,2023; Siaw et al.,2020; Chang and Just,2009). Given the evidence, higher income may allow households to pay premiums for insurance. Therefore, an increase in income may lead households to purchase insurance and demand an optimal number of policies.

Our conceptual framework highlights the various benefits related to higher internet density, specifically in relation to insurance demand. Given greater access to information, the peer effect of insurance holders, the introduction of modern insurance distributors through the internet, and the income effect suggest that internet access can potentially increase insurance demand. However, the net effect of internet density on one's decision to buy insurance is largely an empirical question. In this study, we specifically examine whether internet density in an area is related to better risk management practices of Indian households.

5.5 Data and variables

5.5.1 Data

We use the All-India Debt and Investment Survey data of 2019 for the analysis. AIDIS covers 1,16,461 households from 36 states and union territories of India. Details of the dataset are already discussed earlier in Chapter 3 (refer to Section 3.5.1). However, AIDIS does not contain any information regarding internet availability. The potential dataset currently available in India containing information regarding the latest internet availability includes World Bank data[35] providing year-wise country-level data. The Telecom Regulatory Authority of India (TRAI) report is another source of internet subscription data which is at the state level[36]. However, both datasets mentioned provide internet availability information at the state level. Hence, we consider the district representative dataset collected by 5th round National Family Health Survey (NFHS-5) conducted during 2019-21 under the Ministry of Health and Family Welfare (MOHFW). NFHS is a collaborative project of the International Institute of Population Science, East-West Centre, Honolulu; ICF, Calverton, Maryland, USA; and Hawaii, USA. United States Agency for International Development and United Nation's Children Fund (UNICEF) finance

[35] https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=IN
[36] https://www.trai.gov.in/sites/default/files/PR_No.58of2023_0.pdf

the project. NFHS dataset provides information on population, nutrition and health for India and each state/union territory (UT), along with other district-level estimates. NFHS-5 covers 6,36,699 households from 707 districts across 28 states and 8 union territories in India. In phase I (June 2019-January 2020), households from 17 states and 5 UTs were interviewed, and information regarding the rest was gathered during phase II (January 2020-April 2021). We match the proportion of households having internet access in the 640 districts present in the AIDIS from the NFHS-5 dataset. Additionally, we also used the earlier round of NFHS-4 (2015-16) for the robustness checks of our main result.

5.5.2 Variables

The outcome variable in this chapter is the insurance demand which is captured by two measures Firstly, we consider the insurance purchase decision by considering an *Insurance uptake* dummy that takes the value of one for households holding any insurance product like life, health, motor, crop, or other insurance, etc., and zero otherwise. Secondly, we measure the extent of insurance demand by the household given by the ratio of insurance premium to household's total consumption expenditure. The interest variable is internet density at the district level provided by NFHS-5.

Similar to other studies (Cai et al.,2015; Arun et al.,2012), we control for other socio-demographic factors of the households such as dependency ratio; age, gender, occupation, and education of the household head; economic status, religion, area of residence and state-fixed effects. The variables and their definitions are provided in Table 5.1. The dependent ratio is defined as the proportion of the number of dependents (older ones and children) out of the total household size. The economic status of the household is captured by the logarithmic value of the total value of the assets owned by the household. Occupation dummy gives whether the household is regular salaried or not. Education is denoted by the highest educational attainment

of the household head. The area of residence indicates whether the household is situated at the urban or rural sector. We also we control for state dummies to account for state level unobservable that can affect demand for insurance.

Table 5.1: Variable description

The following table represents the description of the variables used in the analysis.

Variables	Descriptions
Outcome variables	
Insurance uptake	Dummy variable,1 if the household has any type of insurance i.e., life insurance, health insurance, other insurances (motor, crop etc.),0 otherwise.
Insurance premium	Share of insurance premium out of total household expenditure (yearly)
Life insurance uptake	Dummy variable,1 if the household has life insurance,0 otherwise.
Life insurance premium	Share of life insurance premium out of total household expenditure.
Health insurance uptake	Dummy variable,1 if the household has life insurance,0 otherwise
Health insurance premium	Share of health insurance premium out of the total household expenditure
Other insurance uptake	Dpredicummy variable,1 if the household has other insurance,0 otherwise
Other insurance premium	Share of other insurance premiums out of total household expenditure.
Interest variables	
Internet density	Share of households in the district having internet connection during 2019-21 (NFHS-5).
Lag of internet density	Share of households in the district having internet connection during 2015-16 (NFHS-4).
Control variables	
Dependency ratio	The proportion of dependents (old and child) out of total household size.
Age	Age of the household head.
Gender: Male	Dummy variable, one for male household head and zero otherwise.
Education	Highest educational attainment of the household head. Categorical variable, 1 for illerterate,2 for primary and 3 for secondary and above.

Variables	Descriptions
Total assets	Logarithm of total value of the assets. Total value of the assets consists of value of physical assets and financial assets. Physical assets: Land, building, ornaments, livestock and poultry, transport equipment, agricultural machinery and implements owned, non-farm business equipment owned. Financial assets: Deposits in bank (commercial/RRB/POSB/co-operative), and non-bank institutions (finance companies, co-operatives, self-help group, micro-finance institutions) other fixed income deposits (NSC, KVP, savings bond), retirement funds (PF/Pension funds/NPS), other financial savings, other receivables, mutual funds, shares, bonds etc.
Religion	Categorical variable,1 for Hindu,2 for Muslims,3 for others.
Caste	Categorical variable, 1 for General, 2 for SC-ST and 3 for other backward class.
Occupation: Regular salaried	Dummy variable, 1 if the household is regular salaried,0 for others.
Sector: Urban	Dummy variable, 1 for urban sector and 0 for rural areas.
Bank-account	Dummy variable, 1 if the household head has a deposit account in a commercial bank/RRB/Co-operative bank and 0 otherwise.
Ornaments1	Dummy variable, 1 if the household owns ornaments and 0 otherwise.
Household size	The number of members in the households.
Card	Dummy variable, 1 if the household head owns a credit or debit/ATM card and 0 otherwise.
MPCE(net of premiums)	Logarithm of monthly per capita expenditure of the households (excluding premiums paid for insurance).

5.6 Methodology

Given the binary nature of insurance uptake, we employ a probit model where the likelihood of insurance uptake is given as a function of internet density after controlling for other socio-demographic confounders. Equation (5.1) provides the corresponding probit model.

$$L_{hds} = \beta_0 + \beta_1 Internet_{ds} + \sum \partial_k X_{khds} + State_s + \varepsilon_{hds} \quad (5.1)$$

The variable L_{hds} denotes the log-likelihood of *Insurance uptake* variable and $Internet\ density_{ds}$ is the interest variable, i.e., the proportion of households having internet access at the district level. A positive and significant coefficient will indicate that internet

density improves risk management practice of the household. X_{khds} denotes the set of control variable describing the socio-demographic factors of the household.

Next, we employ a tobit regression model to examine the association between district-level internet density and insurance purchase of the household denoted by the variable for *Insurance premium*. The model is given by the following equation (5.2).

$$y_{hds} = \partial_0 + \partial_1 Internet\ density_{ds} + \sum \partial_k X_{khds} + State_s + \varepsilon_{hds} \quad (5.2)$$

$$y_{hds} = Insurance\ premium\ \ if\ insurance\ uptake = 1$$

$$= 0 \text{ otherwise}$$

The variable y_{hds} is the *Insurance premium* , the interest and control variables are the same as mentioned above. A positive and significant ∂_1 will suggest that higher internet density in an area increases insurance demand significantly. In both the equations discussed above, ε_{hds} represents the idiosyncratic shocks that the household faces. We also employ alternate estimation techniques like the propensity score matching method in the robustness section.

5.7 Results

5.7.1 Descriptive statistics

Table 5.2 illustrates the descriptive statistics of the variables used in the study. The average internet density at the district level is around 50 percent. In our sample, 36 percent of the households have insurance, whereas only 2 percent of their expenditure is paid as insurance premiums (Table 5.2). On average, the household's dependency ratio is approximately 35 percent, and the average age of the household head is close to 48 years. Further, nearly 33 percent of household heads have completed secondary education. In our dataset, 82 percent of households are Hindu, 27 percent belong to the general caste, and 20 percent are regularly salaried.

Columns 2-3 of Table 5.2 present the means based on mean internet density. We find that 40 percent of households residing in districts above average internet density have insurance, and this is significantly higher than the proportion of households in districts with lower internet density. Similarly, the proportionate insurance premium paid by the households in the area with higher internet density is significantly higher than that of their counterparts. The univariate analysis suggests that internet density is related to insurance, however, this is explored further using a regression framework.

Table 5.2: Descriptive statistics

The following table presents the mean of the variables along with the standard deviation in parenthesis for the overall sample and also based on the mean of internet density. The significance level mentioned in the table is based on the t-test done to check the equality of means based on the below and above the average of internet density. Standard deviations are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
Variables	Overall	Access to Internet density above 50 percent	Access to Internet density below 50 percent
Internet density	0.491	0.640***	0.370
	(0.161)	(0.095)	(0.084)
Insurance uptake	0.362	0.400***	0.331
	(0.481)	(0.490)	(0.471)
Insurance premium	0.020	0.022***	0.019
	(0.064)	(0.067)	(0.061)
Life insurance uptake	0.465	0.424	0.505***
	(0.499)	(0.494)	(0.499)
Life insurance premium	0.035	0.033	0.036***
	(0.085)	(0.086)	(0.083)
Health insurance uptake	0.067	0.073***	0.062
	(0.251)	(0.260)	(0.241)
Health insurance premium	0.003	0.002	0.003***
	(0.020)	(0.018)	(0.022)
Other insurance uptake	0.724	0.770***	0.680
	(0.447)	(0.421)	(0.466)
Other insurance premium	0.018	0.018***	0.017
	(0.036)	(0.036)	(0.037)
Dependency ratio	0.346	0.330	0.358***
	(0.280)	(0.275)	(0.284)
Age	47.680	47.964***	47.449
	(14.412)	(14.414)	(14.406)
Gender: Male	0.862	0.865***	0.859
	(0.345)	(0.341)	(0.348)
Education:			

	(1)	(2)	(3)
Variables	Overall	Access to Internet density above 50 percent	Access to Internet density below 50 percent
Illiterate	0.299	0.258	0.332***
	(0.457)	(0.437)	(0.471)
Primary	0.377	0.356	0.393***
	(0.485)	(0.479)	(0.488)
Secondary and above	0.325	0.386***	0.275
	(0.468)	(0.486)	(0.446)
Total assets	13.349	13.497***	13.229
	(1.785)	(1.942)	(1.636)
Religion:			
Hindu	0.822	0.818	0.826***
	(0.382)	(0.386)	(0.379)
Muslims	0.121	0.115	0.125***
	(0.326)	(0.319)	(0.331)
Others	0.057	0.067***	0.049
	(0.232)	(0.250)	(0.215)
Caste:			
General	0.272	0.313***	0.239
	(0.445)	(0.464)	(0.426)
SC-ST	0.293	0.259	0.320***
	(0.455)	(0.438)	(0.467)
Others	0.435	0.428	0.441***
	(0.496)	(0.495)	(0.497)
Occupation: Regular salaried	0.199	0.273***	0.139
	(0.399)	(0.445)	(0.346)
Sector: Urban	0.337	0.467***	0.231
	(0.473)	(0.499)	(0.422)
Observations	116,456	55,570	60,886

5.7.2 Main results

Table 5.3 presents the results of probit and tobit regression of insurance on internet density and other household characteristics. Column 1 of Table 5.3 provides a positive and significant effect indicating that the households in the districts with higher internet density are more likely to participate in the insurance market, and the association is significant at a 1 percent significance level. Overall, there appears to be a positive and significant relationship between internet density and the risk management practice of the household.

With respect to control variables, we find that households with more dependants participate and demand less in the insurance market. Probably the high mortality and high risk of falling sick for old and children in the household force them to uptake insurance but low demand is due to their inability to purchase more number of policies. On the other hand, we find the insurance uptake of the households with an old head of the family is significantly higher, whereas the age factor does not have any significant impact on insurance premiums. The awareness gathered through the experience faced by the old head of the household may drive the high insurance uptake. Further, households with male heads of the family are more likely to participate in the insurance market and pay higher share of premiums. This result is in line with Leng et al.(2020).

Table 5.3: Main result

The table below represents the coefficients obtained from the probit and tobit regression of insurance uptake and insurance premium, respectively, on internet density and other socio-demographic factors. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)
	Insurance uptake	*Insurance premium*
Internet density	0.672***[37]	0.048***
	(0.038)	(0.005)
Dependency ratio	-0.332***	-0.034***
	(0.015)	(0.002)
Age	0.001***	0.000
	(0.000)	(0.000)
Gender: Male	0.227***	0.017***
	(0.013)	(0.002)
Education: Base: Illiterate		
Primary	0.218***	0.023***
	(0.011)	(0.001)
Secondary and above	0.424***	0.048***
	(0.012)	(0.002)
Total assets	0.225***	0.023***
	(0.003)	(0.001)
Religion: Base: Hindu		
Muslims	-0.176***	-0.024***
	(0.014)	(0.002)
Others	-0.064***	-0.007***
	(0.019)	(0.002)
Caste: Base: General		
SC-ST	-0.147***	-0.019***
	(0.012)	(0.001)

[37] Marginal effect is 0.212***.

	(1)	(2)
	Insurance uptake	*Insurance premium*
Others	-0.027**	-0.005***
	(0.011)	(0.001)
Occupation: Regular salaried	0.232***	0.023***
	(0.011)	(0.001)
Sector: Urban	0.191***	0.017***
	(0.009)	(0.001)
State fixed effects	Yes	Yes
Constant	-4.966***	-0.503***
	(0.064)	(0.016)
R-squared	0.172	1.0675
Observations	115,957	115,957

Additionally, several studies suggest that a higher education level is related to better financial attitudes (Butler,2021; Leng et al.,2020; Shi et al.,2015). Similarly, our result indicates that households with primary, secondary, and above educational qualifications are positively and significantly related to insurance demand. Like other studies, we observe that households with higher economic status are more likely to uptake insurance and pay higher insurance premiums (Leng et al.,2020; Arun et al.,2012; Beck and Webb,2003). Moreover, our result suggests that the disadvantaged caste groups and religious minority groups have lower participation in the insurance market compared to the general caste and Hindu families, respectively. We also find that insurance uptake and premium are significantly higher for regular salaried households than non-regular salaried ones. Further, urban households have higher insurance demand, which aligns with other studies (Lahiri and Biswas,2022; Gu et al.,2020).

5.7.3 Endogeneity concerns -Propensity Score Matching

One may argue that the internet density variable may not be exogenous since a considerable number of unobservable omitted factors can influence both the internet density and insurance demand. However, to address the endogeneity, we employ the propensity score matching method (Rosenbaum and Rubin,1983). We perform nearest neighbour matching method to match treated households with control households based on dependency ratio, age, gender, and

education of household head, economic status, religion, caste, sector of residence and state (details of PSM are discussed earlier in Chapter 2 in Section 2.7.1). The matched sample consists of 94,342 households. Then, we compare the difference in the insurance uptake and demand between the households residing at district with higher and lower internet density in a sample matched. Table 5.4 suggests that the average insurance participation of the households in districts with higher internet density is larger than the counterparts, and the difference between two groups is statistically significant at a 1 percent level of significance. Similarly, the same result holds for insurance premium (Row 2 of Table 5.4). Hence, the results of the PSM indicate a positive relationship between internet density and risk management practice of the households.

Table 5.4: Endogeneity concerns - Propensity score matching

The following table represents the insurance uptake and insurance premium based on a sample matched by propensity score matching through nearest neighbour matching without replacement based on average insurance density. Standard deviations are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
	Treated	Control	Difference	t-statistic	No. of observations
Insurance	0.414	0.337	0.007***	24.417	94,342
uptake	(0.002)	(0.002)	(0.003)		
Insurance	0.024	0.021	0.004***	7.875	94,342
premium	(0.000)	(0.000)	(0.000)		

5.8 Robustness checks

5.8.1 Alternative definition of interest variable

In this section, we intend to check the robustness of our result by considering alternative measures of our interest variable. Here, we consider lagged internet density at the district level as an alternative interest variable and re-estimate the model. For the lagged variable, we use an earlier round of the NFHS dataset (NFHS-4) conducted in 2015-16 to collect information on

internet density at the district level. Table 5.5 suggests that the households residing in the area with higher internet density, even in the earlier period, also have higher insurance participation (column 1) and pay higher premiums (column 2). Therefore, the positive and significant association between internet density and insurance remains consistent.

Table 5.5: Robustness checks -Alternate interest variable and inclusion of additional controls

The table below represents the result of robustness checks of our main result. Columns 1-2 provide coefficients obtained from the probit and tobit regression of insurance uptake and insurance premium, respectively, on an alternative measure of internet density and other socio-demographic factors. Columns 3-4 present the result of probit and tobit regression of the main model, including additional control variables. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	Alternative interest variable		Additional control variables	
	(1)	(2)	(3)	(4)
	Insurance uptake	*Insurance premium*	*Insurance uptake*	*Insurance premium*
Lag of internet density	0.553***	0.029***		
	(0.058)	(0.006)		
Internet density			0.616***	0.043***
			(0.039)	(0.005)
Ornaments1			0.160***	0.014***
			(0.012)	(0.001)
Card			0.268***	0.028***
			(0.009)	(0.001)
Household size			0.078***	0.004***
			(0.002)	(0.000)
Dependency ratio	-0.333***	-0.035***	-0.385***	-0.037***
	(0.015)	(0.002)	(0.016)	(0.002)
Age	0.001***	0.000	0.002***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Gender: Male	0.224***	0.016***	0.133***	0.011***
	(0.013)	(0.002)	(0.013)	(0.001)
Education: Base: Illiterate				
Primary	0.219***	0.023***	0.192***	0.019***
	(0.011)	(0.001)	(0.011)	(0.001)
Secondary and above	0.423***	0.048***	0.385***	0.041***
	(0.012)	(0.002)	(0.013)	(0.002)
Total assets	0.225***	0.023***	0.189***	0.021***
	(0.003)	(0.001)	(0.003)	(0.001)
Religion: Base: Hindu				
Muslims	-0.177***	-0.024***	-0.229***	-0.026***
	(0.014)	(0.002)	(0.014)	(0.002)
Others	-0.062***	-0.007***	-0.059***	-0.007***
	(0.019)	(0.002)	(0.019)	(0.002)
Caste: Base: General				
SC-ST	-0.154***	-0.020***	-0.170***	-0.019***
	(0.012)	(0.001)	(0.012)	(0.001)
Others	-0.030***	-0.005***	-0.039***	-0.005***

	Alternative interest variable		Additional control variables	
	(1)	(2)	(3)	(4)
	Insurance uptake	*Insurance premium*	*Insurance uptake*	*Insurance premium*
	(0.011)	(0.001)	(0.011)	(0.001)
Occupation: Regular salaried	0.239***	0.023***	0.194***	0.019***
	(0.011)	(0.001)	(0.011)	(0.001)
Sector: Urban	0.210***	0.019***	0.169***	0.014***
	(0.009)	(0.001)	(0.010)	(0.001)
State fixed effects	Yes	Yes	Yes	Yes
Constant	-4.738***	-0.484***	-4.947***	-0.502***
	(0.064)	(0.015)	(0.065)	(0.016)
R-squared	0.171	1.062	0.187	1.129
Observations	115,957	115,957	115,746	115,746

5.8.2 Inclusion of additional control variables

In this section, we re-estimate our model by including additional variables as a control to verify the robustness of our result. One can argue that owning a credit or debit/ATM card may allow households to pay the premiums easily and hence may have a greater likelihood of insurance uptake and higher demand. Further, Dash and Im (2018) provide evidence that household size is important for life insurance demand in India. Household size captures the family's influence on purchasing insurance. Next, holding ornaments is an additional indicator of economic status. As additional controls, we consider the ornament holding, household size, and card ownership of the household head in our regression model. Columns 3-4 of Table 5.5 present the coefficient of the probit and tobit regression model, respectively. We find that all three additional control variables, i.e., ornament holding, household size, and card ownership of the household head, have positive and significant associations with the insurance premium paid by the household. However, the positive association between internet density and insurance demand remains similar to our main result.

5.9 Income as a possible channel

The main result discussed earlier in Section 5.7.2 depicts that internet density in an area is related to higher insurance uptake and demand. Whitacre et al. (2014) find that country-level

internet density is related to higher household income. Moreover, earlier studies provide evidence that internet access is linked to higher income or consumption in the household (Chunfang et al.,2023; Siaw et al.,2020; Chang and Just,2009) since the internet provides various types of career opportunities along with the flexibility to work for the household members. However, higher income may allow households to buy insurance and pay premiums. Given the evidence of increased income as a consequence of the higher availability of the internet, as discussed in the conceptual framework, we consider that income may be a potential channel through which internet density may improve the risk management practice of households. This section empirically analyses the pathway that may explain the positive association between internet density and insurance purchase of the household. We consider income as a pathway that can explain the better risk management practice of families residing in areas with higher internet density. We cannot capture household income directly due to the unavailability of the information in the AIDIS-2019 database. Similar to the literature, we consider the household's monthly per capita consumption expenditure (MPCE) as a proxy in our study. One can argue that the expenditure may be increased due to the premiums paid for insurance. To address the issue, we consider the expenditure, excluding premium, as our outcome variable. We re-estimate our main regression models by considering MPCE (net of insurance premium) as the dependent variable. The result in column 1 of Table 5.6 provides evidence that internet density is significantly related to higher income. Moreover, we verify the robustness of this result by considering the lagged internet density as an alternative interest variable and including additional control variables. Our result remains unchanged (columns 2 and 3) and suggests that internet density is related to higher income, which may increase the insurance demand. Therefore, one can infer that income may be a channel through which internet density can improve the risk management practice of households.

Table 5.6: Income as a potential channel

The following table presents the OLS regression coefficients obtained by regressing MPCE on access to internet density and other socio-economic factors (Column 1) and its robustness checks (Columns 2-3). Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
	MPCE (net of premium)	*MPCE (net of premium)*	*MPCE (net of premium)*
Internet density	0.650***		0.670***
	(0.012)		(0.011)
Lag of internet density		0.722***	
		(0.019)	
Ornaments1			-0.042***
			(0.003)
Card			0.083***
			(0.003)
Household size			-0.084***
			(0.001)
Dependency ratio	-0.156***	-0.157***	-0.099***
	(0.005)	(0.005)	(0.004)
Age	0.001***	0.001***	0.002***
	(0.000)	(0.000)	(0.000)
Gender: Male	-0.106***	-0.107***	-0.025***
	(0.004)	(0.004)	(0.004)
Education: Base: Illiterate			
Primary	0.066***	0.067***	0.045***
	(0.003)	(0.003)	(0.003)
Secondary and above	0.252***	0.251***	0.175***
	(0.004)	(0.004)	(0.003)
Total assets	0.020***	0.020***	0.044***
	(0.001)	(0.001)	(0.001)
Religion: Base: Hindu			
Muslims	-0.067***	-0.068***	-0.008**
	(0.004)	(0.004)	(0.004)
Others	0.067***	0.066***	0.062***
	(0.006)	(0.006)	(0.005)
Caste: Base: General			
SC-ST	-0.169***	-0.175***	-0.126***
	(0.004)	(0.004)	(0.003)
Others	-0.102***	-0.104***	-0.076***
	(0.003)	(0.003)	(0.003)
Occupation: Regular salaried	0.077***	0.083***	0.081***
	(0.003)	(0.003)	(0.003)
Sector: Urban	0.352***	0.366***	0.341***
	(0.003)	(0.003)	(0.003)
State fixed effects	Yes	Yes	Yes
Constant	7.153***	7.321***	7.015***
	(0.019)	(0.019)	(0.018)
R-squared	0.465	0.459	0.558
Observations	115,896	115,896	115,685

5.10 Types of insurances

The main result discussed in Section 5.7.2 suggests that internet density is related to improved risk management practices. In this section, we intend to analyse the primary driver of our result, i.e., which type of insurance majorly drives the positive relationship. To do that, we consider the share of the premium paid for life insurance, health insurance, and other types of insurance (motor, crop, etc.) as the outcome variables and re-estimate the probit and tobit regression model given by equations (5.1) and (5.2) respectively. Table 5.7 provides the result. Columns 1 shows that internet density is insignificant for life insurance uptake but negative significant for its demand (column 2). In contrast, columns 3 and 4 indicate internet density's positive relationship with health insurance demand. On the other hand, columns 5 and 6 depict the result for other types of insurance, showing a significant positive association between internet density and uptake other types of insurance market and its demand. Therefore, one can infer that our main result concerning overall insurance demand improvement due to insurance density is primarily driven by health and other insurance products. The counterintuitive result for life insurance remains unexplained and needs further investigation.

Table 5.7: Types of insurances

The table below presents the probit and tobit regression coefficient of insurance uptake and premium, respectively, for types of insurance (life insurance, health insurance, and other insurance) on internet density and other socio-economic factors in the subsample of insurance holders. Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Life insurance uptake	*Life insurance premium*	*Health insurance uptake*	*Health insurance premium*	*Other insurance uptake*	*Other insurance premium*
Internet density	-0.066	-0.025***	0.768***	0.069***	0.205***	0.009***
	(0.059)	(0.008)	(0.090)	(0.008)	(0.064)	(0.003)
Dependency ratio	-0.039	-0.012***	0.131***	0.010***	-0.103***	-0.005***
	(0.025)	(0.003)	(0.038)	(0.003)	(0.028)	(0.001)
Age	-0.000	-0.000***	0.003***	0.000***	0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Gender: Male	-0.093***	-0.013***	-0.118***	-0.011***	0.247***	0.006***
	(0.021)	(0.003)	(0.030)	(0.003)	(0.022)	(0.001)
Education: Base Illiterate						
Primary	0.016	0.005**	0.020	-0.000	-0.004	0.000
	(0.019)	(0.002)	(0.033)	(0.003)	(0.020)	(0.001)
Secondary and above	0.080***	0.022***	0.175***	0.016***	0.108***	0.006***
	(0.020)	(0.003)	(0.033)	(0.003)	(0.022)	(0.001)
Total assets	0.010**	0.005***	0.011	0.002***	0.160***	0.007***
	(0.005)	(0.001)	(0.007)	(0.001)	(0.005)	(0.000)
Religion: Base: Hindu						
Muslims	-0.362***	-0.042***	-0.187***	-0.018***	0.274***	0.004***
	(0.023)	(0.003)	(0.037)	(0.003)	(0.025)	(0.001)
Others	-0.050*	-0.006*	-0.010	-0.002	0.131***	0.003**
	(0.028)	(0.003)	(0.037)	(0.003)	(0.032)	(0.001)
Caste: General						
SC-ST	-0.078***	-0.014***	-0.071**	-0.007***	-0.002	-0.003***
	(0.018)	(0.002)	(0.028)	(0.003)	(0.020)	(0.001)
Others	0.005	-0.003	-0.123***	-0.012***	-0.023	-0.002**
	(0.015)	(0.002)	(0.024)	(0.002)	(0.017)	(0.001)
Occupation: Regular salaried	0.236***	0.026***	0.066***	0.007***	-0.022	-0.004***
	(0.014)	(0.002)	(0.021)	(0.002)	(0.016)	(0.001)
Sector: Urban	0.119***	0.011***	0.210***	0.020***	0.033**	-0.003***
	(0.014)	(0.002)	(0.021)	(0.002)	(0.015)	(0.001)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.305***	-0.041***	-1.949***	-0.188***	-2.586***	-0.098***
	(0.106)	(0.013)	(0.147)	(0.015)	(0.111)	(0.005)
R-squared	0.091	0.544	0.173	0.353	0.125	-0.046
Observations	45,800	45,800	45,800	45,800	45,800	45,800

5.11 Heterogeneous effect

5.11.1 Age

Earlier studies provide evidence for increasing relative risk aversion with age (Riley and Chow,1992; Morin and Suarez,1983). Young ones are observed to attach a low probability to unprecedented events. In this section, we check for the heterogeneous effects of our result by re-estimating our model for young households. We define a dummy variable young by considering one for the families with heads below the median age of 47 and re-estimate our regression model by following equation (5.3). Column 1-2 of Table 5.8 suggests that the coefficients for interaction terms are negative and significant for younger households suggesting the positive effect of internet density on insurance uptake and its demand is less for young households. This result may be attributed to the lower degree risk aversion of young age.

5.11.2 Gender

Studies suggest that the degree of risk-averseness of women are higher than that of men (Nelson,2015; Charness and Gneezy,2012; Croson and Gneezy,2009; Jianakoplos and Bernasake,1998). They also show that single women are more risk averse than married couples, whose risk aversion index is even higher than single men. Given the evidence, we explore whether internet density and insurance behaviour vary with the gender of the household head. In our sample, 86 percent of the household heads are male. We estimate the following model, including the interaction term. The coefficient of the *Internet density* in Column 3 of Table 5.8 is negative and significant, highlighting that households with male heads of the family are less likely to uptake insurance compared to households with female heads. Similarly, column 4 suggests that the result regarding insurance premiums is also less for male heads of households. The lower risk aversion of males possibly explains this result.

Table 5.8: Heterogeneous effects

The following table presents the result obtained from probit and tobit regression of insurance uptake and insurance density on the interaction term of the Internet density with young (columns 1 and 2), male (columns 3 and 4), and sector variable (columns 5 and 6). Robust standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Insurance uptake	*Insurance premium*	*Insurance uptake*	*Insurance premium*	*Insurance uptake*	*Insurance premium*
*Internet density*Young*	-0.190***	-0.013**				
	(0.050)	(0.005)				
*Internet density*Male*			-0.356***	-0.042***		
			(0.075)	(0.008)		
*Internet density*Urban*					0.047	-0.003
					(0.053)	(0.006)
Young	0.130***	0.011***				
	(0.029)	(0.003)				
Internet density	0.765***	0.055***	0.989***	0.086***	0.650***	0.050***
	(0.046)	(0.005)	(0.077)	(0.009)	(0.045)	(0.005)
Dependency ratio	-0.343***	-0.036***	-0.331***	-0.034***	-0.332***	-0.034***
	(0.016)	(0.002)	(0.015)	(0.002)	(0.015)	(0.002)
Age	0.002***	0.000**	0.001***	0.000	0.001***	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gender: Male	0.227***	0.017***	0.403***	0.038***	0.227***	0.017***
	(0.013)	(0.002)	(0.040)	(0.004)	(0.013)	(0.002)
Education: Base: Illiterate						
Primary	0.217***	0.023***	0.218***	0.023***	0.218***	0.023***
	(0.011)	(0.001)	(0.011)	(0.001)	(0.011)	(0.001)
Secondary and above	0.422***	0.048***	0.424***	0.049***	0.424***	0.048***
	(0.012)	(0.002)	(0.012)	(0.002)	(0.012)	(0.002)
Total assets	0.225***	0.023***	0.225***	0.023***	0.226***	0.023***
	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
Religion: Base: Hindu						
Muslims	-0.176***	-0.024***	-0.176***	-0.024***	-0.176***	-0.024***
	(0.014)	(0.002)	(0.014)	(0.002)	(0.014)	(0.002)
Others	-0.064***	-0.007***	-0.064***	-0.007***	-0.063***	-0.007***
	(0.019)	(0.002)	(0.019)	(0.002)	(0.019)	(0.002)

	(1)	(2)	(3)	(4)	(5)	(6)
	Insurance uptake	*Insurance premium*	*Insurance uptake*	*Insurance premium*	*Insurance uptake*	*Insurance premium*
Caste: Base: General						
SC-ST	-0.148***	-0.019***	-0.147***	-0.019***	-0.147***	-0.019***
	(0.012)	(0.001)	(0.012)	(0.001)	(0.012)	(0.001)
Others	-0.027***	-0.005***	-0.027**	-0.005***	-0.027**	-0.005***
	(0.011)	(0.001)	(0.011)	(0.001)	(0.011)	(0.001)
Occupation: Regular salaried	0.232***	0.023***	0.232***	0.023***	0.232***	0.023***
	(0.011)	(0.001)	(0.011)	(0.001)	(0.011)	(0.001)
Sector: Urban	0.191***	0.017***	0.191***	0.017***	0.168***	0.019***
	(0.009)	(0.001)	(0.009)	(0.001)	(0.028)	(0.003)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-5.069***	-0.514***	-5.121***	-0.521***	-4.958***	-0.503***
	(0.070)	(0.017)	(0.072)	(0.016)	(0.065)	(0.016)
R-squared	0.172	1.068	0.172	1.068	0.172	1.068
Observations	115,957	115,957	115,957	115,957	115,957	115,957

5.11.3 Area of residence

Several studies have found that the area of residence matters for household outcomes. Gu et al. (2020) find that ICT adoption does not have a significant impact on the empowerment of rural women. On the other hand, Sekabira and Qaim (2017) find that mobile phone adoption by rural women improves their nutritional outcomes. This section explores whether the relationship between internet density and insurance behaviour varies between urban and rural households. We consider the heterogeneous effect across urban and rural households by estimating the regression equation by incorporating an interaction term of internet density and area of residence in the model. Column 5-6 of Table 5.8 represents the results. However, we do not find any difference in insurance behaviour due to internet density for both urban and rural households.

5.12 Chapter summary

The importance of the internet for improving financial outcomes has caught the attention of researchers, practitioners, and policymakers in developing economies. This study examines whether internet density at the district level can increase insurance demand in India, a country characterised by low insurance penetration. Using a probit model, we find that households with higher internet density are more likely to participate in the insurance market and pay higher premiums. The results show the positive spillover effects of ICT on insurance participation. We find our results are robust to alternate estimation techniques, alternate measures of internet density, and the inclusion of additional control variables. Additionally, our study suggests that district-level internet density is positively related to the uptake and demand of all types of insurance except life insurance. Further, we find income as the channel through which internet density can improve the insurance demand of households. Finally, our results provide evidence that the effect varies with socio-economic features like age and gender of the household head.

Chapter 6

Conclusion

6.1 Summary of findings

The thesis empirically analyses four household finance issues in India- the role of financial literacy in affecting financial behaviour, the effect of flood shock on financial investments, the relationship between housing and financial assets, and internet density and insurance demand. Chapter 1 provides an overview of household finance literature and its evidence from advanced economies, along with a discussion on the Indian scenario. We identify research gaps based on the existing evidence and postulate the specific research questions addressed in the subsequent chapters.

Chapter 2 investigates the relationship between financial literacy and the financial behaviour of individuals. Using the recent wave of nationally representative data collected by the FII survey (2018) covering over 40,000 individuals aged 15 years or above, Chapter 2 finds that financial literacy improves the timely bill-payment and savings behaviour of individuals. The chapter also addresses the endogeneity concerns using an instrumental variable approach. Additionally, we find that a higher likelihood of financial planning owing to financial literacy is one of the channels through which financial literacy can enhance the financial behaviour of individuals. Moreover, the effect is more substantial for confident individuals, males, and urban residents.

Chapter 3 investigates the long-term effect of a flood in the southern state of Tamil Nadu on household investment portfolios. The chapters consider households residing in Tamil Nadu and Pondicherry and covered in AIDIS-2003, AIDIS-2013, and AIDIS-2019 for the analysis.

Employing a difference-in-difference methodology, we find that flood-affected households reduce illiquid asset holdings and increase financial asset holdings. Further, these affected households invest less in illiquid assets than liquid financial assets. Further, we find that owing to a covariate shock, households rebalance their asset portfolio. Additionally, our result shows that the reduced investment in real estate drives the result of a fall in illiquid assets, whereas increased investment in retirement funds of flood-affected households drives the positive result observed for financial assets.

Chapter 4 examines the correlation between housing and financial investments. Using the AIDIS-2019, Chapter 4 provides evidence of a substitution effect of housing on financial investments. The findings are robust to alternative estimation methods, alternative definitions of outcome and interest variables, and the inclusion of additional control variables. Further, we find that the substitution effect is more prominent for young and poor households and lower for families with more dependents rather than investing in multiple physical assets.

Chapter 5 investigates the association between internet density and insurance demand. Using AIDIS-2019 data and employing the probit and tobit regression methods, this chapter finds that district-level internet density is related to higher insurance demand of the households as proxied by insurance uptake and share of premium in household expenditure. Additionally, Chapter 5 shows that income is possibly one of the channels through which higher internet density in the district improves the risk management practices of households. Finally, we find the effect of internet density for insurance uptake and demand is lower for young and male-headed households and higher for households with more dependents.

Chapter 6 is structured as follows. Section 6.2 underscores the policy implications. Section 6.3 mentions the limitations of the study, and finally, Section 6.4 provides a discussion.

6.2 Policy implications

The findings of the thesis chapters are important from a policy viewpoint. Based on the results of Chapter 2, we conclude that financial literacy is an essential instrument for improving financial behaviour. The Government of India undertakes several initiatives to improve the financial literacy of individuals. For instance, the National Centre for Financial Education (NCFE), promoted by the Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Insurance Regulatory and Development Authority of India (IRDAI), and Pension Fund Regulatory and Development Authority (PFRDA) has been established to implement National Strategy for Financial Education (NSFE) in the country. However, our findings reiterate that investing in financial literacy programs is well-grounded and should remain a priority. Moreover, our study suggests that the policy designed for financial literacy programs needs to focus mainly on understanding the concept of portfolio diversification. Second, our result provides evidence for financial planning as a channel through which financial literacy may improve the financial behaviour of individuals. Further, the study finds that the effect of financial literacy is higher for those confident regarding their financial management skill, male and urban individuals. Therefore, financial literacy programs should target females and individuals residing in rural regions as that can reduce the gap in financial outcomes between these groups. Also, complementary investments to introduce financial education at schools and colleges are desirable. Introducing financial education in the school curriculum may also enhance individuals' confidence in their financial management skills.

Chapter 3 shows that a covariate shock like a flood leads households to reduce investment in illiquid assets and increase investment in liquid financial assets. Households appear to learn from their mistakes; however, there is a to nudge households to invest in liquid

financial assets ex-ante, i.e. before a crisis hits. Hence, policies should focus on improving financial awareness regarding the benefits of holding liquid financial assets, which can partially reduce the vulnerability of Indian households and strengthen resilience in the wake of future covariate and idiosyncratic shocks. Also, financial awareness programs should focus on regions or households more likely to experience shocks, like coastal households.

Next, the findings of Chapter 4 indicate a substitution effect of housing on financial investment. Therefore, our result underscores the need for customised financial products in urban India to ensure liquidity-constrained homeowners keep investing in liquid financial assets. Further, it also highlights the need to improve housing quality as it can lower the cost of maintaining housing, reducing the substitution effect. In this regard, the associations of beneficiaries under the scheme, like the 'Residents Welfare Association,' to take care of the maintenance and welfare of the houses being built under PMAY, should be encouraged to form. Further, there remains scope for creating financial awareness not to widen the gap in financial investments among homeowners and non-owners in urban India. Moreover, our result indicates that the substitution effect is more substantial for poor and younger households. Therefore, there is a need for customised financial products so that financially constrained urban homeowners can invest in liquid financial assets regularly, even in smaller quantities.

Chapter 5 provides evidence for a positive association between internet density and risk management practices of households. The findings draw two policy implications. First, it provides policymakers insights into what interventions can increase insurance demand in India. Especially, the policy should focus on the households with male and young head of the family to increase the awareness. Second, given the positive spillover effects of ICT adoption, the

study highlights that government investment to improve internet supply in developing economies is desirable.

6.3 Limitations of the thesis

Despite significant policy implications, there are a few limitations. FII data does not provide information on the amount invested in each instrument. As a result, in Chapter 2, we are unable to comment on whether financial literacy is related to the optimal share of each asset in the investment portfolio. Second, in the absence of longitudinal data, this study cannot comment on whether the nature of the relationship between financial literacy and financial behaviour has changed after the government of India introduced the flagship financial inclusion program, PMJDY.

Further, in Chapter 3, we use pooled cross-sectional data for our analysis. Since the AIDIS does not track the same set of households, we are not able to identify households actually affected by the flood and have to rely on intent to treat estimates. Further, the unavailability of data just after the flood does not allow us to estimate the short-term effects of the flood on the investment portfolio.

In Chapter 4, we cannot analyse how housing is related to risky asset investments since only a few households (1.7 percent) participate in risky financial markets. Future research based on primary surveys or administrative data may shed further light on the relationship between housing and investment in risky assets.

The information related to internet access at the household level is not available in AIDIS data. Hence, in Chapter 5, we are unable to analyse the direct effect of internet access on insurance demand. Moreover, in the absence of longitudinal data, we cannot explore the relationship between year-to-year growth in internet density and insurance demand.

6.4 Discussion

The thesis concludes that financial literacy is a means to improve the financial behaviour of households, and policies focusing on conducting financial literacy programs are desirable. It reduces the likelihood of committing investment mistakes like not having a financial plan and, through this, improves overall financial behaviour. Further, the findings highlight the need to conduct financial literacy programs targeting people residing in rural areas, females, low-income and young households. Further, we conclude that households learn from their investment mistakes, and households experiencing covariate shocks like floods are likely to increase investments in liquid assets and, at the same time, reduce illiquid asset holdings, especially real estate. The analysis identifies an important trade-off between housing and financial investment in urban India, which has implications for policymaking and the designing of financial instruments. The thesis also finds that improving internet density in India holds promise in the form of enhancing the risk management practices of households. Overall, the thesis identifies key vulnerabilities related to the financial behaviour of Indian households and possible means to rectify such investment mistakes.

Specific Contribution

- **Contribution to literature**

  The thesis contributes to several strands of literature. Primarily it contributes to household finance literature in multiple ways. First, the study underscores the importance of financial literacy for instilling better financial behaviour. Second, it sheds light on how exogenous shock can affect household investment portfolios. It also disentangles the relationship between financial assets and owning a house in the Indian context and indicates a trade-off between housing and financial investments. Next, the thesis contributes to literature related to the role of ICT (information, communication and technology) for financial inclusion, suggesting that neighbourhood internet density can improve the risk management practice of households. The thesis also contributes to the emerging literature on climate change and its effects. It provides evidence of how households rebalance their portfolio after a climate shock, i.e., a flood.

- **Contribution to policy**

  The findings of this thesis have significant contributions to policy. The results of the first objective provide evidence in favour of policies directed toward enhancing financial literacy in India. The findings of the second research question highlight the need to increase investments in financial awareness programs that educate households regarding the merits of investing in liquid financial assets, as this may improve the resilience of households in the wake of a crisis. The third essay highlights the need for introducing customised financial products to ensure that the budget constraints of homeowners do not force them to reduce their financial investments. The fourth objective's findings highlight that last mile internet connectivity should be a policy focus as it holds the promise to improve the insurance demand of households.

Future Scope of Work

The thesis investigates four issues related to household finance in India, namely, the role of financial literacy, the effect of flood on the investment portfolio, the trade-off between housing and financial investments, and internet density as a means to improve insurance demand. Even though the findings are important for extending our understanding of the household finance landscape in India, there remains scope for future research enlisted below:

a) The thesis has not explicitly analysed the socioeconomic characteristics that affect households' participation in risky assets. The risky assets in our analysis were bundled with financial assets. This was primarily because less than 2 percent of households participated in risky asset markets during the period of our analysis. Though the proportion of these households is low, nonetheless, the absolute number of participants in the risky financial asset market has shown an upward trend during the last decade. Hence, the future scope lies in investigating the factors behind participation in risky asset markets. Specifically, one can extend the existing study and explore whether financial literacy is positively associated with understanding risky financial instruments, reduces the likelihood of becoming victims of financial fraud, and increases risk-adjusted returns earned by households in the long run.
b) Using large panel datasets, one can examine the trends in household portfolios over time. Such analysis is critical to evaluate the effect of government policies like PMJDY, PMAY, and others on household investment behaviour.
c) Future studies may focus on the effect of other covariate shocks like the pandemic on household investment portfolios, and there remains scope for examining the effect of idiosyncratic shocks like health shocks on household investment portfolios.
d) This thesis primarily focused on the asset side of the household balance sheet, and the debt side was not considered. The HFC report (RBI, 2017) highlights that Indian households are by non-institutional borrowing. Future studies can explore the role of internet density,

financial literacy, and institutional borrowings of households. Additionally, one can analyse the consequence of household debt behaviour for other household financial activities. For example, RBI Report (2017) documents a strong negative correlation between informal debt and insurance uptake. Hence, future studies can exploit the opportunity of this correlation and draw significant policy implications.

Future research can focus on whether differences in the investment behaviour of households have welfare consequences in terms of differences in consumption, health, and educational investments, among others.

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Appendix

Table A1.1: Financial literacy questions

Financial literacy dimension	Questions
Basic numeracy related	1.Imagine you have Rs.2,000. Somebody gave you Rs.200 more. How much total money will you have? (a) Rs. 2,200 (b) Any other answer 2. Imagine you have Rs. 1,000 and you have to divide it among 5 people. How much money will each person receive if you divide it equally? (a) Rs. 200 (b) Any other answer 3. Suppose you need to borrow Rs. 100. Which is the lower amount to pay back: Rs. 105 or Rs. 100 plus 3 percent? (a)105 (b) Rs.100 plus 3 percent 4. If you saved Rs.200 per month, how many rupees would you have after three months? (a)600 (b)Any other answer
Compound interest related	1.Suppose you put money in the bank for two years and the bank agrees to add 15 percent per year to your account. Will the bank add more money to your account the second year than it did the first year, or will it add the same amount of money both years? (a) Same (b) More 2. Suppose you had 100 Rs. in a savings account and the bank adds 10 percent per year to the account. How much money would you have in the account after five years if you did not remove any money from the account? (a) Exactly Rs. 150 (b) More than Rs. 150 (c) Less than Rs. 150
Inflation related	1.Suppose over the next 10 years the prices of the things you buy double. If your income also doubles, will you be able to buy less than you can buy today, the same as you can buy today, or more than you can buy today? (a) Less (b) Same

	(c) More
Diversification related	1.Is it safer to put your money into one business or investment, or to put your money into multiple businesses or investments? (a) One business or investment (b) Multiple businesses or investments

Table A3.1: Rainfall measures of flood-affected districts

	1.10.2015-9.12.2015		
Tamil Nadu districts	**Actual rainfall (in mm)**	**Normal rainfall (in mm)**	**Percentage departure from normal**
Kancheepuram	1808.6	577.5	213
Chennai	1612.1	708.6	128
Thiruvallur	1468.5	532.3	176
Cuddalore	1215.6	603.2	102
Nagapattinam	1339.0	786.5	70
Villupuram	920.2	436.8	111
Pondicherry districts			
Puducherry	1552.1	727.8	113
Karaikal	1291.8	855.1	51

Source: India Meteorological Department, Regional Meteorological Centre, Chennai

Table A3.2: Descriptive statistics of the types of assets

The above tables present the means of the variables used in the study. Standard errors are in parenthesis. The level of significance mentioned in the table is based on the t-test done to check the equality of means for the two groups. *** p<0.01, ** p<0.05, * p<0.1.

Types of assets	Treatment group	Control group	Overall sample
Illiquid assets:			
Real estate1	0.691	0.765***	0.755
	(0.462)	(0.424)	(0.430)
Real esatet2	8.873***	8.391	8.496
	(1.517)	(1.190)	(1.306)
Ornaments1	0.961	0.951	0.952
	(0.194)	(0.215)	(0.215)
Ornaments2	6.405	6.451	6.392
	(1.320)	(1.204)	(1.242)
No. of observation	7,540	13,131	20,671
Financial assets:			
Deposits1	0.918	0.972***	0.957
	(0.274)	(0.166)	(0.202)
Deposits2	3.585***	3.191	3.258
	(1.658)	(1.538)	(1.585)
Retirement fund1	0.261***	0.100	0.139
	(0.439)	(0.300)	(0.346)
Retirement fund2	5.716***	5.677	5.698
	(1.607)	(1.624)	(1.597)
No. of observation	5,308	10,178	15,486

List of Publications

1. Lahiri, S., and Biswas, S. (2022). Does financial literacy improve financial behavior in emerging economies? Evidence from India. *Managerial Finance*, *48*(9/10), 1430-1452. (ABDC-B,Scopus)
2. Lahiri, S., and Biswas S. (2023). (Im)balance in the household balance sheet in the aftermath of a natural disaster. *International Journal of Disaster Risk Reduction. DOI: **10.1016/j.ijdrr.2023.104174** (ABDC-A, Scopus Q1)*
3. Lahiri, S., and Biswas S.(2023). Home, unsweet home - Effect of housing on financial investments of Indian households. *Journal of Economic Studies. DOI:* 10.1108/JES-05-2023-0238. (ABDC-B, Scopus Q1)
4. Biswas, S. and Lahiri, S. Does access to the internet affect insurance uptake? – Evidence from India (Revision submitted).

List of Awards

1. Awarded '**Best Poster**' for poster presentation in Vidyanotsav (PH.D. fest), 2023 organised by BITS Pilani, Hyderabad. *2023*
2. Awarded **'Best Paper'** for paper presentation in Finance track at 4th Annual Conference in Economics and Finance organised by BITS, Pilani, Hyderabad Campus. *2023*
3. Awarded **'Third prize'** for paper presentation at 3rd Annual Conference in Economics and Finance organised by BITS, Pilani, Hyderabad Campus. *2022*
4. Awarded **'Special prize'** for paper presentation and **'Third prize'** for proposal presentation at Doctoral Colloquium of Management and Development organised by Institute of Rural Management, Anand, Gujarat. *2021*
5. Awarded '**Best Paper'** at International Conference on Business, IT and Enterprise Architecture Organised by MDI, Murshidabad. *2020*

List of Presentations

In 2023:

1. 7th Annual CECFEE research and policy workshop organised by ISI, Delhi.
2. Research Symposium on Finance and Economics organised by IFMR Graduate School of Business, Krea University.
3. 4th Annual Conference in Economics and Finance organised by Birla Institute of Technology and Science, Pilani, Hyderabad Campus.
4. 42nd Annual Conference organised by CUES, University of Calcutta.
5. Asian Meeting of Econometric Society at IIT, Mumbai.
6. Poster presented at Vidyanostab,2023 organised by BITS Pilani, Hyderabad.
7. 18th Annual Conference on Economic Growth and Development organised by Economics and Planning Unit, Indian Statistical Institute.
8. 4th International Conference on Issues in Economic Theory & Policy organised by Presidency University, Kolkata.

In 2022:

9. 30th Annual conference at Jadavpur University.
10. Comprehensive Research (2022), PhD Colloquium organised by IGIDR, Mumbai
11. Vietnam Symposium in Banking and Finance,2022.
12. XVII International Conference on Public Policy & Management organised by Indian Institute of Management, Bangalore.
13. Field workshop on Household Finance by XKDR Forum-Dvara Research Foundation.
14. International Conference on Contemporary Issues in Economics by Xavier's Institute of Management (2022).
15. 3rd Annual Conference in Economics and Finance organised by BITS Pilani, Hyderabad.

In 2021:

16. Doctoral Colloquium of Management and Development by Institute of Rural Management, Anand, Gujarat.
17. 10th India Finance Conference (2021)
18. 7th Conference on Empirical Issues in International Trade & Finance organised by Indian Institute of Foreign Trade, Kolkata Campus.
19. Annual Conference on Economics and Public Policy organised by Jindal School of Government and Public Policy, O.P. Jindal Global University.
20. International Conference on Business, IT and Enterprise Architecture Organised by MDI, Murshidabad.

In 2020:

21. The 4th International Conference on Economics and Development (2020)
22. 3rd ICDE & 14th ISDSI Annual Conference organised by IIM, Raipur.
23. 1st Rajagiri Management Conference (2020)
24. Doctoral Symposium organised by IIM, Kozhikode.
25. International Conference on Business, IT and Enterprise Architecture Organised by Management Development Institute, Murshidabad.

Biography of the candidate

Shreya Lahiri is currently a research scholar at Birla Institute of Technology and Science, Pilani, Hyderabad Campus, India. She completed a Master's degree in Actuarial Economics from the Madras School of Economics with the first rank. She has qualified for the prestigious National Eligibility Test for Assistant Professorship. Her primary research interest is in the household finance and financial markets. During her Ph.D. journey, she has assisted faculties in teaching several finance courses like Security Analysis and Portfolio Management, Derivative and Risk Management, Business Analysis and Valuation, and Financial Management. Her work has been presented at many International and national conferences and published in Scopus-indexed journal. Previously, she worked as an assistant professor at B.P. Poddar Institute of Management and Technology, Kolkata. There, she used to teach economics for BBA courses.

Biography of supervisor

Dr. Shreya Biswas is an Assistant Professor at the Department of Economics and Finance, BITS Pilani, Hyderabad campus. At BITS, Pilani, Hyderabad, she usually teaches the finance courses like Security Analysis and Portfolio Management, Derivatives and Risk Management, Fundamentals of Finance and Accounts (Finance module). Before joining BITS Pilani, she worked as an Assistant Professor at the School of Economics, NMIMS, Mumbai. There she used to teach Statistics, basic and advanced Econometrics, Financial Economics, and Corporate Finance. She is an empirical economist, and her research interest is primarily household finance issues in India, corporate governance challenges faced by financial and non-financial firms in India and public policy issues. Her work has been published in many national and international reputed journals. She has already published 12 journal articles and 5 book chapters. Additionally, she reviews articles for several peer-reviewed journals. She has also worked at Deloitte and KPMG as a transfer pricing consultant.