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**How Much Can Asset Portfolios of Rural
Households Benefit from Formal Financial Services?**

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Abstract

Despite a demonstrated demand for various financial services, this paper finds that the asset portfolio of the average rural household in India is composed almost entirely of two physical assets—housing and jewellery. A comparison with a hypothetical portfolio of financial assets reveals that rural households could earn significantly higher levels of real returns—an increase of 2.02% to 4.97%—at the extant levels of risk. Our results point to the urgent policy imperative to provide rural households with access to financial instruments that would allow them to construct a more diversified, tradable, and liquid portfolio offering higher yields and shelter from local market fluctuations.

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1. Introduction

Despite a demonstrated demand for financial services (ranging from emergency loans for consumption smoothing to a recurring deposit account), the penetration of formal financial products in the asset portfolio of rural households in India remains extremely low. An estimate suggests that only 32% of rural residents in India have a bank account (RBI, 2014b). Anecdotal evidence suggests that the asset portfolio of rural households is dominated by highly illiquid, non-tradable, and localised assets (such as land and housing) and varying degrees of ownership of gold. For instance, the financial savings of households as a percentage of the Gross Domestic Product (GDP) fell from approximately 12.5% in 2005–2006 to 7% in 2012–2013, while the investment in physical savings and valuables (including gold) increased from 12.5% to 14% and from 7.5% to 16%, respectively, over the same time period (RBI, 2014a).

Capital markets offer various instruments that can effectively serve as diversification tools against local market fluctuations; they also increase the choice set for rural investors. Therefore, it is important to understand whether and how rural households can gain from increased penetration of formal financial products in their asset portfolios. However, there is a lack of clear understanding of the various components that constitute the portfolio of an average rural household. In this context, this paper explores the composition of the asset portfolios of rural households in India and assesses the extent to which rural households can benefit from the introduction of financial market instruments into their asset portfolios.

Using customer data from a financial services institution that operates in five remote rural districts (Arilayur, Pudukkottai, and Thanjavur in Tamil Nadu; Ganjam in Odisha; and Tehri Garhwal in Uttarakhand) of India, we construct stylised typologies of household asset portfolios based on primary and secondary sources of income. We then compare the performance of these stylised portfolios over time with the performance of a hypothetical portfolio that introduces financial instruments such as equity, insurance, index funds, government securities, and the National Pension Scheme (NPS), which offer households access to a more diversified and liquid asset portfolio. We compare these portfolios to assess

the change in the financial outcome of the households as a result of the introduction of financial assets.

The remainder of this paper is organised as follows. Section 2 presents a brief review of the relevant literature. Section 3 describes in detail the data and the methodology that the paper employs. Section 4 examines the current composition of the asset portfolios of rural households. Sections 5 and 6 provide an assessment of the portfolio of physical assets and replacement financial assets, respectively. Section 7 discusses the policy implications of our findings, and Section 8 concludes the paper.

2. Literature Review

As Campbell (2006) noted, households typically face long but finite planning horizons; a large portion of the household asset portfolio is composed of non-tradable and illiquid assets in the form of human capital and housing, respectively, and households often face significant constraints on borrowing. A review of the literature on the portfolio allocation of household assets reveals the following.

i. Households actively manage their asset portfolios, even in the absence of access to formal financial markets

The evidence from literature suggests that households actively manage their asset portfolios and employ a variety of risk diversification strategies. For example, Aryeetey (2004) found that farm households in Ghana diversify their source of employment as a risk mitigation strategy. Ghanaian farm households draw almost half of their total income from non-farm self-employment and wage labour. Farm households are also known to diversify crops as a risk mitigation strategy (Townsend, 1993). Rosenzweig and Wolpin (1993) found that agricultural investment decisions by rural households are motivated by the need to smooth consumption in the face of uncertain income streams. They found that households use certain productive farm assets (such as bullocks) in their asset portfolio as a hedge against rainfall risk. Fafchamps and Pender (1997) found that rural farm households in India treat irreversible and reversible investments differently. Households refrain from investing in irreversible investments—investments that cannot be readily reversed into liquidities—such as a well because it restricts their ability to self-insure against external shocks. Households also actively utilise informal financial mechanisms to manage their asset portfolios. Collins et al. (2009) tracked the “financial diaries” of 250 households over a year and found that low-

income households use a wide range of financial instruments. The average number of unique instruments used by households in India was eight. Households in the sample relied heavily on informal savings and loan clubs—such as Rotating Savings and Credit Associations (ROSCAs)—to tide over the “triple whammy” of low incomes, irregular cash flows, and absence of suitable financial tools. Moreover, households frequently entered into reciprocal, contractual relationships with one another as a method of risk pooling. For instance, households in South Africa invest in a type of “funeral insurance,” in which premiums are paid into informally created, group-run neighbourhood societies.

ii. Household asset portfolios are diverse, simple, and predominantly invested in low-risk assets

McCarthy (2004) reported three key observations from a review of the empirical studies on household portfolios. First, different households hold diverse asset portfolios. The asset portfolios of households vary based on a number of variables including the country of residence and wealth, as well as variables such as age, education, and the birth years of the members. For example, across countries, richer households are more likely to hold risky assets such as stocks, shares, property that is rented out, and family business. Second, with the exception of housing, the average household asset portfolio is predominantly invested in low-risk assets including savings and checking accounts, time deposits, and life insurance. Third, the majority of the households hold portfolios that consist of fewer than five asset types. The modal number of assets in the portfolios of households in the US was five.

iii. Investment in housing crowds out investments in other financial assets

Housing forms an important component of asset portfolios of households across countries. Evidence from literature suggests that investments in housing could crowd out investments in other financial assets. Cocco (2000) found that investment in housing is a significant driver of the asset portfolio choice of households, especially for younger investors and households with lower net worth. For these households, investment in housing keeps the overall liquidity low, and thus, crowds out investment in stockholding. Flavin and Yamashita (2002) found that the ratio of housing to net worth of the household declines over the life cycle of the household. Younger households have a relatively large portion of their entire portfolio invested in housing and are highly leveraged. This leads them to invest in less risky investments such as bonds and to use their net worth to pay for their mortgage. As households age, they accumulate wealth, thereby reducing the ratio of housing to net worth of

their portfolio. Similarly, Curcuro et al. (2004) found that the probability of stock ownership decreases with an increase in the ratio of home equity to net worth. They argued that the negative relation between stock holdings and real estate is consistent with a substitution effect—for a given level of wealth, households that choose to spend more on housing have less to invest in other assets. Chetty and Szeidl (2004) found that a USD 1 increase in mortgage size leads to a 50–70% shift in portfolio allocation from stocks to bonds. However, unlike other studies that suggested that this shift to safer assets is due to the increased exposure to housing risk, they proposed that this shift occurs because housing is inherently a “commitments” good—a good on which a transaction cost must be paid to shift consumption.

iv. There are discrepancies between ideal and observed financial behaviour of households

Campbell (2006) suggested that there are discrepancies between the findings of positive household finance (what households actually do) and normative household finance (what households ought to do). For instance, household portfolios are typically analysed within the framework of lifecycle models, which postulate that households follow a “hump-shaped” asset accumulation pattern. The hump-shaped pattern suggests that households build up their asset portfolios over their working years and draw upon them after retirement. Poterba and Samwick (2001) challenged the central assumption of lifecycle models and found that all assets within the asset portfolio need not follow the hump-shaped pattern. For instance, the ratio of financial assets to total assets declines as the household ages and subsequently increases at later ages. Further, the study found significant “cohort effects” that determine asset portfolio choice. For instance, in the US, while baby boomers demonstrate average propensity to hold taxable equity and hold an average share of taxable equity in their portfolio, younger cohorts have larger investment in bonds and tax-deferred accounts. Additionally, younger cohorts leverage their assets to a larger extent than older cohorts do.

3. Data and Methodology

This paper analyses the asset portfolios of the customers of a Rural Financial Institution (RFI)¹ that provides financial products and services to remote rural households in India and functions in areas where other formal financial institutions do not operate. As of September 2013, the RFI services approximately 2,25,000 households across five districts in three

¹ The name of the institution has been withheld in order to ensure confidentiality.

different states, Tamil Nadu, Uttarakhand, and Odisha, and has a network of 201 branches. The RFI aims to provide a complete suite of financial services to all individuals and households in its service area. In doing so, it is guided by a wealth management approach that ensures that products and services are recommended for a household based on an understanding of its financial situation, asset allocation, risk tolerance, needs, and goals.

The RFI captures extensive details of the households that it enrolls. On average, across all its service areas, a branch enrolls 56% of the households in its service area, thereby collecting data on a representative cross-section of rural households. A brief description of the data collected by the RFI is provided in Table 1.

Table 1: Brief Description of RFI Data

Household Details	For each family member (including enrollee): - Name, relationship to enrolled member, age, education
Family Income	Income details for each family member, with provision for incomes to be recorded from multiple sources per member: - Income-generating activities the member is involved in, net income from the activity, frequency of income, duration of income
Family Expenditure	Expenditure amounts and frequency for: - Clothing, education, fees, electricity, festival, food, health, house rent, insurance, shop rent
Assets	- House: number of houses, build type, roof type - Shop: number of shops, build type, roof type - Land ownership and usage: area under cultivation for different crops; non-irrigated land, irrigated land - Number and type of agriculture equipment - Livestock - Electronic goods - Vehicle(s) - Jewellery (quantity)
Liabilities	For existing loans: - Source, amount, frequency, instalment amount, tenure
Household Goals	For the household's goals related to marriage, education, loan repayment, house, land, gold, business, other assets, other expenses: - Family member to whom the goal is to be mapped - Number of years in which to achieve the goal - Amount of money stipulated for the goal - Change in surplus as a result of the goal being added to the household's finances

The mean household-level annual income of the RFI's customers classified by income quintiles is provided in Table 2. A household in the first income quintile has a self-reported annual income of INR 41,452, while a household in the fifth income quintile earns INR 3,56,277.

Table 2: Mean Household-Level Annual Income by Income Quintiles (in INR)

	Income Quintile 1	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5
Annual Household Income	41,452	80,788	118,162	169,840	356,277

For the purpose of this paper, we analyse the asset portfolios of a set of 1,43,632 households.² Segregated by region, 69% of the sample households reside in Tamil Nadu, while Odisha and Uttarakhand account for 19% and 12% of the households, respectively. As explained in Table 1, the RFI collects data pertaining to household investments in nine asset categories—agricultural equipment, electronic goods, housing, investment (in the NPS and Money Market Mutual Funds), jewellery, land, livestock, shop (or business), and vehicles. We further categorise these assets into two groups—consumption assets and investment assets. Consumption assets are defined as those assets whose value is consumed or drawn down over the lifecycle of the asset. This category comprises electronic goods, housing, and vehicles. While housing is traditionally viewed as an investment, we classify it as a consumption asset on the premise that its intrinsic value is distinct from that of the land on which it is situated. This is substantiated by its illiquid character owing to the lack of well-functioning housing or rental markets in the regions in which the RFI operates. Thus, we assume that the value of housing also comes down over time. Investment assets, on the other hand, are defined as productive assets and/or assets that are actively managed in household portfolios. Appendix 1 provides a detailed description of the data collected under each asset category and the per unit value assigned to them. The unit value of an asset is based on self-reported information. Currently, the data does not take into account regional variation in the price of assets such as land, housing, and shops/commercial establishments. Further, per unit values of housing and shop(s) are based on their build and roof types only.

We use this data to construct stylised household asset portfolios that are stratified based on source of income (primary and secondary). Using the tools of Modern Portfolio Theory (MPT), we then compare the performance of the stylised portfolios over time with the performance of a hypothetical portfolio that offers these households access to a suite of financial instruments such as Exchange Traded Funds (ETFs), savings bank accounts, insurance, government securities, index funds, and the NPS, which provides households a

² The number of households in our sample is smaller than the universal set of 2,25,000 households, as households with asset values in the top 5 percentile of each asset category were considered outliers and removed.

more diversified and liquid asset portfolio. For the purpose of this paper, we quantify the financial gain to five stylised occupational categories from a limited suite of seven financial assets.

The foundations of the MPT were laid by Markowitz (1952) when he modelled the behaviour of a rational investor under uncertainty. The MPT laid the platform for various developments in modern finance including the Capital Asset Pricing Model (CAPM), which was developed by Sharpe (1964) and Lintner (1965). The MPT, for the first time, mathematically articulated the idea of portfolio diversification that allowed investors to select a portfolio of assets that in combination has a level of risk lower than that of the individual assets contained in the portfolio.

Despite the various criticisms of the MPT,³ the fundamental principle behind Markowitz's seminal paper rings true even today:

Not only does the *E-V* [expected returns-variance of returns] hypothesis imply diversification, it implies the “right kind” of diversification for the “right reason.” The adequacy of diversification is not thought by investors to depend solely on the number of different securities held. A portfolio with sixty different railway securities, for example, would not be as well diversified as the same size portfolio with some railroad, some public utility, mining, various sorts of manufacturing, etc. The reason is that it is generally more likely for firms within the same industry to do poorly at the same time than for firms in dissimilar industries.

Similarly in trying to make variance small, it is not enough to invest in many securities. It is necessary to avoid investing in securities with high covariances among themselves. We should diversify across industries because firms in different industries, especially industries with different economic characteristics, have lower covariances than firms within an industry. (Markowitz, 1952: 89)

4. Data Summary: Asset Portfolios of Rural Households

In this section, we provide an in-depth examination of the current asset portfolios of rural households based on the RFI's data. Table 3 presents the case of a household whose stylised asset portfolio is composed of median holdings of each asset category. The total net worth of this household is INR 2 lakh. Consumption assets form 54% of the entire asset portfolio of

³ For an excellent review of the history of the MPT, see Elton and Gruber (1997). For a more systematic critique and introduction to competing theories, see Sortino and Satchell (2001).

the stylised household, and jewellery⁴ (44%) is the predominant investment asset. As suggested by our review of extant literature and anecdotal evidence presented earlier, two assets—jewellery and housing—form 93% of the total net worth of the average rural household.

Table 3: Stylised Asset Portfolio of a Household

Asset Category	Median Value (in INR)	Percentage of Total Assets
Electronics	7,000	3.49%
House	99,000	49.36%
Vehicle	1,250	0.62%
<i>Consumption assets (total)</i>	<i>107,250</i>	<i>53.47%</i>
Agricultural equipment	500	0.25%
Investment	-	0.00%
Jewellery	88,320	44.03%
Land	-	0.00%
Livestock	4,500	2.24%
Shop	-	0.00%
<i>Investment assets (total)</i>	<i>93,320</i>	<i>46.53%</i>
All assets (total)	200,570	100.00%

We examined the various stylised households stratified based on source of income. Figures 1a and 1b show the frequency distribution of the entire sample (1,43,632 households) based on:

- i. The household’s primary source of income, i.e., the source that is the highest contributor to total household income.
- ii. The secondary source of income, i.e., the source that is the second-highest contributor to total household income.

Based on reported source of income, we classified households into nine occupational categories, viz. Agriculture & Allied; Business; Salaried; Labour; Professional; Migrant; Working Abroad; Non-earned; and Unpaid/unemployed. Appendix 2 presents the specific occupations that comprise each occupational category. For example, “non-earned” consists of those households that earn their primary source of income without the direct use of their human capital, i.e., from rental housing or from retirement assets. “Unpaid/unemployed” comprise households whose primary breadwinners are students, house-wives, or the unemployed.

⁴ Jewellery in this context refers to gold jewellery only.

Figure 1a shows that just over half of the households (51%) in our entire sample rely on labour as their primary source of income, while 15% rely on agriculture and allied activities, 13% on business, and 12% on salaried employment. Figure 1b shows that more than half (56%) of all households in our sample do not have a secondary source of income. This suggests that at a household level, their income streams are not very diversified, i.e., the households have concentrated exposure to a particular occupation. Further, 19% of all the households have agriculture and allied activities as a secondary source of income while 15% have labour.

Figure 1a: Classification of Households by Primary Occupational Categories

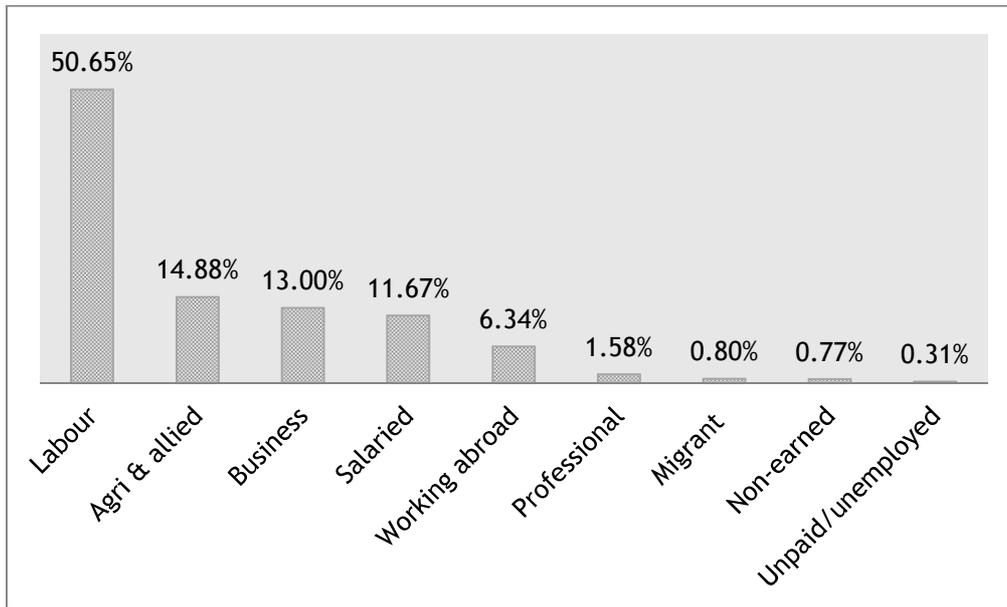
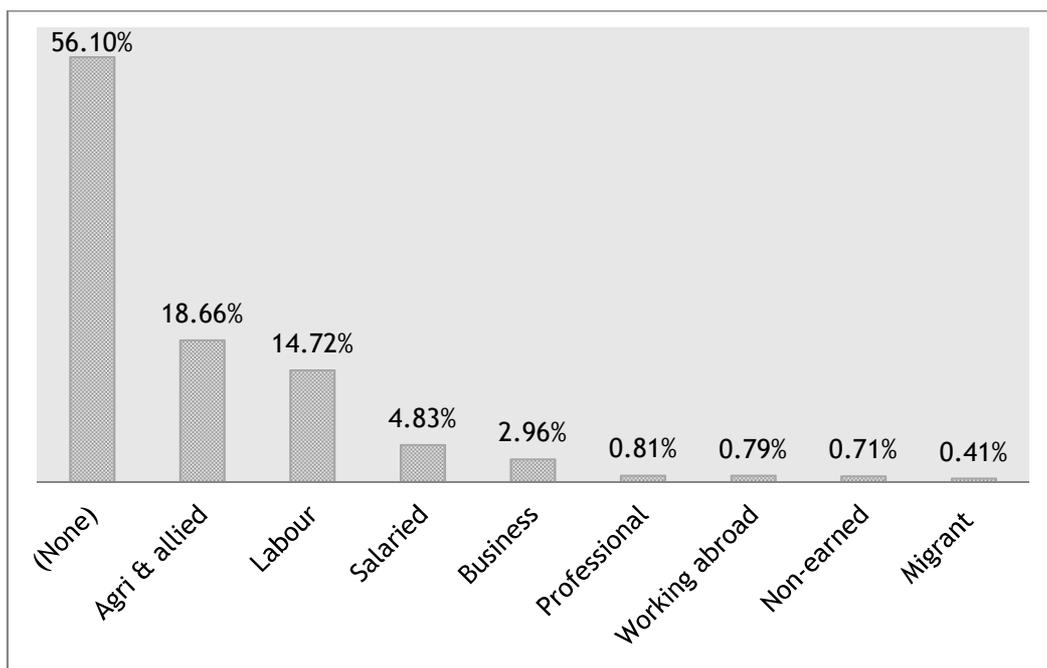


Figure 1b: Classification of Households by Secondary Occupational Categories



We used the nine occupational categories described in Figures 1a and 1b to construct stylised asset portfolios that are segregated by primary source of income. For the purpose of this paper, we restricted our analysis to five stylised occupational typologies that are stratified based on sources of primary and secondary income, which represent 63% of the households in our sample:

- i. Labour (primary) and no secondary occupation
- ii. Agriculture & allied (primary) and no secondary occupation
- iii. Salaried (primary) and agriculture & allied (secondary)
- iv. Business (primary) and agriculture & allied (secondary)
- v. Labour (primary) and agriculture & allied (secondary)

The asset portfolio of each occupational category is composed of the median holding of an asset for that occupational category. For example, the stylised asset portfolio of a business household is composed of median asset values of all business households.⁵ The five stylised portfolios are presented in Table 4.⁶

Table 4: Stylised Asset Portfolios

Asset category	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Electronics	7,000	7,000	7,000	7,000	7,000
House	99,000	63,000	225,000	225,000	99,000
Vehicle	1,250	1,250	-	-	1,250
<i>Consumption assets (total)</i>	<i>107,250</i>	<i>71,250</i>	<i>232,000</i>	<i>232,000</i>	<i>107,250</i>
Agricultural-equipment	2,500	-	5,500	5,500	2,000
Investment	-	-	-	-	-
Jewellery	110,400	66,240	64,384	96,576	66,240
Land	200,000	-	130,000	140,000	120,000
Livestock	20,000	300	25,000	25,000	20,300
Shop	-	-	-	-	-
<i>Investment assets (total)</i>	<i>332,900</i>	<i>66,540</i>	<i>224,884</i>	<i>267,076</i>	<i>208,540</i>
<i>Investment assets (as % of all assets)</i>	<i>75.63%</i>	<i>48.29%</i>	<i>49.22%</i>	<i>53.51%</i>	<i>66.04%</i>
All assets (Total)	440,150	137,790	456,884	499,076	315,790

We now examine the asset portfolio of the five stylised occupational typologies.

⁵ Appendix 3 summarises the stylised asset portfolios of all nine occupational categories and compares these portfolios with the portfolio of the median stylised household presented in Table 3.

⁶ The value of land for the median household presented in Table 3 is zero since the median household is a labour-only household. However, as shown in Table 4, other stylised households have a positive median value for land.

4.1 Agricultural & Allied-Only

The agricultural and allied occupational category comprises 15% of the overall sample of rural households and contains households whose primary source of income originates from agriculture, agricultural trading, dairy, and fishing. Of these households, 60% are households whose sole source of income is from agriculture and allied activities. This occupational category is distinguished by the large proportion of investment assets in the total asset portfolio. Compared to a sample average of 46%, this category holds 75% of the total portfolio in the form of investment assets. This occupational category also has the largest median holdings of jewellery and land in the sample.

4.2 Labour-Only

Labour households—defined as those households that are engaged in wage labour or are employed as drivers—form 51% of the entire sample of rural households. Among these households that are engaged in labour as their primary source of income, the largest proportion (76%) do not have another source of income. Labour-only households are the poorest in terms of net worth in the entire sample of households. These households are heavily invested in jewellery, but the value of their consumption assets exceeds that of their investment assets.

4.3 Salaried and Agriculture & Allied

The salaried occupational category is composed of households whose primary source of income is salaried employment. Most salaried households (76%) have a secondary source of income, and a majority (39%) are engaged in agriculture and allied activities. The salaried-agriculture occupational category has median holdings of livestock and agricultural equipment that exceed the holdings of agriculture-only households. These households are also heavily invested in housing assets. The fact that a large majority of salaried households have a secondary occupation could be explained as a risk mitigation measure in the absence of financial tools to do the same.

4.4 Business and Agriculture & Allied

The business occupational category accounts for 13% of the overall sample and is composed of households whose primary breadwinner is a shop owner, or the owner of a small industry,

or is engaged in other businesses. Surprisingly, therefore, the median holding of shop or family-owned business for this asset category is zero. The higher-than-median holdings of agricultural equipment, livestock, and land suggest that this category derives a significant portion of their income from agriculture and allied activities; 35% of all business households are engaged in agriculture and allied activities for their secondary source of income. This category is also the richest in the sample in terms of net worth.

4.5 Labour and Agriculture & Allied

The labour-agriculture combined occupational category constitutes 14% of all labour households. Labour-agriculture households have a significantly higher net worth compared to other labour households. This is driven most significantly by their investment in land and livestock. Their holding of housing assets is also the highest within the labour category.

5. Assessment of Current Asset Portfolios

We assess the performance of the five selected asset portfolios presented in Table 4 over time. As seen earlier, three assets—land, jewellery (gold), and livestock—constitute the entirety of investment assets for most households. In order to assess the performance of these assets over time, we use historical gold price data and construct cash-flow models for land and livestock. Both models are discussed in detail below.

5.1 Land

Price data on land transactions in India is difficult to obtain due to three primary reasons. First, the absence of unified state-level land registries makes transaction data on land extremely difficult to obtain. The most comprehensive study on Indian land markets that we could find was GIZ (2014), which collected data on land transactions for a period of thirty years in four districts of Haryana and Madhya Pradesh. By the study's own admission, "merging the data collected from the four districts for a period of 30 years yielded close to 6,80,000 lines of entry" (GIZ, 2014: 13). Such an exercise for the districts in our sample was beyond the scope of this study. Second, as Chakravorthy (2013: 169) observed, "official records often understate the actual prices, primarily to underpay stamp duties. Many states have pre-emptively set stamp duty rates (by zones, grades etc.) to get around this problem, but all that means is buyers and sellers know what official price to declare, which is not necessarily the true transaction price." Third, even if true transaction prices could be

obtained, the reservation price of land would remain unknown. As several studies have found, many instances of land sales are instances of distress sales. For example, Patil and Marothia (2009) observed that in the state of Chhattisgarh, marginal landowners obtain only a third of the price for their land when compared to larger landowners. Many households sell land as a measure of last resort, especially in the absence of sufficient access to credit.

On account of these difficulties, we resorted to a theoretical estimation of the price of land. The underlying assumption of our model, based on Chakravorthy (2013), is that “land is like all other income-producing assets—its value is determined solely by the income it can produce—and a sale is possible only if a buyer’s valuation of the discounted future income stream is more than the seller’s valuation of the same.” In order to estimate the cash flows from holding land as an asset, we made the following assumptions:

1. The sole use of land is agricultural.
2. The lifetime of land as an asset is 50 years.
3. Capital gain from the sale of land at the end of its lifetime is zero.
4. The model does not take into account regional variations in agricultural productivity. The internal rate of return (IRR) is projected based on mean all-India values.
5. The present value of an acre of land is INR 2 lakh.

Chakravorthy (2013) estimated the price of land based on output per acre (2003–2006) of a basket of 44 crops for 17 states in India. The average value of output per acre for India is estimated to be INR 14,543 (2012–2013 prices). Based on Foster and Rosenzweig (2011), we assumed that profit or income per acre of land is 35% of the value of the output. Further, we assumed that agricultural productivity increases at a CAGR of 2.35%, based on Bhalla and Singh (2010). In our model, output per acre is dependent only on the average rainfall received during the year; based on BIGNAUT et al. (2009), we assumed that a 1% deviation from mean historical rainfall would lead to a 1% decline in the value of output per acre. If the rainfall in any year varied in excess of one standard deviation above or below the mean historical rainfall, we assumed that the farmer lost the entire value of his/her crop.⁷ Based on data available from the Indian Institute of Tropical Meteorology, mean all-India annual rainfall between 1813 and 2006 was 1150.49 mm, with a standard deviation of 110.59 mm.⁸ Finally,

⁷ The Indian Institute of Tropical Meteorology classifies years of flood and drought using this methodology. Available at: <http://www.tropmet.res.in/~kollu/MOL/Monsoon/Historical/air.html>.

⁸ Available at <http://www.tropmet.res.in/Data%20Archival-51-Page>

we simulated the IRR and standard deviation on holding land as an asset based on 10,000 Monte Carlo trials.

5.2 Livestock

The cash flows from holding livestock were projected for a stylised median household to estimate the returns and risk on such an investment. This was based on primary information collected from a para-veterinarian for a large insurance company. The median household owns INR 20,000 worth of livestock, the value of which corresponds to that of an Ongole breed cow.⁹ The cash flows were projected for a 10-year time frame, based on the estimated life expectancy of this breed of cow. Further, we assumed that the household makes this investment at the beginning of the cow's lifetime.

In terms of revenue streams, the following were taken into account:

1. **Milk:** The revenue from milk was estimated based on primary information collected about the daily peak yield of milk and yearly peak yield factors of an Ongole breed cow, as well as the price of milk.
2. **Manure:** Revenue from manure was estimated based on primary information collected about the value of manure generated per week.
3. **Calf:** Our model assumed that there is a 50% probability of a maximum of one calf being born to a cow each year between the third and eighth years of its lifetime, with a maximum of six calves during its lifetime. Further, we assumed that the calf is sold as soon as it is born for the value at which the cow was purchased, i.e., INR 20,000.
4. **Terminal value:** Our model assumed that there is no value for the cow's meat, carcass, or any other part at the end of its lifespan.

In terms of costs, the following were taken into account:

1. **Purchase price of asset:** This represents the initial one-time cash outflow, which in our model was taken to be INR 20,000 (which corresponds to the market price of an Ongole cow).
2. **Fodder costs:** The cost of fodder was estimated based on primary information collected about the daily consumption, the cost per kilogram, and the proportions of dry fodder, green fodder, and concentrated feed.

⁹ Description of Ongole breed cow: <http://www.ansi.okstate.edu/breeds/breeds/cattle/ongole/index.htm>.

3. **Medical costs:** Medical expenses included the annual costs of periodic deworming and vaccination.
4. **Insemination costs:** Based on the probability of the birth of a calf, our model assumed the cost for insemination in the year before a calf is born.
5. **Treatment expenses:** This was based on the estimated cost of treating an incidence of foot and mouth disease.
6. **Labour costs:** Our model did not take into account the cost of labour required for the upkeep of the cow.

The model assumed that the only sources of risk were those associated with the morbidity (incidence of foot and mouth disease) and/or death of the animal during its 10-year lifetime. These were taken into account by simulating the state of the cow (alive or dead; if alive: healthy or unhealthy) from a binomial distribution, based on the mortality and morbidity rates estimated through primary research conducted by Bangar et al. (2013) in Maharashtra. Finally, the internal rate of return (IRR) was computed for 10,000 trials of the ensuing simulated cash flows.

While other studies such as Anagol et al. (2013) found low to negative returns and Attanasio & Augsborg (2014) found high returns on the ownership of a cow in India, the model in this paper differs in its calculation of returns over the entire lifetime of a cow, even without taking into account labour costs. Additionally, our model accounts for the risk associated with the mortality and morbidity of a cow, although not in the case of drought (or deviation from mean rainfall).

5.3 Gold

Returns on gold (jewellery) were estimated based on actual gold price time series data from MCX for the period 2003–2014.¹⁰ Table 5 presents the mean projected return and standard deviation on land, jewellery (gold), and livestock.

¹⁰ Available at <http://www.mcxindia.com/sitepages/HistoricalDataForVolume.aspx>.

Table 5: Annual Returns and Standard Deviation on Assets

	Jewellery (Gold)	Land	Livestock
Annual Returns	14.64%	2.35%	10.26%
Standard Deviation	18.70%	0.21%	17.86%

6. Portfolio Risk-Return on Current Assets

Based on the estimated mean annual returns and risk (standard deviation) on assets, we estimated the weighted return and risk of five stylised household asset portfolios.¹¹ This is presented in Table 6.

Table 6: Annual Returns and Standard Deviation of Stylised Portfolios

	Agriculture- Only	Labour- Only	Salaried- Agriculture	Business- Agriculture	Labour- Agriculture
Annual Returns	6.93%	14.62%	6.86%	7.64%	7.07%
Standard Deviation	6.13%	18.60%	5.48%	6.79%	5.92%

Based on our projections, the stylised asset portfolio of labour-only households—composed almost entirely of jewellery—realised the best returns over time: 14.63%, with a corresponding portfolio risk (standard deviation) of 18.60%. The portfolio of business-agriculture households realised annualised returns of 7.64% with a standard deviation of 6.79%. The asset portfolios of salaried-agriculture as well as labour-agriculture households realised annual returns of 6.86% and 7.07%, respectively. Although providing comparable returns (6.93%), the portfolio risk of agriculture-only households remained marginally higher at 6.13% compared to that of salaried-agriculture (5.48%) and labour-agriculture households (5.92%).

7. Assessment of Hypothetical Portfolios with Financial Assets

7.1 Insurance

We now compare the projected performance of these asset portfolios with a set of hypothetical portfolios that introduces financial instruments that offer risk mitigation. Table 7 shows the modified annual returns and risk of holding land and livestock with two additional

¹¹ As explained in Section 5, the returns and standard deviation on land and livestock were simulated individually, without taking their correlation with other local assets into consideration. As a result, the returns and standard deviation on physical assets did not take the effect of local, systematic risks into account and could, therefore, be over-estimated in our analysis.

products—rainfall and livestock insurance. Table 8 compares the extant asset portfolio of households with a hypothetical portfolio in which households have these two additional products.

Livestock insurance involved the following factors:

- a. An annual premium payment of 5% of the initial value of the cow.¹²
- b. A pay-out of 100% of the initial value of the cow in the event of its death, as described in the risk consideration above.

Rainfall insurance took into account the following factors:

- a. An annual premium payment equivalent to 10% of the sum assured.¹³ The sum assured is assumed to be the expected output per acre.
- b. The pay-out from insurance is equivalent to the shortfall from expected output per acre caused due to deviations from mean rainfall.

Table 7: Annual Returns and Standard Deviation on Assets (with Insurance)

	Land	Livestock
Annual Returns	2.52%	12.06%
<i>Change in Returns</i>	0.17%	1.80%
Standard Deviation	0.00%	9.12%
<i>Change in Risk</i>	-0.21%	-8.74%

Table 7 shows that the introduction of rainfall insurance improves the returns on land marginally by 0.17% and reduces standard deviation to zero. Livestock insurance improves the returns on livestock by 1.80% and substantially reduces the risk due to the death of the livestock by 8.74%.

Table 8: Annual Returns and Standard Deviation on Stylised Portfolios (with Insurance)

	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Annual Returns	7.15%	14.63%	7.16%	7.91%	7.35%
<i>Change in Returns</i>	0.22%	0.01%	0.30%	0.27%	0.28%
Standard Deviation	6.21%	18.61%	5.47%	6.86%	5.96%
<i>Change in Risk</i>	0.08%	0.01%	-0.01%	0.07%	0.04%

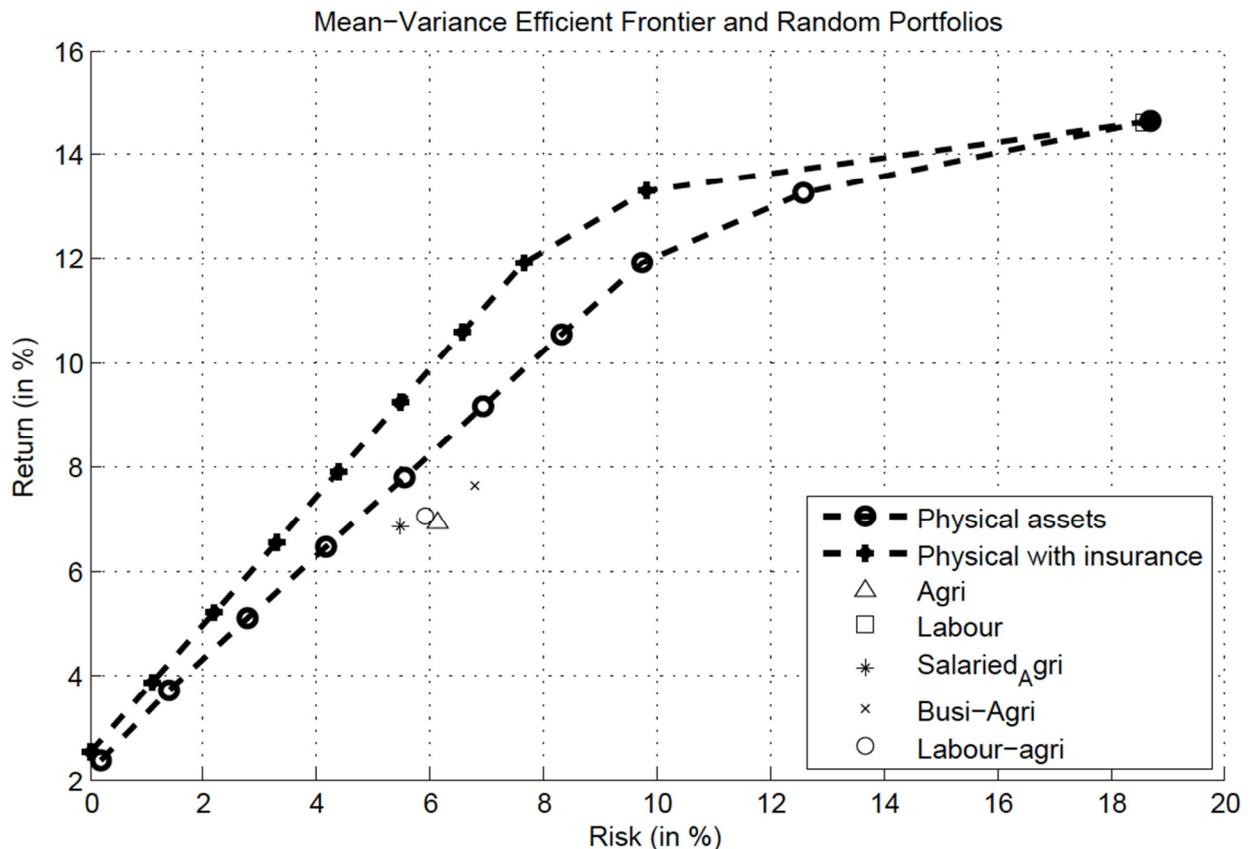
Table 8 demonstrates that with the introduction of two additional products—rainfall and livestock insurance—all the stylised households (except labour-only households) realise

¹² The annual premium rate was based on observed market rates.

¹³ The annual premium rate was based on observed market rates.

higher returns on their portfolios at a similar level of risk. For example, salaried-agriculture households now realise annual returns of 7.16% with a standard deviation of 5.47%, compared to annual returns and risk of 6.86% and 5.48%, respectively, when their assets were uninsured. Plotting the efficiency frontier for these portfolios clearly demonstrates that the introduction of insurance yields Pareto-optimal portfolios compared to the current portfolios (Figure 2). The efficient frontier represents the locus of all possible combinations of assets in a portfolio that provide the highest level of expected returns for a given level of risk.

Figure 2: Efficiency Frontier with and without Insurance



7.2 Hypothetical portfolio of financial assets

We now compare the projected performance of the five stylised portfolios with a hypothetical portfolio of financial instruments that offer greater diversification, liquidity, and tradability. The hypothetical portfolio consists of a suite of six financial products and is presented in Table 9 below. The suite of financial instruments include a basic savings bank account, an exchange-traded fund (ETF) that is designed to closely track the returns of the CNX Nifty Index, government securities (G-Sec) of varying tenors (3-year, 5-year, and 15-year tenors), and return on equity as represented by the return on the BSE Top 100 stocks. The suite of

financial instruments is designed to provide the stylised households access to instruments of varying maturity, liquidity, and tradability. The mean and standard deviation for the suite of financial products were calculated for a 9-year period ranging from April 2004 to April 2013.

Table 9: Annual Returns and Standard Deviation on Financial Assets¹⁴

	Mean	SD
BSE Top 100	22.82%	33.24%
Equity-ETF	20.77%	30.43%
Savings Bank Account	5.00%	0.00%
G-Sec (3-year)	7.17%	0.98%
G-Sec (9-year)	7.61%	0.79%
G-Sec (15-year)	7.97%	0.70%

Table 10 presents the returns on portfolios of physical assets as well as financial assets for a given level of risk. Although households are likely to change their behaviour in the presence of a larger suite of investment options, we assumed that the standard deviation presented in Table 6 represents the preferred or revealed level of risk tolerance of the stylised households. This assumption allowed us to compute the maximum returns that households could attain (at a given level of risk) from investing in the hypothetical portfolio of financial assets. Figure 3 presents the entire range of risk-return portfolios in which the households could potentially invest.

Table 10 shows that all the stylised households in our sample would be able to attain significantly higher returns on their investment if they were to shift to a portfolio of financial assets. For example, at their assumed level of risk tolerance (5.48%), salaried-agriculture households would be able to attain 3.19% higher returns than their current level. Table 10 also reveals that apart from the labour-only households, no other category of households attains positive real returns on their extant portfolio of assets. Switching to a portfolio of financial assets provides these households with annual real returns ranging from 2.01% (for salaried-agriculture households) to 3.05% (for business-agriculture households).

In Figure 3, we plot the efficient frontiers of the portfolios of both physical assets as well as financial assets. It is evident that the efficient frontier of the portfolio of financial assets

¹⁴ Source of data: The S&P BSE Top 100 Index is available at <http://www.bseindia.com/>; the equity ETF tracks the return on a Goldman Sachs Nifty Exchange-Traded Scheme launched in January 2002, available at <http://www.nseindia.com/products/content/equities/etfs/etf.htm>; the rate of return and standard deviation on the savings bank account is based on market information; and the data on government securities is available in the Handbook of Statistics on Central Government Debt (November 2013), available at: http://finmin.nic.in/the_ministry/dept_eco_affairs/middle_office/handbook_stat_Debt.pdf.

completely dominates the portfolio of physical assets currently held by the stylised households in our sample. This means that at any given level of risk, investment in a portfolio of financial assets would provide a higher level of returns than investment in physical assets would. By investing in financial instruments, the stylised households in our sample could attain their present level of returns at a substantially lower level of risk.

Table 10: Comparison of Returns on Portfolio of Physical and Financial Assets

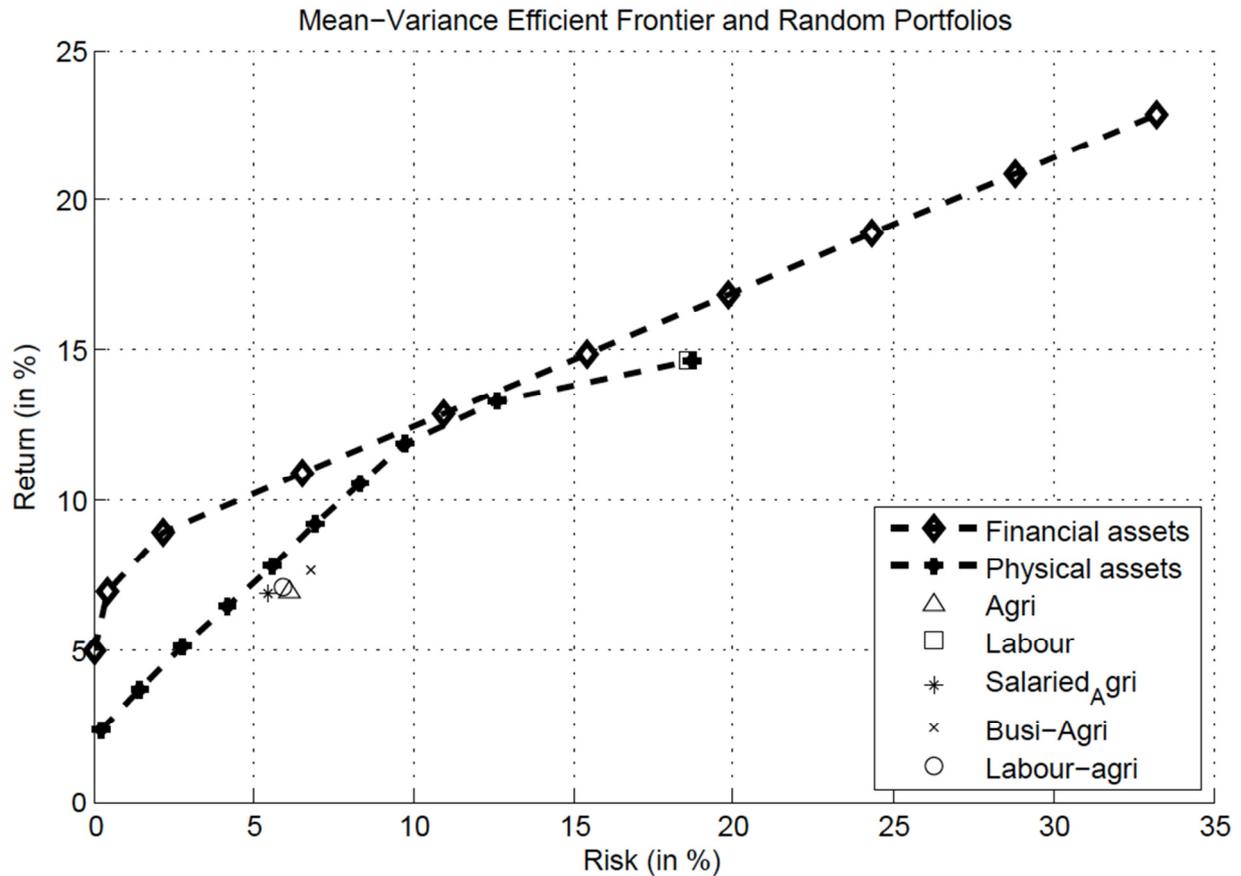
	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Nominal Returns on Portfolio of Physical Assets	6.93%	14.62%	6.86%	7.64%	7.07%
Real Returns on Portfolio of Physical Assets ¹⁵	-1.11%	6.58%	-1.18%	-0.40%	-0.97%
Nominal Returns on Portfolio of Financial Assets	10.54%	16.64%	10.05%	11.09%	10.38%
Real Returns on Portfolio of Financial Assets	2.50%	8.60%	2.01%	3.05%	2.34%
<i>Change in Returns</i>	<i>3.61%</i>	<i>2.02%</i>	<i>3.19%</i>	<i>3.45%</i>	<i>3.31%</i>
Standard Deviation	6.13%	18.60%	5.48%	6.79%	5.92%

Figure 3 also plots the individual portfolios of the five stylised households. Except for the labour-only households, all the other households hold portfolios that are inefficient, even with respect to a suite of assets that are currently accessible to them. This could partially be explained by the lumpy nature of investment in physical assets (it is not possible to own half a cow). The only stylised household whose portfolio lies on the efficient frontier is the labour-only household category. However, it should be noted that labour-only households adopt a high risk-high return strategy due to their over-investment in one asset, viz. gold. We assume that rural households are forced to adopt a high risk-high return strategy due to two reasons. First, rural households have access to a limited set of assets that they can use to diversify their portfolio. Diversification by investment in land—the asset that is missing from the portfolio of labour-only households—is precluded by the very nature of land being a lumpy investment and the absence of a tradable rural land market. Second, labour-only households are the poorest (in terms of net worth) households in our sample. Diversification into land requires a substantial amount of investment and is unsuited to the requirements of these households that often save in small amounts. Due to these two factors, labour-only

¹⁵ Mean annual inflation for the period 1983–2012 was 8.04%.

households are over-invested in one asset, leaving them singularly vulnerable to the risk of adverse price fluctuations on that asset.

Figure 3: Efficiency Frontiers of Physical Assets and Financial Assets



The efficiency frontiers presented in Figure 3 are the result of an unconstrained optimisation, i.e., we did not pre-determine a minimum or maximum holding value for any asset in the portfolio. In Table 11, we estimate the portfolio returns on financial assets after the addition of a long-term pensions saving product, represented by the National Pension Scheme (NPS). According to our estimates, the NPS offers returns of 10.97% at a risk level (standard deviation) of 2.40% over a lifecycle of 40 years. The mean and standard deviation on the NPS were calculated based on a model that estimates the annual returns from the scheme. The model assumed that the contribution to NPS is invested in three classes of assets—equity, corporate bonds, and government securities—based on an age-linked investment process called the lifecycle mix. The lifecycle investment mix varies the proportion of investment in the three classes of assets according to the age of the customer and shifts investments from riskier assets (80% of the contribution is invested in equity and corporate bonds for a 20-year old) to safer instruments (80% is invested in government securities for a

55-year old) as the customer ages. The mean and standard deviation were calculated based on 10,000 trials of a Monte Carlo simulation.

Unlike the other financial assets in the portfolio, the NPS is not a tradable asset, but is a critical component of the household's asset portfolio from a long-term perspective. To capture the nature of this investment, we imposed a constraint that forces households to invest 20% of their portfolio in NPS. We found that at their assumed level of risk preference, all the stylised households could gain a rate of return that is higher than the returns obtained on the initial suite of six financial assets. Compared to their current portfolio of physical assets, households could gain an increase in returns, ranging from 2.47% for labour-agriculture households to 4.94% for agriculture-only households. In real terms, the annual returns on portfolio range from 2.70% for salaried-agriculture households to 3.83% for agriculture-only households.

Table 11: Comparison of Returns on Portfolio of Physical and Financial Assets including NPS

	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Nominal Returns on Portfolio of Physical Assets	6.93%	14.62%	6.86%	7.64%	7.07%
Real Returns on Portfolio of Physical Assets	-1.11%	6.58%	-1.18%	-0.40%	-0.97%
Nominal Returns on Portfolio of Financial Assets (including NPS)	11.87%	17.09%	10.74%	11.73%	11.27%
Real Returns on Portfolio of Financial Assets (including NPS)	3.83%	9.05%	2.70%	3.69%	3.23%
<i>Change in Returns</i>	<i>4.94%</i>	<i>2.47%</i>	<i>3.88%</i>	<i>4.09%</i>	<i>4.20%</i>
Standard Deviation	6.13%	18.60%	5.48%	6.79%	5.92%

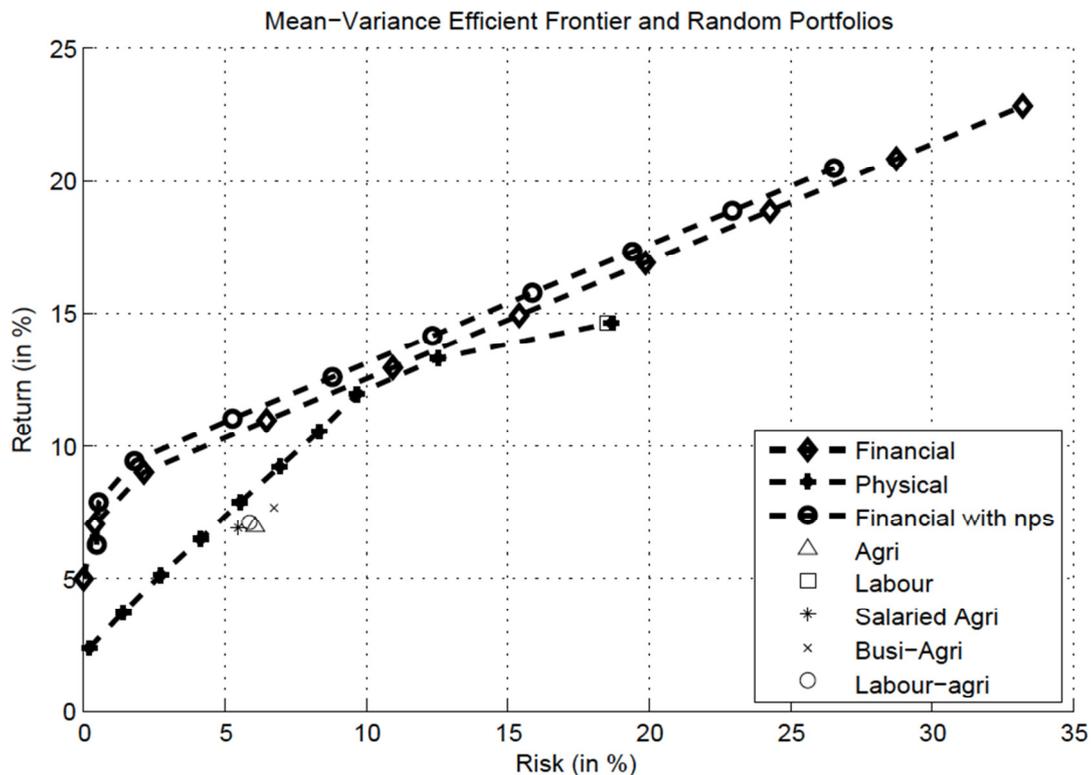
Table 12 compares the Sharpe ratio of the asset portfolios of physical and financial assets. The Sharpe ratio measures the excess returns per unit of additional deviation in a portfolio of assets, i.e., a risk-adjusted indicator of the performance of a portfolio. Table 12 shows that the Sharpe ratio for portfolios of physical assets is negative, except for labour-only and business agricultural households. A negative Sharpe ratio indicates that compared to the current portfolio, the household is better off investing entirely in risk-free assets. Table 12 also reveals the poorer quality of asset choice by labour-only households. Although their extant portfolios offer them a high rate of return, the risk premium (as measured by the Sharpe ratio) they obtain for taking additional risk is low compared to that of both portfolios of financial assets.

Figure 4 plots the efficiency frontier of the portfolio of financial assets including NPS. At any point on this efficient frontier, 20% of the household's investment is held in NPS. We found that the portfolios of financial assets with NPS yield Pareto-optimal results compared to both the portfolio of physical assets as well as the limited suite of financial assets (without NPS).

Table 12: Comparison of Sharpe Ratio of Asset Portfolios of Physical and Financial Assets

Sharpe Ratio	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Portfolio of Physical Assets	-3.92	40.05	-5.66	6.92	-1.69
Portfolio of Financial Assets	54.98	50.91	52.55	57.73	54.22
Portfolio of Financial Assets including NPS	76.67	53.33	65.15	67.16	69.26

Figure 4: Efficiency Frontier with NPS



The gap between the efficient frontiers of physical assets and financial assets (plotted in Figures 2, 3, and 4) represents the efficiency loss to rural households due to their exclusion from the ambit of the formal financial system. It is clear that this exclusion prevents them from realising higher returns on their investments by forcing them to invest in a limited range of lumpy, illiquid, and non-tradable physical assets. As the case of labour-only households

reveals, the lack of diversification tools also forces households to assume an adversely risky position. Further, the portfolio of physical assets provides a narrow range of risk-return positions that rural households can assume in the market. While a complete substitution of physical assets for financial assets may not be possible or desirable, it is clear that extending the benefits of formal financial services to rural households could expand their choice set and help them attain a more diversified, liquid, and tradable portfolio that would protect them from fluctuations in the local market, while simultaneously ensuring liquidity in times of need.

8. Policy Implications

We discuss the policy implications of our findings, especially in the context of two important investment products of relevance to small business and low-income households.

8.1 Mutual funds

A mutual fund (MF) is a Collective Investment Scheme (CIS) that pools money from many investors and invests in securities. Of particular interest for low-income households are those mutual funds that provide very high levels of security and those providing exposure to the market index, which allow for diversification from the local risks to which many low-income household portfolios are exposed. A Money Market Mutual Fund (MMMF) invests in money market instruments of high credit quality and short maturity. This can be seen as a substitute for a savings account, though it does not come with the option of deposit insurance as in the case of bank accounts. An index fund, on the other hand, seeks to match the performance of a market index such as the BSE Sensex or NIFTY. While these products are available in the Indian context, they are largely available to middle- and high-income households. There is a need to make them available for lower-income households; these products can significantly enhance the welfare of these households.

1. **Ticket size:** For low-income customers with small investment amounts, it is essential that MF investment options allow minimum investments as low as INR 1. There do not appear to be any regulatory barriers on the minimum investment size in MMMFs and index funds. However, current market practice creates a huge barrier to the participation of low-income households by setting very high minimum investment amounts. For instance, the UTI Money

Market Fund has a minimum investment of INR 10,000,¹⁶ and the Quantum Index Fund (Liquid Fund) has a minimum investment limit of INR 5,000.¹⁷ Minimum investment amounts tend to be relatively high on account of the costs associated with the maintenance of the electronic data records of investors (for instance, the difference between maintaining 1000 records of investors with INR 5,000 minimum investment and 500,000 records of investors with minimum INR 10 investment) by the asset management company (AMC) and the costs of issuing receipts and account statements. However, with the Aadhaar e-KYC being a possibility now, a lot of the customer-related data can be validated through this process, and the amount of information required to be stored by the AMC will be reduced, bringing costs down.

2. Investment and redemption: The Securities and Exchange Board of India (SEBI) permits cash investments into mutual funds¹⁸ up to a limit of INR 50,000 (per investor, per mutual fund, per financial year); amounts beyond that will require a cheque, demand draft, or other channel. However, proceeds from any redemptions of the mutual fund are required to be deposited in the customer's bank account without exception.¹⁹ This highlights the fact that in the absence of a bank account, the citizen is deprived of access to multiple financial services. **There is the need for a full service electronic bank account for all citizens over the age of 18. However, in the interim, since the KYC requirements for opening a bank account and an MMMF account are essentially identical, the SEBI could permit AMCs to appoint high quality distributors who are authorised to deposit and withdraw cash from the MMMF account of a customer without the need to access it through an intervening bank account.**

8.2 National Pension Scheme-Swavalamban

The National Pension System (NPS) is a public scheme that attempts to provide adequate retirement income to every citizen of India. The NPS aims to ensure financial security during old age by encouraging citizens to contribute to retirement savings. The NPS-Swavalamban (NPS-S) was launched in 2010 to encourage households engaged in the unorganised sector to save towards retirement. Under this scheme, the Government of India provides a contribution

¹⁶ Source: <http://www.utimf.com/Funds/debtffunds/Pages/uti-money-market-fund.aspx>.

¹⁷ Source: http://www.quantumamc.com/FAQ/Generic_Scheme_Details.aspx.

¹⁸ Source: http://www.sebi.gov.in/cms/sebi_data/attachdocs/1400751529272.pdf

¹⁹ Source: SEBI Master Circular on Mutual Funds (September 2013, p. 87); available at: http://www.sebi.gov.in/cms/sebi_data/attachdocs/1378979660117.pdf.

of INR 1000 per year (currently, for a period of five years ending 2016–2017) to every NPS account that contributes a minimum of INR 1000 per year.

1. Ticket size: The NPS-Swavalamban has been designed to incentivise low-income customers in the unorganised sector to contribute a minimum of INR 1000 per year. Under the Swavalamban scheme, the Government of India provides a government contribution of INR 1000 per year for individual investments of INR 1000 or more. However, individuals can contribute less than INR 1000 per year, but they will not receive any contribution from the government. There is currently no provision for perpetual annual contributions from the government or for these contributions to be indexed to inflation. For instance, research suggests that under the current scheme, a 20-year old in the lowest income quintile can accumulate only 31% of his/her required post-retirement corpus (IFMR, 2013). An inflation-indexed matching contribution from the government would enable a 20-year old to reduce the shortfall from his/her minimum corpus to 57.5%, a reduction of 11.5% from the current state (IFMR, 2013). **It is essential, therefore, that the Government of India makes a commitment to ensure that the matching contribution is available in perpetuity and that there is regular indexation to inflation—once in every 3 years.**

Additionally, the investment mix for NPS-Lite is extremely conservative, with 85% invested in government securities and 15% in equity. This differs vastly from the investment mix of the NPS product, which follows a lifecycle strategy that changes the mix of debt and equity based on the age of the individual and offers the potential for higher returns. Moving to the lifecycle investment mix used by NPS-Main combined with inflation-indexed matching contributions would allow a 20-year old to reduce his/her shortfall to 14.5%. **The current NPS-S investment mix should also be changed to the lifecycle strategy to enable higher returns for these investors.**

2. Contribution and payment: Contributions can be made in cash and can be up to a maximum of INR 12,000 per year. As for exit from the scheme, there are multiple options that offer a mix of lump sum and annuitized payments. As the NPS-S scheme picks up momentum over time, there will be a need to ensure that all investors have bank accounts into which the payments (both lump sum and annuities) can be directed. **The mandate for universal bank accounts is, therefore, going to be critical to low-income households' access to pension solutions.**

8.3 Distribution channel

The current distribution channels available to most households are the local post office as a means to save, the agents of one or more insurance companies who offer pure life insurance or endowment plans, and possibly a local bank branch, credit cooperative, or microfinance institution (MFI) that she can approach for her credit needs. Options to invest in the national debt and equity markets as a way to reduce the concentration of household investments in local physical assets are virtually non-existent.

The current delivery framework is, therefore, characterised by dispersed entities focused on a single product or product category. Even if a rural or semi-urban customer has access to such a front-end, she is unable to avail all the financial services she needs to secure herself. Such a situation severely compromises the financial wellbeing of the customer on account of the paucity of access, the absence of comprehensive service providers, and the lack of customised solutions, leading to outcomes such as: (a) financial stress due to mismatches between frequency of cash inflows and debt servicing frequencies; (b) over-investment in assets whose value is highly correlated with the state of the local economy; and (c) underinsurance against the risk of accidental death of self or the death of livestock.

There is a need for a regulatory approach that enables greater partnerships between existing institutions as well as creates new financial service providers who can distribute a range of financial services and can therefore be one-stop front-ends for customers to access all these services. This will require the encouragement of banking designs capable of full service delivery, enabling economies of scope, harmonising KYC norms, allowing small-ticket transactions, and universalising bank accounts.

The delivery of comprehensive financial services would require the presence of financial institutions that have a seamless front-end interface for clients to access a full range of services, all of which can be accessed through a one-time KYC process and an enrolment process that meets the requirements of all the financial institutions involved. The institution may have physical branches that service remote pockets and target every last household and enterprise within its geography. The geographical spread of these local institutions may well be limited, but their strength will be the depth of penetration into local geographies, enabling them to harness the benefits from economies of scope. Such a deep branch network will make it possible to build a granular understanding needed to design a range of financial products and services required by those in that geography, whether they are individuals, households, or

enterprises. It would make the effective use of “soft” local information possible. With a granular understanding of the segments they serve, these institutions will be ideally placed to negotiate with AMCs/insurance companies and provide products and services that are suited to the context of the customer’s and her household’s realities. For instance, if a customer requires a life insurance cover of INR 10 lakh, the institution must be able to provide just that, without underinsuring or overinsuring her due to the rigidity in pre-designed product features. If a customer needs a facility where she can make small investments and redemptions in a debt-linked mutual fund—as small as INR 10 a day—she must be able to do so in cash in a seamless manner.

9. Conclusions

This paper’s objectives were two-fold: first, to understand the composition of the asset portfolios of rural households in India; and second, to compare the performance of the extant portfolios with a hypothetical portfolio of financial assets. We found that almost the entire asset portfolio (93%) of the average rural household in our sample is composed of two assets—housing and jewellery. We also found that a majority (56%) of the households in our sample are dependent solely on a single source of income tied to the local area in which they operate. With the jobs and assets of rural households tied to the local economy, it is evident that they are particularly vulnerable to local, systematic risks. Further, three assets—land, livestock, and jewellery (gold)—constitute the suite of investment assets available to these households. Depending on the proportion of these assets in the portfolio, rural households earn a level of returns ranging from 6.86% (salaried-agriculture households) to 14.62% (labour-only households) at levels of risk ranging from 5.48% to 18.60%.

A comparison with a hypothetical portfolio composed of a limited suite of six financial assets revealed that there are large and significant efficiency losses for rural households as a result of their exclusion from the formal financial system. Our estimates revealed that households could earn a significantly higher level of returns, ranging from 10.05% (salaried-agriculture households) to 16.64% (labour-only households) at the same level of risk that they presently hold. The efficiency frontier of the portfolio of financial assets completely dominates the frontier of physical assets. On the introduction of an additional long-term pension product (investment in which is equated to 20% of the households’ total assets), households could earn a level of returns that is higher compared to both the limited suite of financial assets as well as the initial portfolio of physical assets.

The present study has three limitations. First, the valuation of land and livestock are based on theoretical models, and not primary data. Further, the valuation of these physical assets does not take into account any regional variation in the prices of assets. Additionally, the portfolio of stylised households presented in the paper does not take into account two important sets of assets—financial assets in the portfolio of households, other than the ones held with the RFI; and the employment of children as a means of smoothing consumption in old age. Evidence suggests that there is a degree of substitutability between asset accumulation for old age and children helping parents in their old age. For example, Hasanath-Ruthbah (2007) found that twenty years after the launch of a family planning program in Bangladesh, households in the treatment village had significantly larger assets compared to households in the control villages. Re-estimating the efficient frontier and risk-return profile of these households with actual transaction data and a larger suite of assets could provide a truer picture of their asset portfolios.

Second, due to paucity of data, the portfolio of financial assets excludes important financial instruments that could provide households with greater diversification and liquidity. For example, in the 5-year period between March 2008 and March 2013, gold ETFs outperformed physical gold by providing returns of 23.97% at a standard deviation of 10.04% compared to returns of 20.97% at a standard deviation of 13.56% for physical gold. Inclusion of a wider suite of financial assets including gold ETFs, MMMFs, and corporate bonds could lead to a Pareto improvement in the risk-return profile of households. Further, our estimates did not take important costs such as commissions, brokerage fees, and taxes on financial assets into consideration.

Third, we used the framework provided by the MPT to quantify the efficiency gain of financial inclusion in the context of rural households. However, alternate schools of finance like the post-modern portfolio theorists have pointed out several limitations of the MPT school, including the use of variance as a measure of risk and the assumption that asset returns follow a joint normal distribution. Using alternate measures including downside risk and the Sortino ratio, and assuming non-normal distributions for asset returns of portfolios could yield different results. These limitations notwithstanding, we believe that this paper provides a coherent theoretical framework to study the asset portfolios of rural households and the gains from the inclusion of financial assets in their portfolio.

It is clear that there is an urgent policy imperative to extend the benefits of the formal financial system to rural households and to provide them with access to financial instruments

that allow them to construct a diversified, tradable, and liquid portfolio that would shelter them from fluctuations in the local market. While households may still choose to invest in some amount of physical assets due to a variety of social commitments, they stand to gain substantially by the inclusion of financial instruments in their portfolio. As Shiller (2012) argues, modern finance is a central pillar of civilised society, and for society to fully realise its promise, finance “has to be expanded, democratized and humanized ... [by] giving people the ability to participate in the financial system as equals” (Shiller, 2012: 66).

Appendices

Appendix 1: Asset Values

Asset	Categories	Per Unit Value (INR)	Asset	Categories	Per Unit Value (INR)	
Jewellery	Grams	2,760	Shop	BRICK/RCC	180,000	
Land	Acre	200,000		BRICK/SHEETS	117,000	
Agricultural Equipment	Fishing Net	2,000		BRICK/STONE	90,000	
	Harvester	5,000		BRICK/THATCHED	63,000	
	Plough	3,000		BRICK/TILES	99,000	
	Pump-Set	20,000		CONCRETE/RCC	225,000	
	Small Agricultural Tools	500		CONCRETE/SHEETS	146,250	
	Sprayers	3,000		CONCRETE/STONE	112,500	
	Electronics	CD/DVD Player		2,000	CONCRETE/THATCHED	78,750
Computer		15,000		CONCRETE/TILES	123,750	
Grinder		2,000		MUD/RCC	112,500	
Mixer		2,000		MUD/SHEETS	73,125	
Mobile		2,000		MUD/STONE	56,250	
Refrigerator		7,000		MUD/THATCHED	39,375	
Sewing Machine		5,000		MUD/TILES	61,875	
TV		3,000		Vehicle	Auto-Rickshaw	40,000
Washing Machine		7,000			Bike	20,000
House		BRICK/RCC			180,000	Boat
	BRICK/SHEETS	117,000			Bullock/Push Cart	2,500
	BRICK/STONE	90,000	Car		150,000	
	BRICK/THATCHED	63,000	Cycle		1,250	
	BRICK/TILES	99,000	Moped		10,000	
	CONCRETE/RCC	225,000	Tractor		200,000	
	CONCRETE/SHEETS	146,250	Truck/Lorry		300,000	
	CONCRETE/STONE	112,500	Livestock		Buffalo	25,000
	CONCRETE/THATCHED	78,750		Bullock	10,000	
	CONCRETE/TILES	123,750		Cow	20,000	
	MUD/RCC	112,500		Goat	1,500	
	MUD/SHEETS	73,125		Hen	150	
	MUD/STONE	56,250		Mule/Horse	20,000	
	MUD/THATCHED	39,375		Pig	750	
MUD/TILES	61,875					

Appendix 2: Composition of Income Source Categories

Income source	Occupation
Agriculture & allied	Agriculture
	Agricultural Trading
	Dairy
	Fishing
Business	Other Business Owners
	Shop Owner
	Small Industry Owners
Salaried	Salaried: Government
	Salaried: Private Sector
Professional	Professionals
	Performing Arts
Labour	Wage Labour
	Driver
Migrant	Migrant Labour
Non-earned	Rental Income Earner
	Retired/Pensioner
Working abroad	Working Abroad
Unpaid/Unemployed	Student
	Unemployed
	Housewife

Appendix 3: Asset Portfolios by Primary Source of Income (in INR)

Asset category/ Occupation category	Agriculture & allied	Business	Salaried	Professional	Labour	Migrant	Non- earned	Working abroad	Unpaid/unemployed	Overall
Electronics	7,000	7,000	7,000	7,000	7,000	7,000	7,000	9,000	5,000	7,000
House	99,000	180,000	225,000	117,000	78,750	99,000	225,000	99,000	90,000	99,000
Vehicle	1,250	1,250	-	1,250	1,250	1,250	-	1,250	-	1,250
<i>Total (Consumption assets)</i>	107,250	188,250	232,000	125,250	87,000	107,250	232,000	109,250	95,000	107,250
Agricultural- equipment	2,500	2,500	3,000	500	-	1,500	3,500	500	-	500
Investment	-	-	-	-	-	-	-	-	-	-
Jewellery	110,400	96,576	96,576	82,800	66,240	66,240	66,240	110,400	66,240	88,320
Land	200,000	60,000	80,000	-	-	10,000	80,000	66,667	-	-
Livestock	20,000	12,000	20,000	2,550	1,500	6,000	20,000	4,800	-	4,500
Shop	-	-	-	-	-	-	-	-	-	-
<i>Total (Investment assets)</i>	332,900	171,076	199,576	85,850	67,740	83,740	169,740	182,367	66,240	93,320
Total (All assets)	440,150	359,326	431,576	211,100	154,740	190,990	401,740	291,617	161,240	200,570

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