HOW MUCH CAN ASSET PORTFOLIOS OF RURAL HOUSEHOLDS BENEFIT FROM FORMAL FINANCIAL SERVICES?

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Abstract: The paper's objectives are two-fold- first, to understand the composition of asset portfolios of rural households in India, and second, to compare the performance of extant portfolios with a hypothetical portfolio of financial assets. We find that almost the entire asset portfolio (93%) of the average rural household in our sample is composed of two assets - housing and jewellery. Depending on the proportion of these assets in the portfolio, rural households earn a level of return ranging from 6.86% to 14.62% 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 reveals that households could earn a significantly higher level of return, ranging from 10.05% to 16.64% at the same levels of risk. The introduction of an additional long-term pensions product (investment in which is equated to 20% of the households' total assets) results in even higher returns at the same levels of risk. We believe that our results point to the urgent policy imperative to extend the benefits of the formal financial system to rural households, and provide them with access to financial instruments that allow them to construct a diversified, tradable, and liquid portfolio that shelters them from fluctuations in the local market.

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I. 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. For example, an estimate suggests that only 32% of rural residents in India have a bank account[2]. Anecdotal evidence suggests that the asset portfolio of rural households is dominated by highly illiquid, non-tradable, and localized assets (such as land and housing) and varying degrees of ownership of gold. For example, households' financial savings as a per cent of the Gross Domestic Product (GDP) fell from approximately 12.5% in 2005-06 to 7% in 2012-13, while investment in physical savings and valuables (including gold) increased from 12.5% and 7.5% to 14% and 16% respectively over the same time period[3]. Since capital markets offer various instruments that can effectively serve as diversification tools against local market fluctuations, and also increase the choice set for rural investors, 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 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. The paper then compares 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 New Pension Scheme (NPS), offering households access to a more diversified and liquid asset portfolio. We compare these portfolios to assess the change in financial outcome of the households on account of the introduction of financial assets.

We find 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 find that a majority (56%) of the households in our sample are dependent solely on a single source of income tied to the local area they operate in. With jobs and assets of rural households tied to the local economy, it is apparent that they are particularly vulnerable to local, systematic risks. Depending on the proportion of these assets in the portfolio, rural households earn a level of return ranging from 6.86% to 14.62% 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 reveals that there are large and significant efficiency losses for rural households as a result of their exclusion from the formal financial system. Our estimates reveal that households could earn a significantly higher level of return, ranging from 10.05% to 16.64% at the same level of risk as previously noted. The introduction of an additional long-term pensions product (investment in which is equated to 20% of the households total assets) results in even higher returns at the same levels of risk. It is clear that there is an urgent policy imperative to extend the benefits of the formal financial system to rural households, and provide them with access to financial instruments that allow them to construct a diversified, tradable, and liquid portfolio that shelters them from fluctuations in the local market. While households may still choose to invest in some level of physical

[2] Report of the Reserve Bank of India Committee on Comprehensive Financial Services for Small Businesses and Low Income Households (2014)
[3] Reserve Bank of India Financial Stability Report (June 2014)

assets due to a variety of social commitments, they stand to gain substantially by the inclusion of financial instruments in their portfolio.

The remainder of this paper is organised as follows. Section II presents a brief review of literature. Section III describes the data and the methodology that the paper employs in detail. Section IV examines the current composition of asset portfolios of rural households. Sections V and VI provide an assessment of the portfolio of physical assets and replacement financial assets respectively, Section VII discusses policy implications of our results, and Section VIII concludes the paper.

II. Review of Literature

As Campbell (2006) notes, 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 household asset portfolio allocation reveals the following:

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

Evidence from literature suggests that households actively manage their asset portfolios and employ a variety of risk diversification strategies. For example, Aryeetey (2004) finds 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 & Wolpin (1993) find that agricultural investment decisions by rural households are motivated by the need to smooth consumption in the face of uncertain income streams. The study finds that households use certain productive farm assets, like bullocks, in their asset portfolio as a hedge against rainfall risk. Fafchamps & Pender (1997) find 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 - like 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. For example, Collins et al (2009) track the "financial diaries" of 250 households over the period of a year and find 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 (like Rotating Savings and Credit Associations or RoSCAs) to tide over the "triple whammy" of low incomes, irregular cash flows and absence of suitable financial tools. Households also frequently entered into reciprocal, contractual relationships with each other as a method of risk-pooling. For example, 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) reports three key observations from a review of the empirical studies on household portfolios. First, different households hold diverse asset portfolios. Asset portfolios of households vary based on a number of variables including the country of residence, wealth, and variables like age, education and birth years of members. For

example, across countries richer households are more likely to hold risky assets like 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, 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. Investments in housing crowds out investment in financial assets

Housing forms an important component of asset portfolios of households across countries. Evidence from literature suggests that investment in housing could crowd out investments in other financial assets. For example, Cocco (2000) finds that investment in housing is a significant driver of asset portfolio choice of households, especially for younger investors and households with lower net worth. For these households, investment in housing keeps overall liquidity low and thus, crowds out investment in stockholding. Flavin and Yamashita (2002) find that the ratio of the 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 riskier investments like bonds and 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. Curcuru et al (2004) also find that the probability of stock ownership decreases with an increase in the ratio of home equity to net worth. The paper argues 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) find that a $1 increase in mortgage size leads to a 50-70 per cent shift in portfolio allocation from stocks to bonds. However, unlike other studies that suggest that this shift to safer assets is caused due to the increased exposure to housing risk, the paper finds 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 (2004) suggests that there are discrepancies between findings of positive household finance (what households actually do) and normative household finance (what households ought to do). For example, household portfolios are typically analysed within the framework of life-cycle 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 down on them after retirement. Poterba and Samwick (2001) challenge the central assumption of life-cycle models, and find 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 households age and increases at later ages. The study also finds that they are 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 the average share of taxable equity in their portfolio, younger cohorts show larger investment in bonds and tax-deferred accounts. Additionally, younger cohorts leverage their assets to a larger extent than older cohorts.

III. Data and Methodology

The paper analyses the asset portfolios of customers of a Rural Financial Institution (RFI)[4] 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 different states, Tamil Nadu, Uttarakhand, and Odisha, and has a total 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 it enrols. On average, across all its service areas, a branch enrols 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 captured is provided in Table 1.

Table 1: Brief Description of RFI Data

Household Details	For each family member (including enrolee): - 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 under different crops; un-irrigated land, irrigated land - Number and type of Agriculture equipment - Livestock - Electronic goods - Vehicle - Jewellery (quantity)
Liabilities	For existing loans: - Source, amount, frequency, instalment amount, tenure
Household Goals	For the household's goals relating to marriage, education, loan repayment, house, land, gold, business, other assets, other expenses: - Family member to whom the goal is to be mapped to - The number of years away to achieve the goal - The 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. The mean household in the first income quintile has a self-reported annual income of Rs. 41,452 while a household in the fifth income quintile earns Rs. 3,56,277.

[4] The name of the institution has been masked in order to ensure confidentiality

Table 2: Mean Household Level Annual Income by Income Quintiles (in Rs.)

	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[5]. 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 National Pension Scheme 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 life-cycle of the asset. This category is comprised of 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 is also drawn 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 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 the regional variation in the price of assets such as land, housing, and shop. Furthermore, per unit values of housing and shop are based only on their build and roof types.

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 Account, Insurance, Government Securities, Index Funds and the New Pension Scheme (NPS), thereby providing households a 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 MPT were laid by Markowitz (1952) when he modelled the behaviour of a rational investor under uncertainty. MPT laid the platform for various developments in modern finance including the Capital Asset Pricing Model (CAPM) 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 the individual assets contained in the portfolio.

Despite the various criticisms of MPT[6], 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

[5] 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 removed as outliers.
[6] For an excellent review of the history of MPT, see Elton & Gruber (1997). For a more systematic critique and introduction to competing theories, see Sortino & Satchell (2001).

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."

IV. 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 Rs. 2 lakh. Consumption Assets form 54% of the entire asset portfolio of the stylised household and jewellery[7] (44%) is the predominant investment asset. As suggested by our review of literature and anecdotal evidence, two assets - jewellery and housing - form 93% of the total net worth of the average rural household.

Table 3: Stylised asset portfolio

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

We now examine various stylised households stratified based on source of income. Figure 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; and
ii. the secondary source of income, i.e. the source that is the second-highest contributor to total household income.

[7] Jewellery in this context indicates only gold jewellery

Based on reported source of income, we have 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 bread-winners are students, house-wives, or the unemployed.

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 & allied activities, 13% on business, and 12% on salaried employment. Figure 1b shows that more than half (56%) of all households in our entire 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. Furthermore, 19% of all households have agriculture & allied activities as a secondary source of income while 15% have labour.

Figure 1a: Frequency of households by primary occupation categories

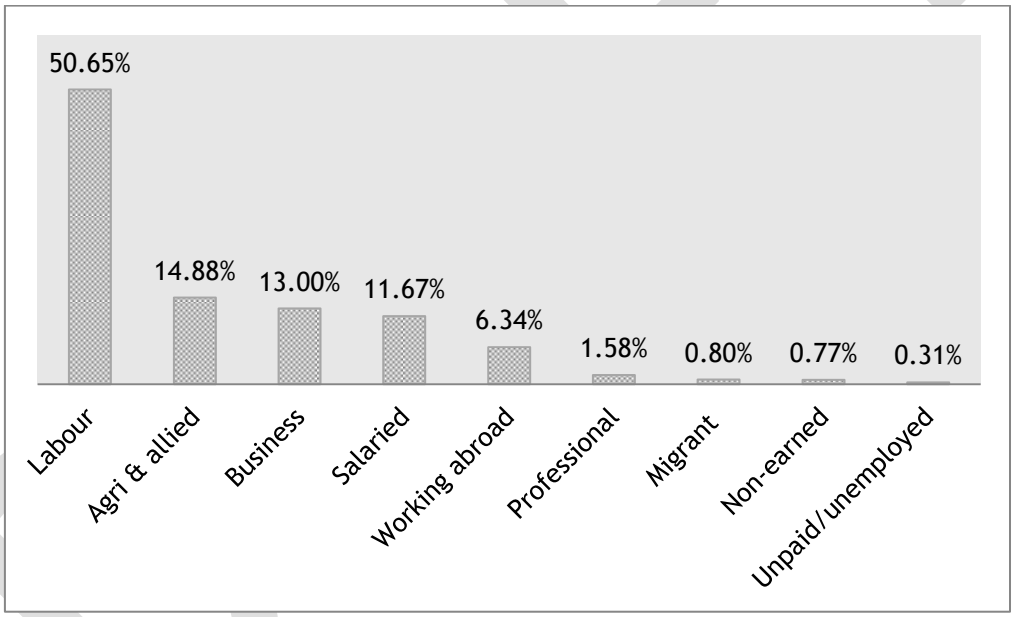
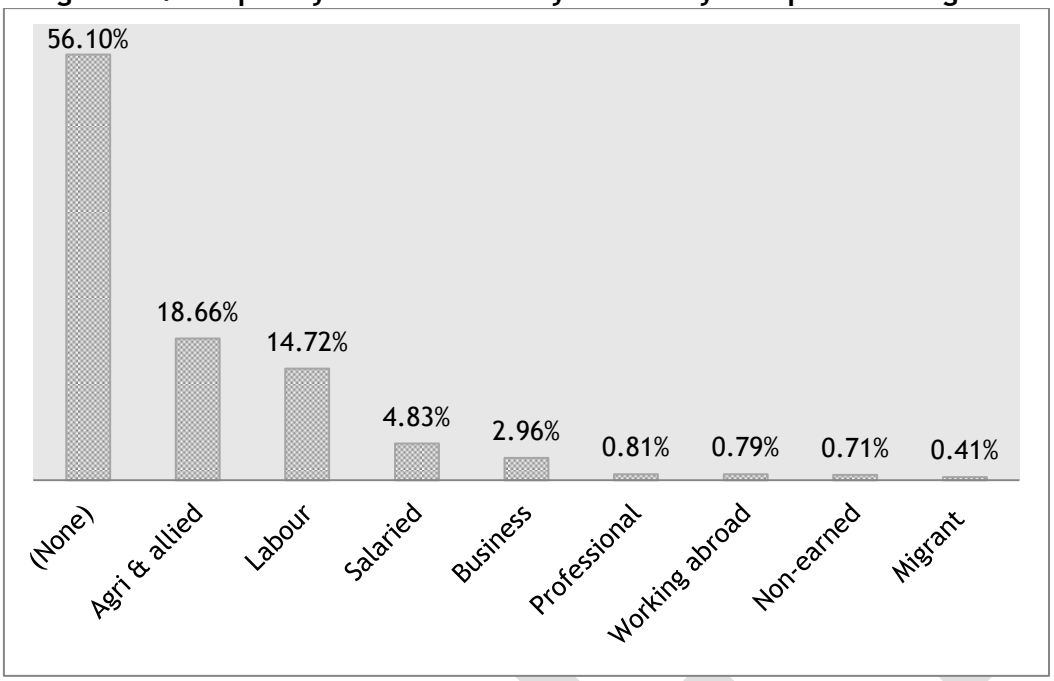


Figure 1b: Frequency of households by secondary occupation categories



We use the nine occupation 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 will restrict our analysis to five stylised occupational typologies, stratified based on sources of primary and secondary income, that represent 63% of the households in our sample:

i. Labour (primary) and no secondary occupation,
ii. Agriculture and Allied (primary) and no secondary occupation,
iii. Salaried (primary) and Agriculture and Allied (secondary),
iv. Business (primary) and Agriculture and Allied (secondary), and
v. Labour (primary) and Agriculture and 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[8]. The five stylised portfolios are presented in Table 4[9].

[8] For the interested reader, 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 earlier in Table 3.
[9] 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 seen in Table 4, other stylised households have a positive median value for land.

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
Consumption assets (total)	*107,250*	*71,250*	*232,000*	*232,000*	*107,250*
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	-	-	-	-	-
Investment assets (total)	*332,900*	*66,540*	*224,884*	*267,076*	*208,540*
Investment assets (as % of all assets)	*75.63%*	*48.29%*	*49.22%*	*53.51%*	*66.04%*
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.

i. 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 this 15% of households, 60% are households whose sole source of income is from agriculture and allied activities. The Agriculture-only occupational category is distinguished by the large proportion of investment assets in their total asset portfolio. Compared to a sample average of 46%, this category holds 75% of their total portfolio in the form of investment assets. This occupational category also has the largest median holdings of jewellery and land in the sample.

ii. 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 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.

iii. Salaried And Agriculture & Allied

The salaried occupational typology 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 & allied activities. The Salaried-Agriculture occupational category has median holdings of livestock and agricultural equipment that exceeds 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 may be explained as a risk mitigation measure in the absence of financial tools to do the same.

iv. Business And Agriculture & Allied

The business occupational category comprises 13% of the overall sample and is composed of households whose primary breadwinner is a shop owner, owner of a small industry, or 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 & allied activities for their secondary source of income. This category is also the richest in terms of net worth in our sample.

v. Labour And Agriculture & Allied

The Labour-Agriculture combined occupational category comprises 14% of the 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.

V. An 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 depth below:

i. 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 (GIZ, 2014) collects 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". For obvious reasons, such an exercise for the districts in our sample is beyond the scope of this study. Second, as Chakravorthy (2013) observes, "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) observe that in the state of Chattisgarh, marginal land-owners obtain only a third of the price for their land when compared to larger land-owners. 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 resort 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 make 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 assumed to be Rs. 2 lakh.

Chakravorthy (2013) estimates the price of land based on output per acre (2003-06) of a basket of 44 crops for 17 states in India. The average value of output per acre for India is estimated to be Rs. 14,543 (2012-13 prices). Based on Foster and Rosenzweig (2011), we assume that profit or income per acre of land is 35 per cent of the value of the output. Further, we assume that agricultural productivity increases at a CAGR of 2.35%, based on Bhalla and Singh (2010). In our model, output per acre is dependant only on the average rainfall received during the year and we assume, based on Blignaut, Ueckermann & Aronson (2009) that a 1% deviation from mean historical rainfall leads to a 1% decline in the value of output per acre. If the rainfall is any year varies in excess of one standard deviation above or below the mean historical rainfall, we assume that the farmer loses the entire value of her crop[10]. 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[11]. Finally, we simulate the IRR and standard deviation on holding land as an asset based on 10,000 Monte Carlo trials.

ii. Livestock

The cash-flows from holding livestock are projected for a stylised median household to estimate the returns and risk on such an investment. This is based on primary information collected from a para-veterinarian for a large insurance company. The median household owns Rs. 20,000 worth of livestock, the value of which corresponds with an Ongole breed cow[12]. The cash flows are projected for a 10 year time frame, based on an estimated life expectancy of this breed of cow. It is also assumed that the household makes this investment at the beginning of the cow's lifetime.

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

1. Milk: The revenue from milk is estimated based on primary information collected about the daily peak yield of milk and yearly peak yield factors of an Ongole breed cow, and the price of milk.
2. Manure: Revenue from manure is based on primary information collected about the value of manure generated per week.
3. Calf: Our model assumes that there is a 50% probability of a maximum of one calf being born to a cow each year between the 3rd and 8th years of its lifetime, up to a maximum of 6 calves during its lifetime. Furthermore, it is assumed that the calf is sold as soon as it is born for the value at which the cow was purchased i.e., Rs. 20,000.
4. Terminal Value: Our model assumes that there is no value of the cow's meat, carcass, or any other part, at the end of its lifespan.

[10] The Indian Institute of Tropical Meteorology classifies years of flood and drought using this methodology. Available at: http://www.tropmet.res.in/~kolli/MOL/Monsoon/Historical/air.html
[11] Available at http://www.tropmet.res.in/Data%20Archival-51-Page
[12] Description of Ongole breed cow: http://en.wikipedia.org/wiki/Ongole_cattle

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

1. Purchase price of asset: This represents the initial one-time cash outflow, which in our model is taken to be Rs. 20,000, which corresponds to the market price of an Ongole cow.
2. Fodder Cost: The cost of fodder is estimated based on primary information collected about the daily consumption, the cost per kg., and the proportions of dry fodder, green fodder, and concentrated feed.
3. Medical Costs: Medical expenses comprise the annual costs of periodic deworming and vaccination.
4. Insemination Costs: Based on the probability of the birth of a calf, our model assumes a cost for insemination in the year before a calf is born.
5. Disease Expenses: This is based on the estimated cost of treating an incidence of foot and mouth disease.
6. Labour Costs: Our model does not take into account the cost of labour attached with the upkeep of the cow.

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

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

iii. Gold

Returns on gold (jewellery) are estimated based on actual Gold Price time series data from MCX for the period 2003 – 2014[13]. Table 5 below presents the mean projected return, and standard deviation on land, jewellery and livestock.

Table 5: Annual Return and Standard Deviation on Assets

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

iv. Portfolio Risk-Return on Current Assets

Based on the estimated mean annual returns and risk (standard deviation) on assets presented above, we estimate the weighted return and risk of five stylised household asset portfolios[14]. This is presented in Table 6.

[13] Available at http://www.mcxindia.com/sitepages/HistoricalDataForVolume.aspx

Table 6: Annual Return and Standard Deviation on Stylised Portfolios

	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Annual Return	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, realise the best returns over time, 14.63%, with a corresponding portfolio risk (standard deviation) of 18.60%. The portfolio of Business-Agriculture households realise an annualised return of 7.64% with a standard deviation of 6.79%. The asset portfolios of both Salaried-Agriculture and Labour-Agriculture households realise an annual return of 6.86% and 7.07% respectively. Although providing comparable returns (6.93%), the portfolio risk of Agriculture only households remains marginally higher at 6.13% compared to that of both Salaried-Agriculture (5.48%) and Labour-Agriculture households (5.92%).

VI. An Assessment of Portfolios with Replacement Financial Assets

1. Insurance

We now compare the projected performance of these asset portfolios with a set of hypothetical portfolios that introduces financial instruments which offer risk mitigation. Table 7 shows the modified annual returns and risk of holding land, and livestock with two additional products - rainfall and cattle insurance. Table 8 compares the extant asset portfolio of households with a hypothetical portfolio in which households have the two additional products.

Livestock insurance is taken into account in terms of the following:

a. An annual premium payment of 5% of the initial value of the cow[15].
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 is taken into account in terms of the following:

a. An annual premium payment equivalent to 10% of the sum assured[16]. 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 deviation in rainfall.

[14] As explained in Section V, the return and standard deviation on land and livestock are simulated individually, without taking their correlation with other local assets into consideration. As a result, the return and standard deviation on physical assets does not take the effect of local, systematic risks into account and could, therefore, be over-estimated in our analysis.
[15] The annual premium rate is based on observed market rates.
[16] The annual premium rate is based on observed market rates.

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

	Land	Livestock
Annual Return	2.52%	12.06%
Change in Return	*0.17%*	*1.80%*
Standard Deviation	0.00%	9.12%
Change in Risk	*-0.21%*	*-8.74%*

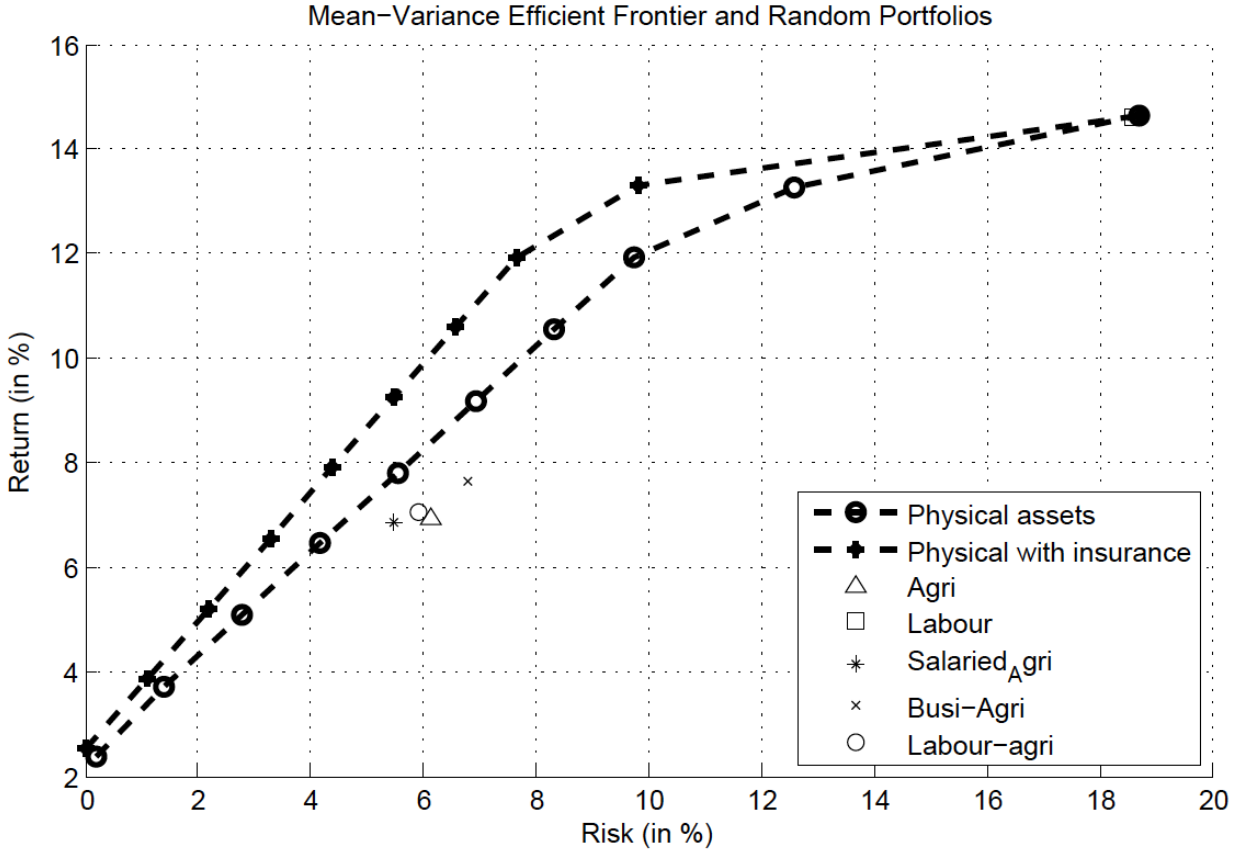
The introduction of rainfall insurance improves the return on land marginally by 0.17% and reduces standard deviation to zero. Livestock insurance improves the return on livestock by 1.80% and substantially reduces the risk by 8.74% from the death of the livestock.

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

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

The above table demonstrates that with the introduction of two additional products, rainfall and cattle insurance, all stylised households (except labour only households) are able to avail of a higher return on their portfolios at a similar level of risk. For example, Salaried-Agriculture households now realise an annual return of 7.16% with a standard deviation of 5.47%, compared to an annual return and risk of 6.86% and 5.48% respectively when assets were uninsured. As Figure 2 shows, 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: Efficiency Frontier with and without Insurance



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 of varying tenors (3 year, 5 year and 15 years), 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 have been calculated for a nine year period ranging from April 2004 to April 2013.

Table 9: Annual Return and Standard Deviation on Financial Assets[17]

	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 below presents the return on portfolios of both physical assets and 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 assume that the standard deviation presented in Table 6 represents the preferred or revealed level of risk tolerance of the stylised households. This assumption allows us to compute the maximum return 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 that households could potentially invest in.

It is clear from Table 10 that all stylised households in our sample would be able to attain a significantly higher return 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 a return that is 3.19% higher than their current level. Table 10 also reveals that apart from the labour-only household, no other household attains a positive real return on their extant portfolio of assets. Switching to a portfolio of financial assets provides these households with an annual real return ranging from 2.01% for salaried-agriculture households to 3.05% for business-agriculture households.

[17] 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

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

	Agriculture-Only	Labour-Only	Salaried-Agriculture	Business-Agriculture	Labour-Agriculture
Nominal Return on Portfolio of Physical Assets	6.93%	14.62%	6.86%	7.64%	7.07%
Real Return on Portfolio of Physical Assets[18]	-1.11%	6.58%	-1.18%	-0.40%	-0.97%
Nominal Return on Portfolio of Financial Assets	10.54%	16.64%	10.05%	11.09%	10.38%
Real Return on Portfolio of Financial Assets	2.50%	8.60%	2.01%	3.05%	2.34%
Change in Return	*3.61%*	*2.02%*	*3.19%*	*3.45%*	*3.31%*
Standard Deviation	6.13%	18.60%	5.48%	6.79%	5.92%

In Figure 3 below, we plot the efficient frontiers of the portfolios of both physical assets and financial assets. The efficient frontier represents the locus of all possible combinations of assets in a portfolio that provide the highest level of expected return for a given level of risk. It is evident that the efficient frontier of the portfolio of financial assets completely dominates the portfolio of physical assets that is 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 return than investment in physical assets. Conversely, by investing in financial instruments, the stylised households in our sample could attain their present level of return at a substantially lower level of risk.

[18] Mean annual inflation for the time period 1983-2012 is 8.04%.

Figure 3: Efficiency Frontiers of Physical Assets & Financial Assets

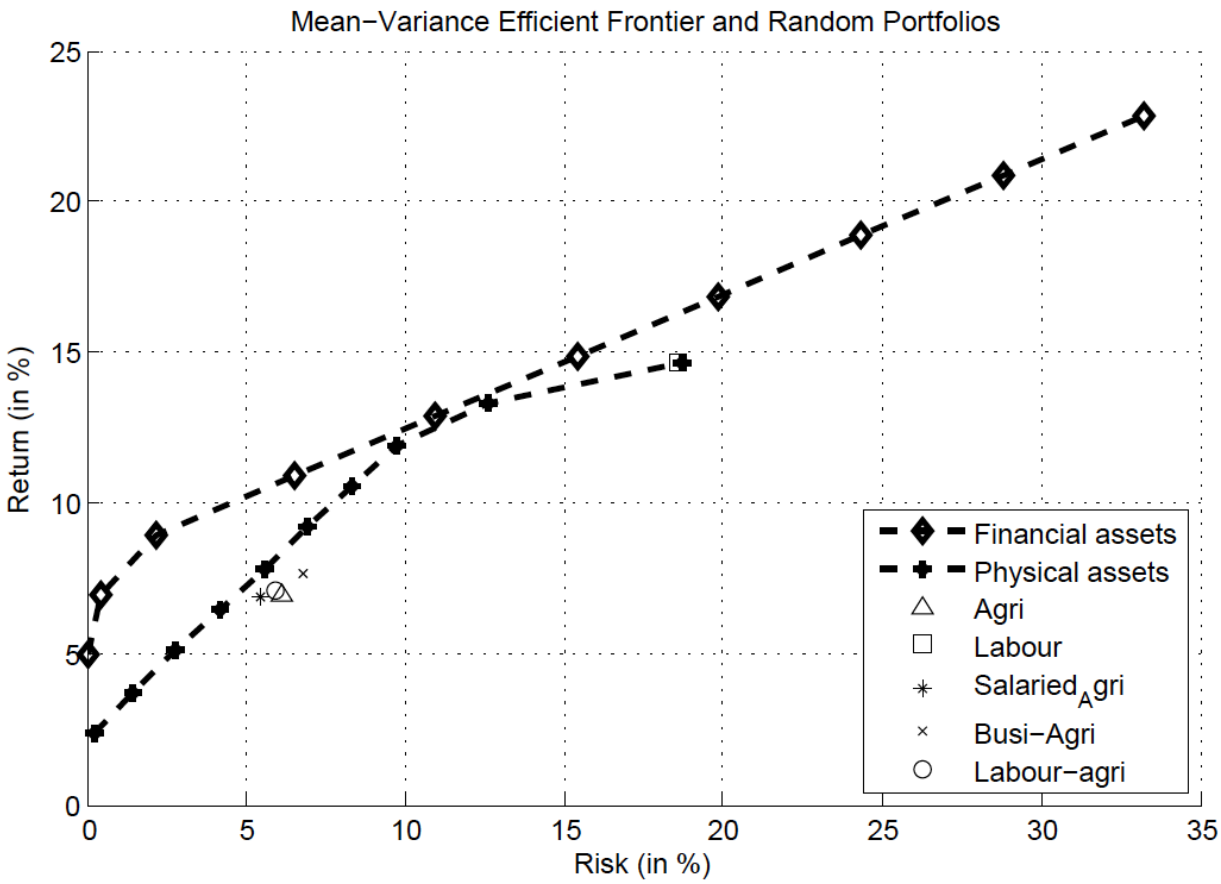


Figure 3 also plots the individual portfolios of the five stylised households. Except for the Labour-Only households, all the other households hold portfolios that are inefficient, even with respect to a suite of assets that are currently accessible to them. This could partially be explained by the lumpy 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. 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 conjecture that rural households are forced to assume 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. As a result of these two factors, labour-only households are over-invested in one asset, leaving them singularly vulnerable to the risk of adverse price fluctuations on that asset.

The efficiency frontiers presented in Figure 3 are the result of an unconstrained optimisation, i.e. we do not pre-determine a minimum or maximum holding value for any asset in the portfolio. In Table 11 below, we estimate the portfolio return on financial assets after the addition of a long-term pensions saving product, represented by the National Pensions Scheme (NPS). According to our estimates, the NPS offers a return of 10.97% at a risk level (standard deviation) of 2.40% over a life cycle of 40 years. The mean and standard deviation on the NPS have been calculated based on a model that estimates the annual return from the scheme. The model assumes 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 life-cycle mix. The life-cycle investment mix varies the proportion of investment in the three classes of assets according to the age of the customer and shifts investment 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 have been arrived at based on a 10,000 trial 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 impose a constraint that forces households to invest 20% of its portfolio in NPS. We find that at their assumed level of risk preference, all the stylised households could gain a rate of return that is higher than the return obtained on the initial suite of six financial assets. Compared to their current portfolio of physical assets, households could gain an increase in return, ranging from 2.47% for labour-agriculture households to 4.94% for agriculture-only households. In real terms, annual return on portfolio ranges from 2.70% for salaried-agriculture households to 3.83% for agriculture-only households.

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

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

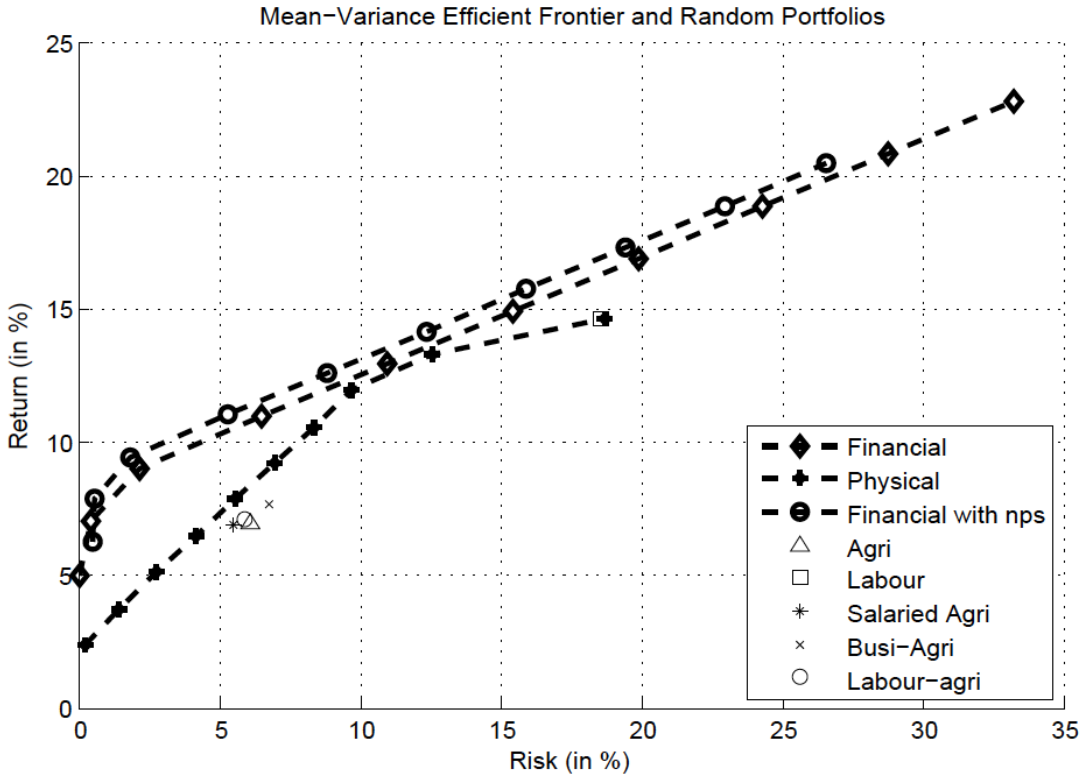
Table 12 compares the Sharpe ratio of asset portfolios of physical and financial assets. The Sharpe ratio measures the excess return per unit of additional deviation in a portfolio of assets, i.e. a risk-adjusted indicator of the performance of a portfolio. Table 12 shows that the Sharpe ratio for portfolios 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 both portfolios of financial assets.

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 plots the efficient 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 find that the portfolios of financial assets with NPS yield Pareto-optimal results compared to both the portfolio of physical assets and the limited suite of financial assets (without NPS).

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 a higher return on their investment by forcing investment 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. Furthermore, 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 protects them from fluctuations in the local market, while at the same time ensuring liquidity in times of need.

VII. Policy Implications

We discuss below policy implications of our findings for two important investment products of relevance to small business and low-income households:

i. 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 diversifying away local risks that many low-income household portfolios are exposed to. 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 without access to 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 for whom these products can be significantly welfare enhancing.

1. Ticket Size: For low-income customers with small investment amounts, it is essential that MF investment options allow minimum investments as low as Re. 1. There do not appear to be any regulatory barriers on minimum investment size in Money Market Mutual Funds (MMMFs) and Index Funds. However, current market practice creates a huge barrier to participation by low-income households by setting very high minimum investment amounts. For instance, the UTI Money Market Fund has a minimum investment of Rs. 10,000[19]; and the Quantum Index Fund (Liquid Fund) has a minimum investment limit of Rs. 5,000[20]. Minimum investment amounts tend to be relatively high on account of costs associated with the AMC maintaining electronic data records of investors (for instance, the difference between maintaining 1000 records of investors with Rs. 5,000 minimum investment and 500,000 records of investors with minimum Rs. 10 investment), and the costs of issuing receipts and account statements. However, with Aadhaar e-KYC 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 reduce, bringing costs down.

2. Investment and Redemption: SEBI permits[21] cash investments into mutual funds up to a limit of Rs. 50,000 (per investor, per mutual fund, per financial year); amounts beyond that will require a cheque, demand draft or other channel. Proceeds from any redemptions of the mutual fund are however required to be deposited in the customer's bank account without exception[22]. This again highlights the fact that in the absence of a bank account the citizen is deprived of access to multiple financial

[19] http://www.utimf.com/Funds/debtfunds/Pages/uti-money-market-fund.aspx
[20] http://www.quantumamc.com/FAQ/Generic_Scheme_Details.aspx
[21] http://www.sebi.gov.in/cms/sebi_data/attachdocs/1400751529272.pdf
[22] SEBI Master Circular on Mutual Funds (September 2013), page 87: http://www.sebi.gov.in/cms/sebi_data/attachdocs/1378979660117.pdf

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 a MMMF account are essentially identical, 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.**

ii. 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. 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 the scheme, Government of India provides a matching contribution of Rs. 1000 per year (currently, for a period of five years ending 2016-17) to every NPS account that contributes a minimum of Rs. 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 Rs. 1000 per year. Under the Swavalamban Scheme, the Government of India provides a matching government contribution of Rs. 1000 per year for individual investment of Rs. 1000 or more. Individuals can however contribute less than Rs. 1000 per year as well, but in this case will not receive any matching contribution from the government. However, there is currently no provision for perpetual annual matching contributions from the government and also 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 her required post-retirement corpus[23]. An inflation-indexed matching contribution from the government would enable a 20-year old to reduce the shortfall from her minimum corpus to 57.5%, a reduction of 11.5% from the current state[24]. **It is essential, therefore, that the Government of India make a commitment first of all to ensure that the matching contribution is available in perpetuity and secondly 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 life-cycle strategy[25] 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 life cycle investment mix used by NPS-Main, combined with inflation indexed matching contributions, would allow a 20-year old to reduce her shortfall to 14.5%. **The current NPS-S investment mix should also be changed to the life cycle strategy to enable higher returns for these investors.**

2. Contribution and Payment: Contributions can be made in cash and up to a maximum of Rs. 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**

[23] IFMR Finance Foundation & IFMR Research (2013)
[24] *Ibid*
[25] The life-cycle investment mix varies the proportion of investment in the three classes of assets according to the age of the customer and shifts investment 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.

universal bank accounts is therefore going to be critical to low-income households' access to pensions solutions.

iii. Distribution Channel

The current distribution channels available to most households comprise of 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, besides the possibility of a local bank branch or credit cooperative or MFI that she can approach for her credit needs. Options to invest in the national debt and equity markets as a way to reduce 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 so as 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) under-insurance against risk of accidental death of self or the death of livestock.

There is a need for a regulatory approach that both enables greater partnerships between existing institutions and creates new financial service providers that 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 will require the presence of financial institutions that would 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 financial institutions it is intermediating for. 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, be they individuals, households or enterprises. It would make possible the effective use of "soft" local information. 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 for Rs. 10 lakhs, the institution must be able to provide just that, and not end up under-insuring or over-insuring 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, of as small as Rs.10 a day, she must be able to do so in cash in a seamless manner.

VIII. Conclusion

This paper's objectives were two-fold- first, to understand the composition of asset portfolios of rural households in India and second, to compare the performance of extant portfolios with a hypothetical portfolio of financial assets. We find that almost the entire asset portfolio (93%) of the average rural household in our sample is composed of two assets - housing and jewellery. Furthermore, 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 return 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 reveals that there are large and significant efficiency losses for rural households as a result of their exclusion from the formal financial system. Our estimates reveal that households could earn a significantly higher level of return, 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 pensions product (investment in which is equated to 20% of the households' total assets), households earn a level of return that is higher compared to both the limited suite of financial assets and the initial portfolio of physical assets.

There are three limitations of the present study. First, the valuation of land and livestock are based on theoretical models, and not primary data. The valuation of these physical assets also doesn't take into account any regional variation in price of assets. Furthermore, the portfolio of stylised households presented in the paper does not take into account two important sets of assets- one, financial assets in the portfolio of households, other than the ones held with the RFI; and two, 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) finds that twenty years after the launch of a family planning program in Bangladesh, households in the treatment village had significantly larger assets than 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 five year period between March 2008 and March 2013, gold ETFs outperformed physical gold by providing a return of 23.97% at a standard deviation of 10.04% compared to a return of 20.97% at a standard deviation of 13.56% for physical gold. Inclusion of a wider suite of financial assets including gold ETFs, Money Market Mutual Funds, and Corporate bonds could lead to a Pareto improvement in the risk-return profile of households. Furthermore, our estimates do not take important costs like commissions, brokerage fees, and taxes on financial assets into consideration. Third, we have used the framework provided by MPT to quantify the efficiency gain of financial inclusion to 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, 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 provide them with access to financial instruments that allow them to construct a diversified, tradable, and liquid portfolio that shelters them from fluctuations in the local market. While households may still choose to invest in 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 (2013) 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."

Appendices

Appendix 1: Asset values

Asset	Categories	Per Unit Value (Rs.)	Asset	Categories	Per Unit Value (Rs.)
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	10,000
	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
	House-wife

Appendix 3: Asset portfolios by primary source of income (in Rs.)

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
Total (Consumption assets)	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	-	-	-	-	-	-	-	-	-	-
Total (Investment assets)	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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