# Measuring the Resilience of Small-holder Farmer to shocks: Aurepalle a case in point

**Report Submitted to**

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## DECLARATION

I do hereby declare that the dissertation entitled upon "Measuring the Resilience of Small-holder Farmer to shocks: Aurepalle a case in point" is an original and independent record of project work undertaken by me under the supervision of Dr. MCS Bantilan (Research Programme Director), Mr. Jaison Davis (Consultant), Mr. Byjesh Kattarkandi (Consultant) at Markets, Institutions and Policies, International Crop Research Institute for Semi-Arid Tropics(ICRISAT), Patancheru, India, during the period of my study as a part of curriculum of Masters in Agribusiness Economics.

Patancheru, Hyderabad By,

Date: 25th July, 2014 Sarah Ashraf

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**Title : Measuring the Resilience of Smallholder Farmers to shocks: Aurepalle a case in point**

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## Abstract

Resilience is a set of responses that may counter the structural and stochastic factors that allow a household or other unit to be vulnerable when exposed to some set of shocks and stressors, while vulnerability is just the absence of resilience during a catastrophe. Resilience and Vulnerability are thus indispensable sides of the same coin.

Resilience has been quantified using several different methods; however one generic method of quantifying resilience is amiss. Development of resilience measures in this study takes into account the aftermath of a shock as the result of a chain of ex-post mitigation measures. These consequences, which are further used as tools to measure the resilience, directly affect well-being of the farming households.

'Smallholder farmers are naturally susceptible to shocks' is an intuitive statement. Setting this hypothesis as the backdrop, the aim of the study is to test the claim.

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# 1. Introduction

Shock is an event that can trigger decline in well-being, which can affect individuals, a community, a region, or even a nation. – Word Bank

And,

Resilence can be defined as 'any capacity and skills, and action, strategy, investment and anticipation, which helps individual, households and communities to anticipate, absorb, accommodate, or recover from the impacts of a particular adverse event (shock, stress, or (un)expected changes)'(Bene and Christophe,2013).

Resilience is not simply about change (loss) in assets, it is also about individual's psychological stress following a disaster (Almedom and Glandon 2007); and about the role of reciprocal (informal) risk management mechanisms in helping individual households recovering more rapidly and preventing them from engaging in some detrimental coping strategies (Hoogeveen 2002; Barrett et al. 2006)

Shocks to an Agricultural household/community can largely be looked at as weather-related and idiosyncratic. While the former hits a particular community as whole, the latter allows the affected families to get relief from friends and relatives as not everyone suffers at the same time. Idiosyncratic shocks are thus easier to recover from. The adjustment mechanism is rather straightforward as the most obvious outcome in such shocks is the use of savings and over all reserves may or may not go down. Weather-related shocks on the other hand have long lasting effects as an entire community is washed off its asset-base, either due to the occurrence of the shock or in sustaining its occurrence.

According to Department of International Development(DFID)(1999) Sustainable Livelihood Framework (SLF) indicates that livelihood of a given household/state is dependent on its asset endowments- mainly Human Capital, Social Capital, Physical capital, Financial Capital and Natural Capital- which together enable households to pursue a sustainable livelihood.

Picking a case in point of a farming household/Community, the similar endowments are needed; Human Capital in form of farm labour, Social Capital in the form of creditworthiness, gender equality or membership of cooperatives, Physical Capital in the form of stack animals, farm implements, machinery etc, financial capital in the form of profits that induce investments and Natural capital in the form of ground water , rains or healthy soil(for example). These forms of capital later go on to form exploratory variable in the study.

Agriculture in the a Semi -Arid Tropic (SAT) area has two predominant features; one that it is rain-fed and two that almost 80% of the farmers are small and marginal with the average size of land holding being less than two acres. If seasonal rainfall fails or its amount or timing deviates from the norm, agricultural production will be negatively affected (World Bank, 2006) with damaging consequences not only for a country's economy but also on food security. Hence, any irregularity in the weather conditions has a hostile weight on the farming community because the farmers are unable to afford other measures of water resourcing. The profits earned from farming are scanty for the small holders and often even negative. Returns that can be ploughed back into the farm for greater yield are very rare opportunities.

To this end it is important to develop an Index that measures the resilience of small holder farmers to climatic, financial, policy, market and idiosyncratic shocks. However, climate variability and extreme weather conditions are among the major risk factors affecting agricultural productivity. Previous studies have shown that weather variability emanating from changes in climatic conditions affect food security (Rosenzweig et al. 1995) and that effect is pronounced in the rural households of the developing countries (Downing 1992, Benson and Clay 1998) where the capacity to cope in event of shock is low. In the above case food security has been used as a proxy to agricultural yield.

Hence the objective of the study is to investigate consequences of shocks and their recovery mechanism in order to reach a concluding set of variables that can help us quantify resilience or the lack of it i.e. vulnerability. The results of this study and concept note can be used to adjust and fine-tunes policies aimed at improving farmer's resilience and addressing their profitability concerns.

Resilience and Vulnerability are not directly observable without the help of proxies. Hence, using the approach outlined in this paper we try to measure the resilience of farming community in a particular year, over the years. Using selected indicators that are proxies for consequences of shocks we try to quantify its presence and also the degree of it presence. Selection of indicators was based on, the literature available on Resilience of Small holders, availability of data, interaction with the sample respondents and also some amount of intuition. Accordingly, following are the indicator variables that reflect its different dimensions: Gini Coefficient, share of expenditure on food, ratio crop to non-crop sources of income, ratio of debts to assets, and marginal propensity to save. The justification of their inclusion is provided in the chapters that follow.

In this study we hypothesise a direct relationship of resilience with ratio of crop to non-crop sources of income and the Marginal Propensity to Save (MPS). On the other hand we

hypothesise an inverse relationship between resilience & Gini Coefficient, Share of expenditure on food and ratio of debts to assets.

**Objective**:

As the intensity of catastrophic events increases the resilience of small holders dampens. The main of objective of this study is to bring out the development in resilience of a particular farming community over the years and along the way also measure the cost incurred in being resilient against a shock.

## 2. Definitions: Key Terms

Mechanisms through which climate impacts felt are similar to those for agriculture, i.e., variation or change in precipitation and temperature, changes in atmospheric composition that affect the competitive balance among different types of plants, changes in soils, and changes in the incidence of diseases and pests. Ecosystems are also influenced by other environmental stress, including pollution (both runoff in water courses and deposition from the atmosphere), increasing extraction of resources, and incursion/fragmentation.

Risk offers a holistic perspective on the interplay of processes operating in social and environmental systems, and it is this interplay that produces the precondition for disaster. The notion of risk expresses the likelihood that something can be gained, while there is an accompanying probability that something is lost. Within the context of natural hazard and disasters, it is usually the loss coming to the fore and risk captures not ony the probability of potentially harmful events occurring but also the consequences of when they occur (Crozier and Galde 2005).

Risks can be looked at from three perspective- elements at risk, hazard and damages.

Vulnerability refers to the potential degree of damage that can be expected depending on the characteristics of an element at risk with response to a certain hazard (Varne's 1984). However 30 years later this understanding of vulnerability has been complemented by encompassing 'the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Hazard and household livelihoods collide when a geophysical process turns normal (daily) life situation upside and down (wisner et al. 2004). This triggers different levels of adapting within the means of a household. Depending on availability of resources, the previous unsafe condition is preserved, lessened or worsened. Vulnerability also stems from individual profile regarding the socio-demographic characteristics of a person (age, gender, etc.) within a household.

## 3. Resilience Development Index: Concept Note

As per the framework provided by Dr. Hans Binswanger, Shocks can be classified into 6 categories, based on the severity of their consequences;

| | |
|---|---|
| Class I | Total Consumption remains unaffected. |
| Class II | Total consumption is maintained with help from Friends and Relatives. |
| Class III | Total consumption is affected (declines). Food consumption is maintained. |
| Class IV | Total consumption along with Food consumption is affected (declines). |
| Class V | Productive Assets are sold. |
| Class VI | Alternate employment is sought. |

**Table 1:Classification of shocks**

**Sources: Dr. Hans Binswanger's vulnerability approach**

Thus, from review of literature, past experience of researchers and a Focused group discussion, which involved members of the Panchayat, farmers and elderly persons from the village, at Aurepalle and Dokur we could verify that when a shock such as drought occurs the immediate consequences are as mentioned as under:

- Increased Income disparity
- Search for alternate sources of employment/ migration
- Increase in proportion of income spent on food
- Increase in debts
- Depletion of savings
- Reduction in asset base
- Dependence on government subsidy and public welfare programmes

The RDI includes the following five variables, Gini Coefficient, correlation coefficient of crop to non-crop income, Proportion of Food expenditure, debt to asset ratio and marginal propensity to save; which are proxies of income disparity, alternate sources of income, well-being, credit worthiness and savings as a function of income respectively. The RDI is a summary measure of development in resilience of a farming community.

Thus, RDI= $f$ ( GC, CCI, PFE, RDA, MPS)

Where,

RDI is Resilience Development Index
GC is Gini Coefficient
CCI is Coefficient of crop to non-crop income
PFE is proportion of food expenditure
RDA is Ratio of Debts to assets
MPS is Marginal Propensity to save

**Assumption:**

The celling limit of RDA is 1, because by convention the loan advanced to farmers cannot exceed the value of their total physical assets, under normal circumstances.

**Explanation**:
The Gini Coefficient is the most commonly used measure of Income disparity in a certain state/community. The Gini Coefficient ranges between 0 and 1, 0 indicates complete equality and 1 perfect inequality.
Natural calamities and hazards of very high magnitude do not differentiate between income classes and land holding. We have intuitive known that in a natural calamity the rich are impacted more in terms of absolute numbers but proportionally the poor are brunt of the poor is far worse.

The percentage of households that are affected by a shock increases with household wealth; this suggests that the better-off in the community are more likely to be affected than the poorer. This result is not necessarily intuitive, as it 'contradicts the notion that poorer households are more vulnerable [than better-off households] to shocks' (Carter *et al*. 2007: 842). However they also found that the losses faced by poorer households were proportionally larger than those for richer households in the same communities. In other words, the poor have very little to lose (which explains why the richer in these communities are likely to lose more – in absolute terms), but that 'very little' is actually a larger share of the poor's initial assets.
Therefore, $|A| > |B|$ but $A/A^* < B/B^*$.

The third relevant finding of Carter's analysis is that the poorer are slower at rebuilding their asset-base than the richer.

Thus, due to the greater percentage of loss of the poor as against the rich, the disparity in income increases leading to a greater income divide, which is capured by the Gini Coefficient.

As a measure of last resort when a farm household begins to deplete savings and reduce asset base to shocks with no further investment and incentive for agriculture alternate sources of employment are sought. A correlation coefficient of crop to non-crop income explains what propoertion of non-crop income is needed to supplement the crop income, so that the existing consumption level is sustained.

The distribution of consumption expenditure between food and non-food items reflects the actual economic well-being of the population. In general, the poor households are expected to spend substantially more on food items as against non-food items. Indeed the share of expenditure on food items is expected to decline with development and economic prosperity. Whether it is developed country or an underdeveloped one, the percentage spending on food items going down signifies overall prosperity of the population, and the ability of people to spend more on food and non- food items . The NSS identifies non-food to include transport, tobacco/ cigarettes and pan, fuel, light, clothing, bedding, footwear, education, medical bills, entertainment and durable goods.

Thus, the share of food expenditure explains the amount well- being in a certain community. In case of shock, if farm household is able to maintain its level consumption but not letting share of expenditure on food slip away, then the household can be deemed to be resilient.

In the face of a shock, when income goes down and savings are depleted, the next best option for a household is to take loans in order to survive. In case of farming households or community when one crop fails, there isn't enough financial capital to invest in agriculture as the next cropping season begins. Availability of credit is anticipated positive influence because it enables farmers to apply more inputs by easing short term liquidity constraints thereby influencing production. However, if the loans and borrowings surpass the level of asset base then it leads to a situation of poverty trap where farmers are unable to repay the loans and have to eventually sell off their lands.

By convention and standard operating procedures the debt to asset ratio must be 1:2, however for a rural farm households in many cases it has been observed to be 1:1.

The MPS is the proportion of each addition unit of money income that is used for saving. In the face of a shock when the income of households decreases the propensity to save also reduces. Thus, lower propensity to save during a shock is a sign of high vulnerability and the converse of which is resilience.

There can be several reasons as why a rural farming household/community can be resilient despite a shock for example good irrigation facility, membership of Self Help groups, government subsidies, loan waivers etc. however, the only reason for vulnerability is the lack of resilience in the above mentioned heads .

**MethodofCalculation**

Step 1: Calculate Gini Coefficient for the farming community, for each year.

Formula:

1.1 Arrange the data from lowest to highest.

1.2 Calculate the total income

1.3 Divide into quintiles

1.4 Calculate the total income in each quintile

1.5 Calculate the percent of total income in each quintile

1.6 Approximate the percentages for easier graphing

1.7 Calculate the cumulative percentage of household income

1.8 Graph quintiles, cumulative percent of income, and line of perfect equality. Begin by Deleting the two middle columns and adding a third column (the line of perfect equality.)

1.9 Highlight data

1.10 Use the Chart Wizard, select "Scatter Plot"

1.11 Eliminate gridlines, background, Legend as you prefer, and finish

1.12 Calculate the area under the Lorenz Curve using the properties of a trapezoid. The formula is: ½(b1 + b2).2.

1.13 Subtract area under the line of perfect equality from the area under the Lorenz Curve

1.14 The Gini Coefficient is found by taking the ratio of the area between the line of perfect equality and the Lorenz Curve to the area under the line of perfect equality

Step 2: Compute correlation matrix of Crop and non-crop income.

Step 3: Compute proportion of food to non-food expenditure.

Step 4: Compute debts to asset ratio using absolute values of total borrowing and absolute values of total asset base.

Step 5: Calculate MPS

Formula: change in savings/ Change in income

Step 6: Compute harmonic mean of individual variables to have a central tendency of all variables.

Step 7: Repeat for all years in the time series data set

Step 8: Make table with all variables for the entire time line

Step 9: Compute Geometric mean for each year to arrive at a resilience index of the farming community for that particular year.

**Limitations of proxies:**

Several critiques of the general methodology can be made. It may be argued that the proxies are not representative enough, that the set is incomplete, and/or that the proxies within the set are overlapping. These are issues of any indicator set; most discussions of sets address the first concern but not the latter two. Each proxy's representativeness can be questioned. It may be argued about land use as a case in point that a land use proxy may not explicitly account for soil characteristics or historic civil strife in an area. Although no proxy can perfectly represent an abstract category, judgement of its adequacy should be based on the criteria described above: the proxy's ability to summarize a number of important properties and its capacity to be quantified. Finally it must be recognized that there is a degree of arbitrariness in any set of indicators, and that the variability of good quality data will always be place limits on developing a fully exhaustive set.

## 4. Village Profile: Aurepalle

Aurepalle, situated in Madgul mandal, Mahboobnagar district is a village that is 70km away from Hyderabad. This proximity to a bustling city, with great employment opportunities, is both a boon and a bane for Aurepalle. It is a boon because 2/3$^{rd}$ household in Aurepalle have younger member of the family working in the city that send remittances to parents, making them less vulnerable to climatic and idiosyncratic shocks; while it is a bane because the landless farmers go to the city and nearing hinterlands in search of masonry work. This leads to a huge shortfall in labour especially during the peak seasons, so much so that farmers have to pay the travel expense of farm labour from neighbouring villages apart from giving them competitive wages.

Aurepalle majorly practices rain-fed agriculture, with huge dependence on loans from institutional & non-institutional sources and government sources. The farmers themselves confess to have waited until the election to replay government loans in the expectation that populist policies would give room to loan waivers. Aurepalle grows cotton in tremendous measures and hence no subsistence needs are fulfilled. However a couple of families from the backwards class grow paddy in order to support themselves. The reason behind doing so is the PDS system which gives out rice at a nominal cost of Re.1/Kg.

The credit facility in the village is like any other village in country with both institutional and non-institutional lending sources being present. The interest rate charged is Rs. 3 per Rs.100 of loan amount. Also in case of emergency and non-productive loans the unofficial interest rates go up to Rs.5 per Rs.100 of loan amount. The recovery from these debts totally depends upon rains, if the year following the debt year is announced as a drought years then there are no more options for borrowing money to even maintain consumption. Also because of this reason the livestock suffer deaths, forcing the farmers to sell them off at lower prices. The average loan amount depends on the creditworthiness of the farmers. However there are also 26 self-help groups in the village with 15 members each. These groups consist only of women and manage to make savings every month that help them during times of need.

The villagers when asked about production of cotton despite it being a water intensive crop, responded by saying that it is a commercial crop that fetches them good money if it rains well. The riskiness of growing cotton does not deter them from sowing cotton each year because of the crop insurance provided by the government. In case of a crop failure the government pays the farmers a sum of Rs. 5000/- per acre. When the rains are plentiful the

yield is 6-10 quintals per acres that fetch them a price of Rs.4000-5000 per quintal. However in case of low rains the yield is expected to be 3-5 quintals per acres. The yield also depends upon the soil type as Black soil yields higher output.

The labour requirements in the village are high and extremely crucial during the picking season because any exposure to excess rains can ruin the crops. The transport expense for labour from neighbouring villages per famers is Rs. 1000-1200. Women are given a daily wage of Rs.250 per day during non-peak seasons; however the wage rate roars very high during the picking season as the farmer can afford no delay. Sowing times also needs labour because not very many farmers have their own machinery or stack animals. Only a meagre 3-5% farm household have their own bullocks.

The closest market yard where the farmers can sell their produce is 70km away hence the farmers completely depend on brokers. The brokers themselves come to the village and buy the produce from the farmers; which is also preferred by the farmers because it helps them avoid the transportation cost.

Apart from faming the other major occupation practiced in the village is toddy tapping and production of Gudumba. However the production and sale of Gudumba is unauthorised. The farm household are also supported by government employment programs. There is also old age pension for the people at Rs. 200/ month. The income generated from farm and non-farm sources are shared equally as each household has 2-3 sources of income. Some households that own milk animals that contributes to their income at Rs. 22/liter for cow milk and Rs. 40/liter for bull milk. Depending on the cream content in the milk the prices increase or decrease, higher prices being given for more cream content.

The main sowing season starts from October and the gestation continues until December-January, depending on the rains. In the months of March- July the villages take up work under the NREGS scheme; It also during this same time that the village sees huge migration.

Each farmer spends approximately Rs.20, 000/- per acre that involves costs such as Rs. 800/ hour for tractors, Rs.1000/day for harrowing that needs to be done 6-8 times and for renting bullocks for farmers without any stack animals of their own.

Post production, payments are made towards repayment of loans, investment in agri-inputs and storage. If they still have more money leaving aside what is needed for household expenses, the farmers prefer to dig bore wells on their field.

The village experiences great diversification in terms of sources of income with each household having 2-3 sources. One such household is that of Chintapally Malaya Pedda. This household grows cotton and paddy, depending on the rainfall and have their own bore-well.

Besides they rent toddy trees at Rs.100/tree for a month and climb 10 such trees to collect juice worth Rs.25,000-45,000 annually. The months of June-July are very tough on expenses because most of the agri-inputs have to be bought during months, thus to supplement their investment the husband-wife duo take up work under the NREGS.

Recent Wage rate Trends in Aurepalle:

| Year | Conversion Factor | Wage rate for Women | Wage rate for men | Wage rate for women_C | Wage rate for Men_C |
|---|---|---|---|---|---|
| 2005 | 1.45 | 30 | 50 | 43.5 | 72.5 |
| 2006 | 1.35 | 50 | 70 | 67.5 | 94.5 |
| 2007 | 1.25 | 50 | 70 | 62.5 | 87.5 |
| 2008 | 1.14 | 80 | 100 | 91.2 | 114 |
| 2009 | 1.00 | 100-150 | 150-200 | 100-150 | 150-200 |
| 2010 | 0.91 | 100-150 | 150-200 | 91-136.5 | 136-182 |
| 2011 | 0.84 | 150-200 | 200-250 | 126-168 | 168-210 |

**Table 2: Recent wage rate trends in Aurepalle**

**Source: Focused group discussion with members of the Panchayat**

Thus, increasing wage rage rates have also added to the resilience of the farm households, as they are able to maintain their consumption level even in the face of climatic shocks by supplementing their income with farm labour and casual labour. This income also helps them to invest more in their lands as declared by the farmers. The Sarpach informed that the years 2009 and 2010 saw a surge in the investments made by households in their own lands.

Rainfall pattern in Aurepalle from 1975 to 1994 and 2006 to 2008 (3 years average):

| Month | 1975-1977 | 1978-1980 | 1981-1983 | 1984-1986 | 1987-1989 | 1990-1992 | 1993-1994 | 2006-2008 |
|---|---|---|---|---|---|---|---|---|
| January | 0.00 | 2.17 | 2.80 | 10.20 | 7.50 | 2.50 | 3.4 | 0.00 |
| February | 0.00 | 20.00 | 0.00 | 6.83 | 3.53 | 1.20 | 7.2 | 32.33 |
| March | 0.00 | 2.40 | 24.20 | 2.90 | 26.23 | 8.13 | 25.2 | 55.93 |
| April | 27.07 | 20.30 | 23.20 | 16.60 | 24.87 | 22.63 | 15.5 | 32.70 |
| May | 12.73 | 65.37 | 32.43 | 7.47 | 10.53 | 44.93 | 52.9 | 57.13 |
| June | 59.73 | 110.67 | 52.17 | 58.60 | 50.13 | 106.67 | 18.8 | 110.93 |
| July | 59.50 | 102.60 | 128.93 | 122.90 | 179.97 | 109.47 | 66.8 | 93.77 |
| August | 169.37 | 130.10 | 119.07 | 69.43 | 156.13 | 95.43 | 105.6 | 168.53 |
| September | 95.67 | 169.00 | 198.10 | 117.97 | 145.53 | 140.30 | 47.6 | 136.07 |
| October | 88.80 | 15.80 | 74.30 | 104.23 | 56.97 | 64.13 | 201.9 | 49.60 |
| November | 38.80 | 42.40 | 15.03 | 26.37 | 90.63 | 41.33 | 17.4 | 33.43 |
| December | 0.00 | 0.00 | 0.67 | 14.47 | 11.50 | 0.00 | 19.6 | 20.73 |
| **Total rainfall** | **551.67** | **680.80** | **670.97** | **557.97** | **763.53** | **636.73** | **581.9** | **791.17** |
| Total rain received during crop season (June-October) | 473.07 | 528.17 | 572.57 | 473.13 | 588.73 | 516.00 | 440.7 | 558.90 |
| % to total rain | 87.64 | 77.35 | 84.54 | 84.31 | 77.90 | 80.10 | 75.9 | 69.48 |

**Table 3:Rainfall pattern in Aurepalle**

**Source: Aurepalle VLS 2014**

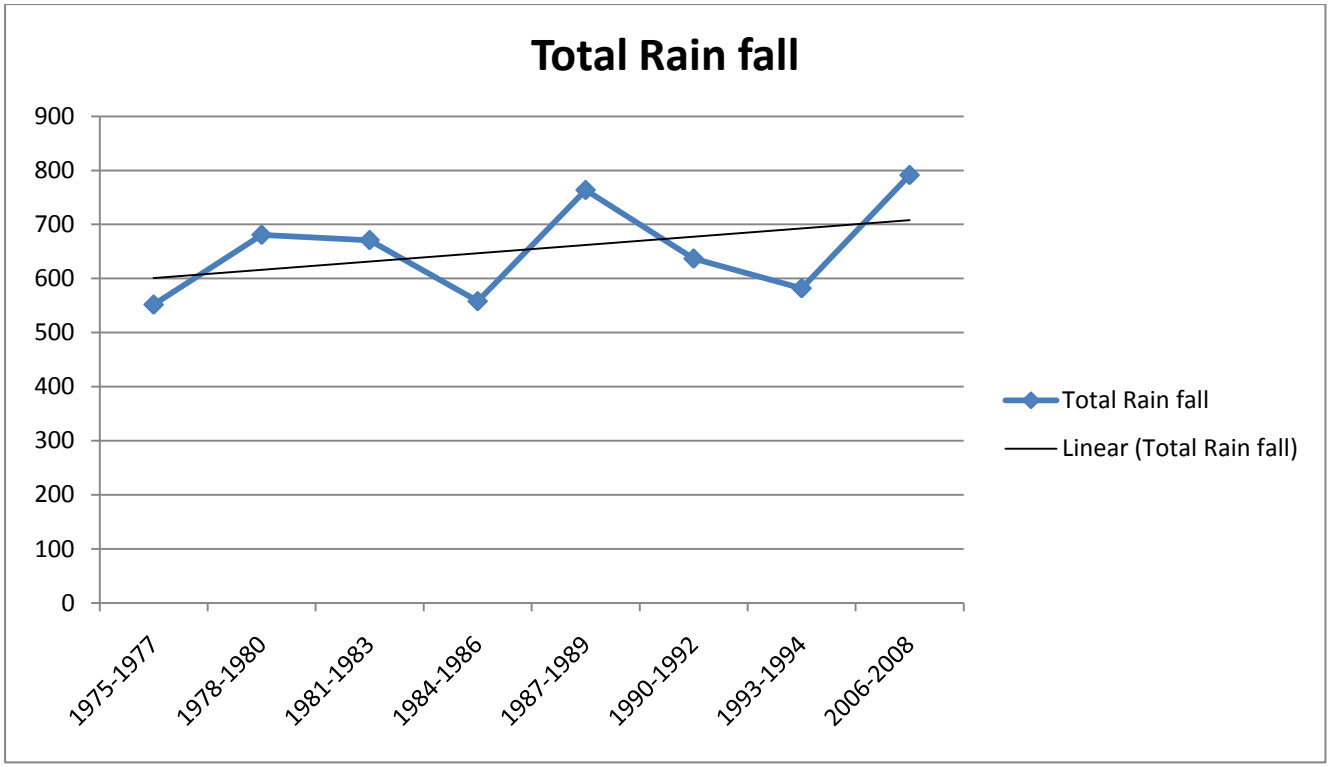


**Figure 1: Total Rainfall in Aurepalle 1975-2008**

**Source: VLS Data**

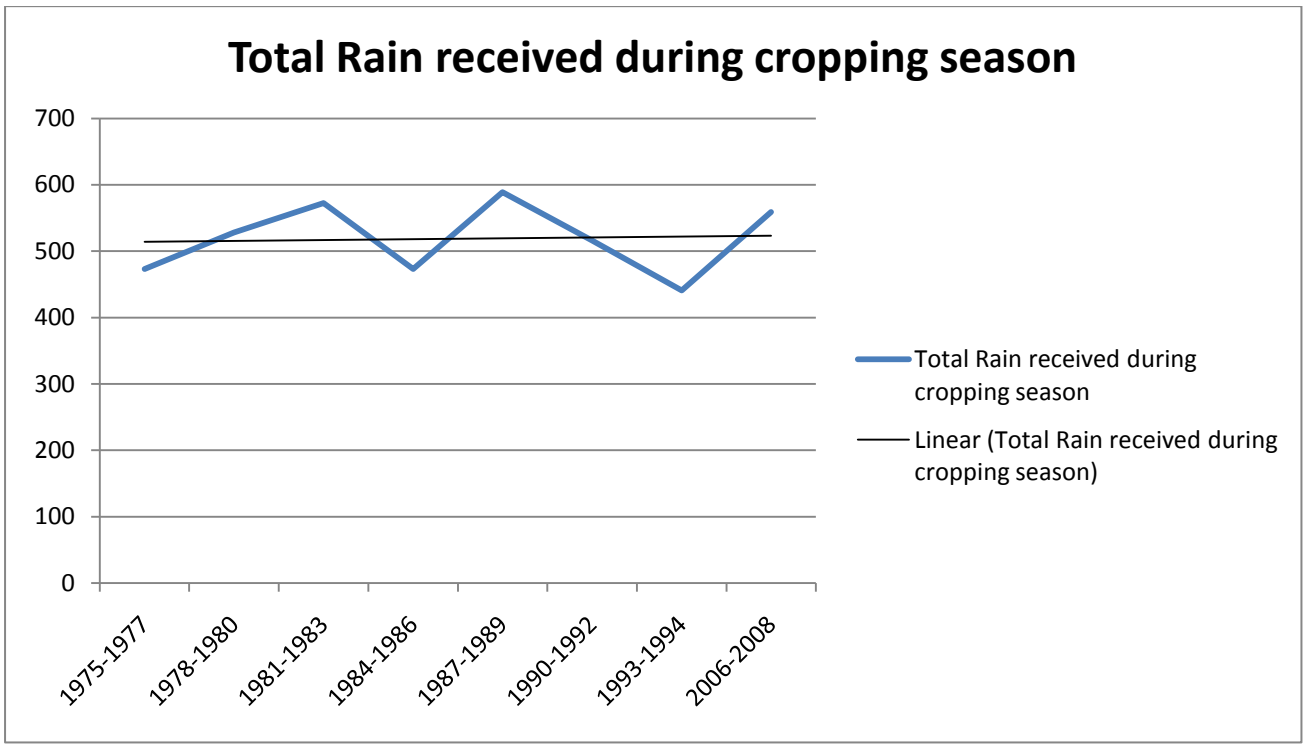


Figure 2 : Total rainfall received during cropping season

Source: VLS Data

Extent of migration, nature of employment and wage rates

| Migrants | Place | Distance | Nature of employment | Sex | Wage rate |
|---|---|---|---|---|---|
| 80% | Hyderabad city and its suburbs | 70 km from village | Driving of jeep, taxi and trucks e | Male | 4000-5000 Rs/month |
| | | | Watchman near residential houses, flat lets, shops and small size industries | Male | 3000-3500 Rs/month |
| | | | Service boy in hotels, bar cum restaurants and lodges | Male | 3000 Rs/month and free food and accommodation |
| | | | Mud work (construction of buildings, roads, digging canals for cable lines, and water pipes | Male | 120-150 Rs/day |
| | | | Mud work (construction of buildings, roads, digging canals for cable lines and water pipes | Female and children | 80-100 Rs/day |
| | | | Mud work (construction of buildings, roads, digging canals for cable lines and water pipes | Female and children | 80-100 Rs/day |
| | | | Toddy tapping outside | Male | 3000-4000 Rs/month |
| | | | Driving Autos, and cycle rickshaws | Male | 150-200 Rs/day |
| | | | Monthly salaried jobs in shops, companies and other establishments | Male | 3500-5000 Rs/month |
| | | | Maid servant (cleaning, washing and sweeping at resident families) | Female | 600-800 Rs/month (some people provide tea and little quantity of food) |
| 20% | Surrounding places | 10-30 km | Non-farm activities (goldsmith, barber, watchman, shop keeper and part time job) | Mostly male | 120-150 Rs/day |

**Table 4:** Extent of migration, nature of employment and wage rates

Source: Aurepalle VLS data

## 5. RDI Calculated for Aurepalle

1. Gini Coefficient- Aurepalle

| Year | Gini Coefficient |
|---|---|
| 2005 | 0.340 |
| 2006 | 0.213 |
| 2007 | 0.330 |
| 2008 | 0.277 |
| 2009 | 0.277 |
| 2010 | 0.164 |
| 2011 | 0.359 |

**Table 5:Gini Coefficient for Aurepalle 2005-11**

**Source: Computed using raw data from VLS**

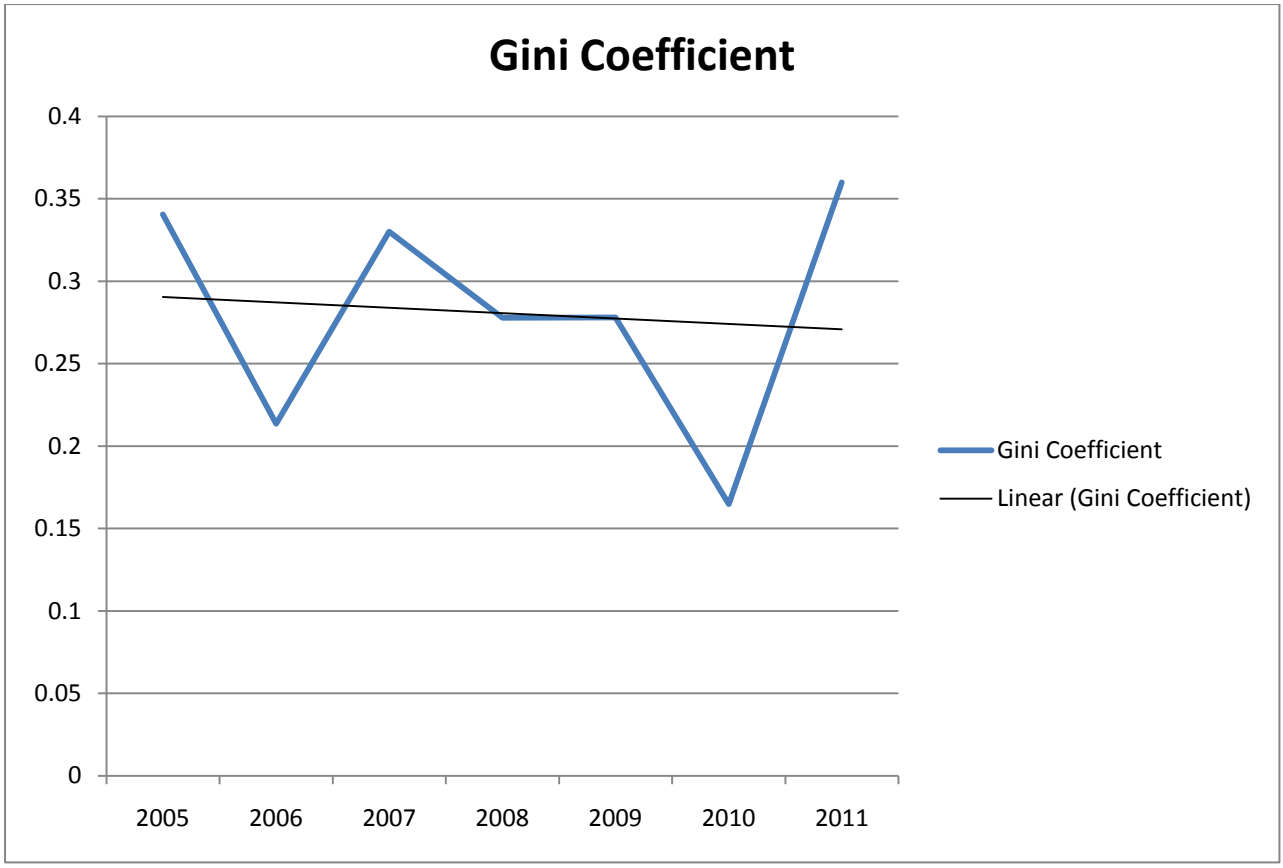


Figure 3:Gini Coefficient for Aurepalle 2005-11
Source: Computed using VLS raw data

The years 2005 and 2011 see the highest disparity in income. However, there is no particular trend that the graph follows. The hills and valleys of the graph can be explained by several factors such as the initiation of NREGS works 2006 onwards, higher income from migration to Shamshabad, remittances from members of the family living in other cities, etc.

2. Correlation Coefficient between crop and non-crop income- Aurepalle

| Year | Correlation Coefficient between crop and non-crop income |
|---|---|
| 2005 | 0.264 |
| 2006 | 0.061 |
| 2007 | 0.299 |
| 2008 | 0.104 |
| 2009 | 0.331 |
| 2010 | 0.270 |
| 2011 | 0.437 |

**Table 6: Correlation Coefficient between Crop and non-crop income for Aurepalle 2005-11**
**Source: Computed from VLS raw data**

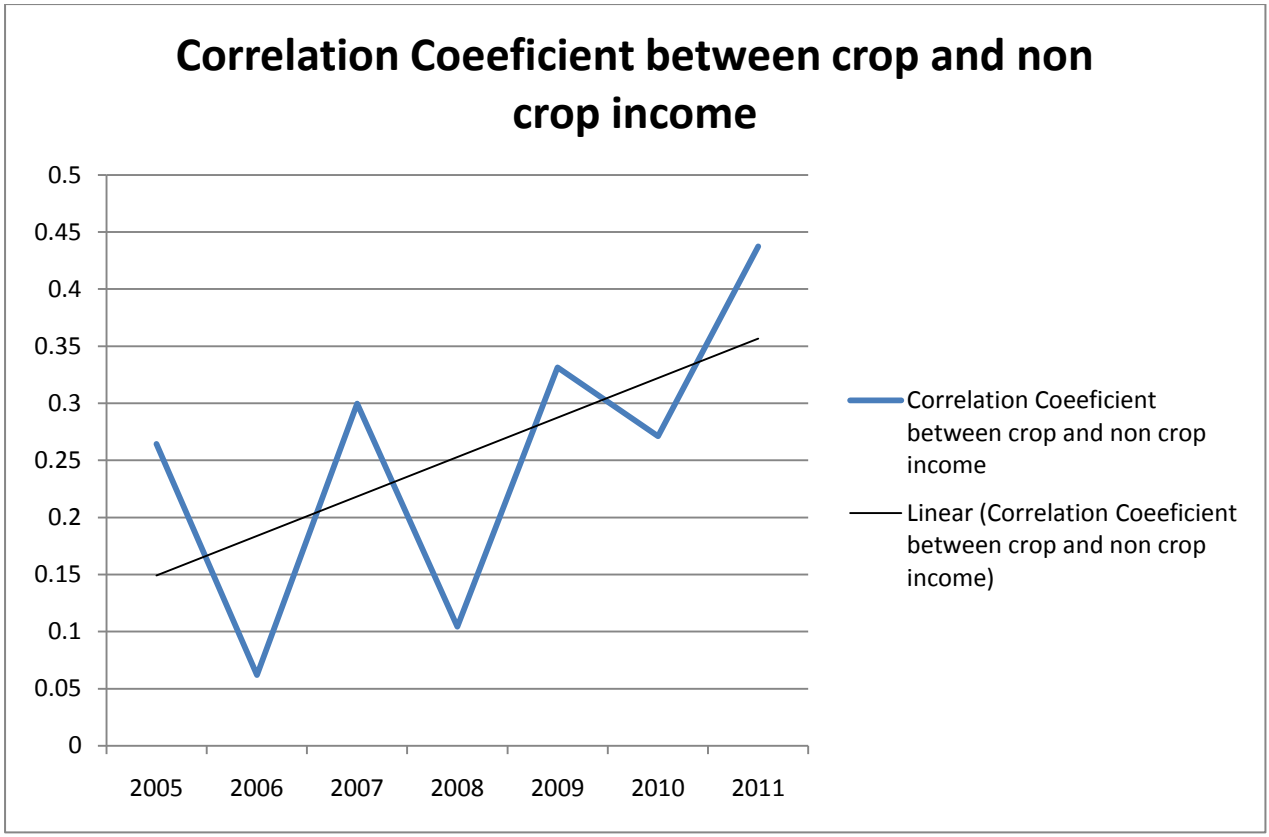


**Figure 4:Correlation Coefficient between crop and non-crop income for Aurepalle 2005-11**

**Source: Computed from VLS data**

Although, from a macroscopic perspective we see that the correlation between crop income and non-crop income sees an increasing trend with time, there has been huge fluctuation within in consecutive years. The reasons for the fluctuation being that at constant prices the total incomes of the farming households have remained the same. However when there is a dip in income from crop source the households try to balance the deficit with non-crop sources of income.

3. Proportion of food expenditure- Aurepalle

| Year | Ratio of food/Total expenditure |
|---|---|
| 2005 | 0.750 |
| 2006 | 0.574 |
| 2007 | 0.555 |
| 2008 | 0.692 |

| | |
|---|---|
| 2009 | 0.720 |
| 2010 | 0.568 |
| 2011 | 0.774 |

**Table 7:Proportion of food expenditure for Aurepalle 2005-11**

**Source: VLS raw data**

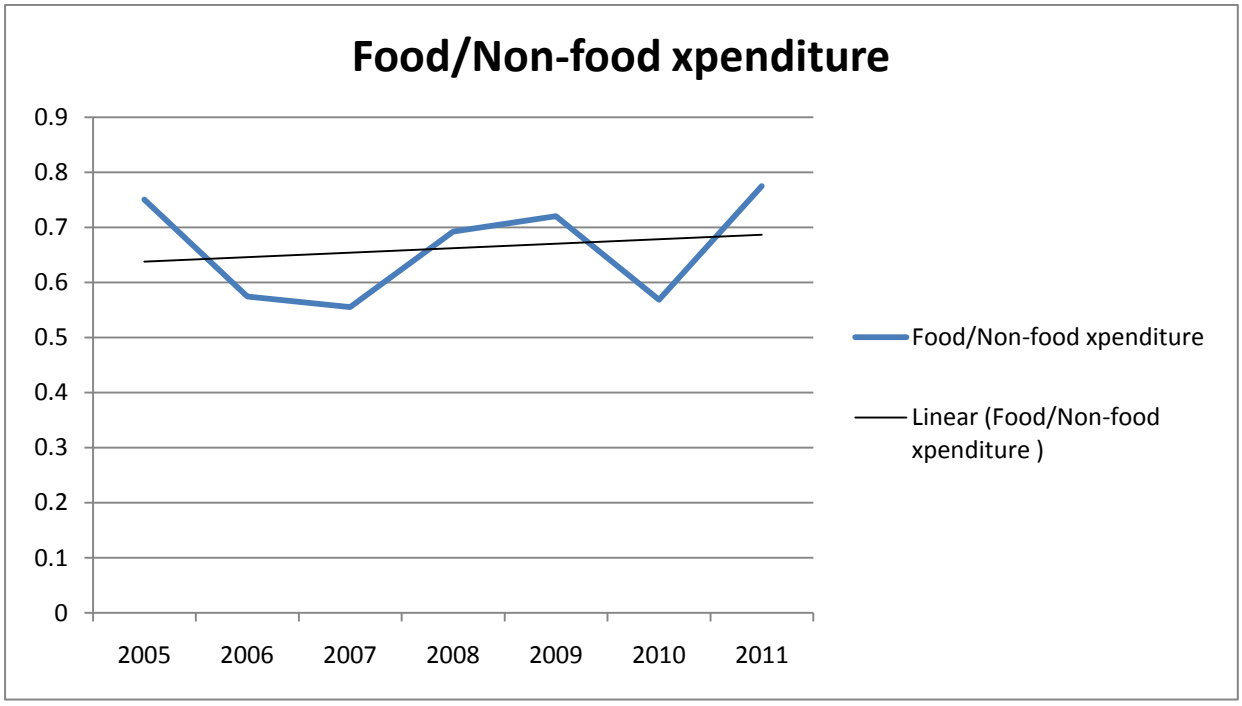


**Figure 5: Proportion of food expenditure for Aurepalle 2005-11**

**Source: VLS raw data**

The trend in the proportion of expenditure on food remains rather constant because of the Public Distribution system and hence even in shock years the total expenditure on food does not change by much expect for the luxury food items such as meat. To add to that, the respondents, of the Focused Group Discussion in Dokur, maintained that the food consumption hardly ever changes for them. In all times the expenditure on Food and beverages is stable, even at the cost of borrowing from friends and relatives or taking institutional and non-institutional loans.

4. Debt/ Asset Ratio-Aurepalle

| Year | TotalDebt/Total Asset |
|---|---|

| | |
|---|---|
| 2005 | 0.117 |
| 2006 | 0.051 |
| 2007 | 0.035 |
| 2008 | 0.043 |
| 2009 | 0.052 |
| 2010 | 0.054 |
| 2011 | 0.073 |

Table 8:Debts/ Asset Ratio for Aurepalle 2005-11

Source: VLS raw data

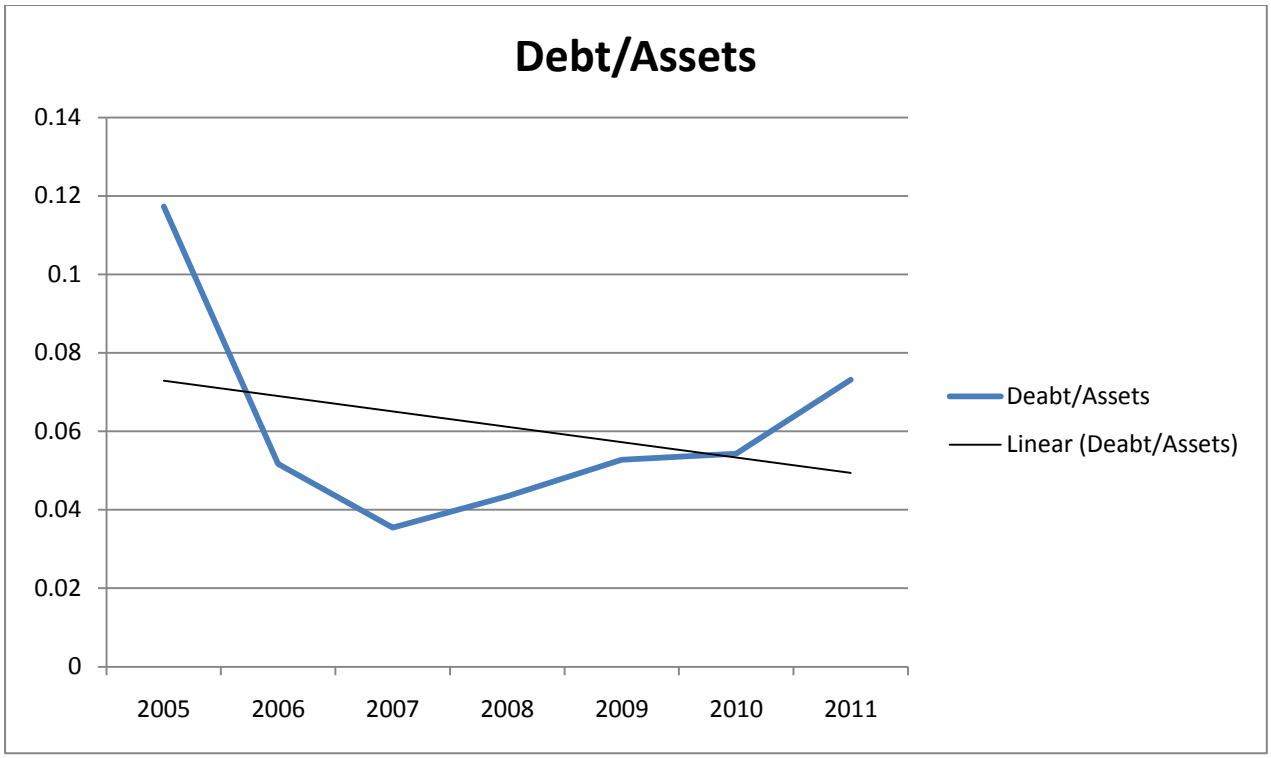


Figure 6: Debt/Asset Ratio for Aurepalle 2005-11

Source: VLS Raw data

The respondent of the Focused Group Discussion said that the loan amount advanced to a farmer depends on the value of their assets and their credit worthiness. In the above graph we see a reverse trend in the debt/asset ratio with a pick-up in again in the year 2011. The plummeting ratio could be the product of a good and consistent rainfall over the years, until 2011. Aurepalle has 26 Self-help groups with 15 members in each. The SHGs are comprised

only of women. These women practice regular savings and households with SHG members find it easier to get loans during shocks.

5. Marginal Propensity to Save (MPS)- Aurepalle

| Year | MPS |
|---|---|
| 2005 | 0.259 |
| 2006 | 0.151 |
| 2007 | 0.185 |
| 2008 | 0.301 |
| 2009 | 0.299 |
| 2010 | 0.184 |
| 2011 | 0.146 |

**Table 9:MPS for Aurepalle 2005-11**

**Source: VLS Raw data**

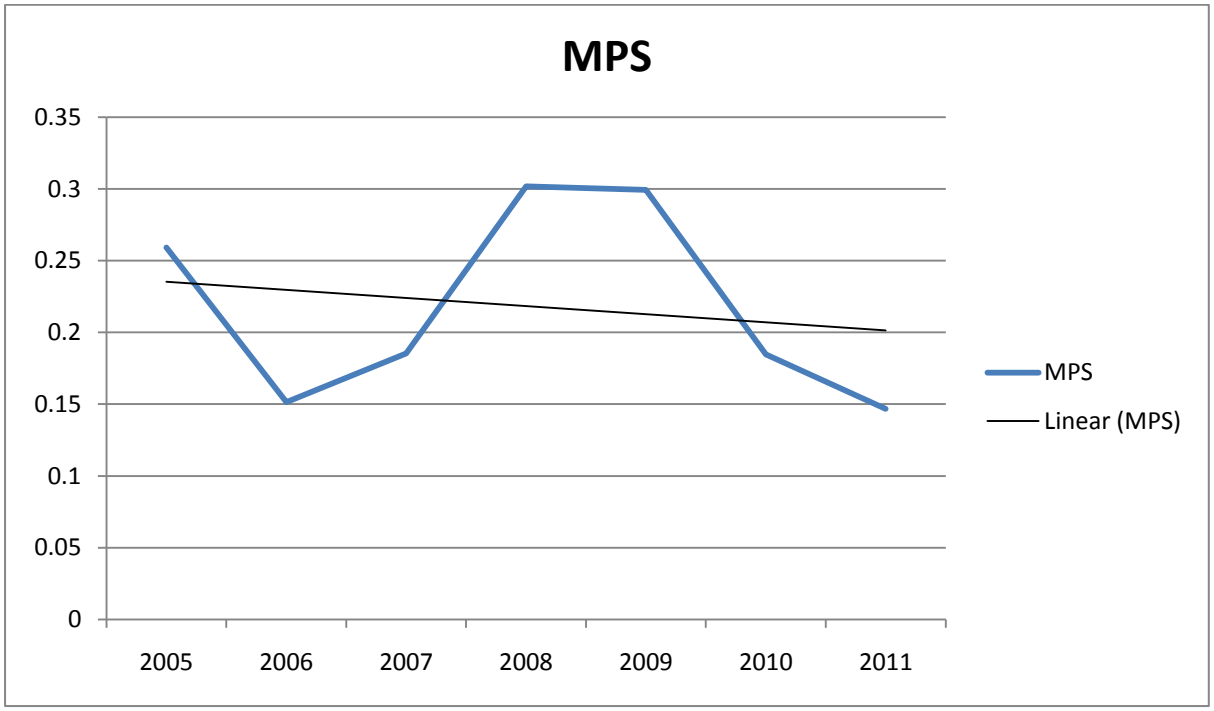


**Figure 7 : MSP for Aurepalle 2005-11**

Source: VLS Raw data

The year 2005 was a shock year with inadequate rainfall and hence we see fall in the MPS of the following year, as the savings may have been used for the purpose of paying previous debts. In 2007 the MSP picks up again to reach its peak in 2008 and 2009. However 2010 sees a drop in the level of savings as the Farmers confessed to have increased the amount of investment in their land in 2010. 2011 being a drought year, saw extremely reduced incomes and hence the ability to save reduced even further.

**Resilience Development Index –Aurepalle**

| Year | Gini Coefficient | Correlation Coefficient between crop and non-crop income | Food/Non-food expenditure | Debt/Assets | MPS | RDI_GM |
|---|---|---|---|---|---|---|
| 2005 | 0.340 | 0.264 | 0.431 | 0.117 | 0.259 | 0.290 |
| 2006 | 0.213 | 0.061 | 0.368 | 0.051 | 0.151 | 0.142 |
| 2007 | 0.330 | 0.299 | 0.350 | 0.035 | 0.185 | 0.204 |
| 2008 | 0.277 | 0.104 | 0.409 | 0.043 | 0.301 | 0.192 |
| 2009 | 0.277 | 0.331 | 0.411 | 0.052 | 0.299 | 0.253 |
| 2010 | 0.164 | 0.270 | 0.367 | 0.054 | 0.184 | 0.191 |
| 2011 | 0.359 | 0.437 | 0.436 | 0.073 | 0.146 | 0.265 |

**Table 10 :Resilience Development Index for Aurepalle 2005-11**

**Sources: Computed from VLS Raw data**

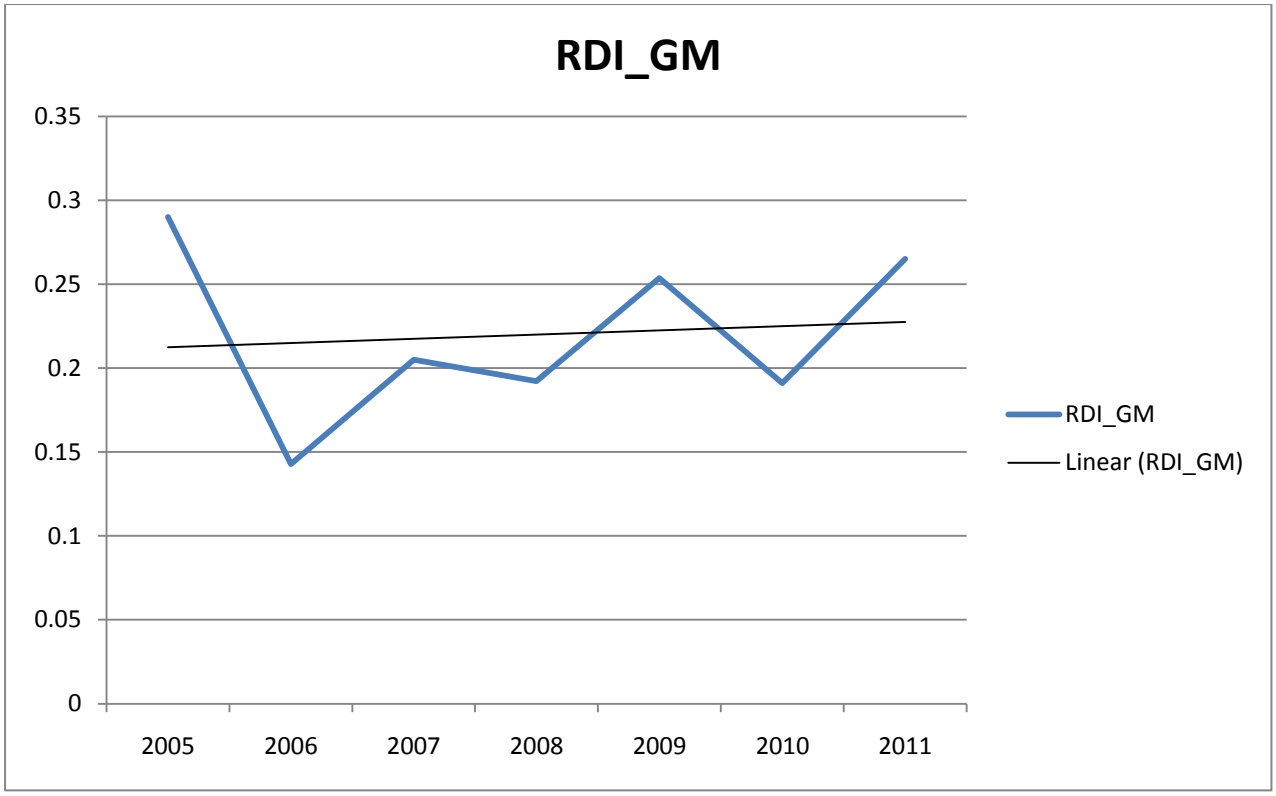


Figure 8 : Resilience Development Index for Aurepalle 2005-11

Source: Computed from VLS raw data

The Resilience Development Index (RDI) sees a slight increasing trendfrom 2005-11. However both peak points are in the years of 2005 and 2011, which from the data we know to be drought years. For explaining this behavior of the index we will have to delve deeper into the expenditure patterns of the farm households to understand their investment configuration, expenditures on other important heads and productive heads such as health and education.

The RDI does not incorporate or explain the role of community organizations, but social capital do explain certain fluctuation in the RDI. In their review, Bhattamishra and Barrett (2010) identified several different risk-management functions for community based organization; mutual insurance, insurance for major life events, savings and credit facilities, social assistance facilities, and public goods and services. Within these functions and groups a diversity of arrangements exists, from those with more formal codified rules to informal organizations that depend on social enforcement mechanisms. However, all are based upon bonds of trust and interpersonal relationships. In addition, Agarwal identified three roles that groups and local organizations play in adaptation to climatic change: " 1.Local institutions structure environmental risk and vulnerability, and thereby the nature of the climate impacts and vulnerability; 2. They create the incentive framework within which outcomes of

individual and collective action unfold, and 3. They are the media through which the external interventions reinforce or undermine existing adaption practice"(2010,179-180). Thus groups have an important impact on resilience by building on relationships of trust and interaction but also by increasing access to outside actors and resources ( Di Gregorio et al. 2012)and encourage the adoption of new technologies( Tumbo et al. 2013).

## 6. Cost of Recovery: Concept Note

The process by which the household regains its original position in terms of asset base, income and consumption expenditure to reach the previous standard of living, from which it had slipped on account of exposure to a particular shock whether climatic or idiosyncratic.
The speed of recovery is a determining factor in the determination of the level of resilience of a household.
Recovery can be brought about by

- Reducing the level of stocks/savings- Prior savings can be used for the purpose of asset or consumption recovery
- Increasing employment- supplementation of incomes by increasing employment opportunities both on and off farm.

Recoveries can be explored in terms of

- Total consumption recovery; where the absolute original consumption schedule is attained again after the exposure to shock
- Food consumption recovery; where the absolute consumption expenditure experiences a decline but the food consumption expenditure remains constant.
- **Failure,** in which both food consumption expenditure and overall expenditure experience a downfall, coupled with the inability to bounce back leading to a state of poverty-"Destitution". In these cases the assets are sometimes never recovered.

In exploring recoveries the time by which households recover from a particular shock, becomes of primary importance.

- For such an analysis, we can analyse the time for recovery of a household in a given year (taking into account if the particular household is hit by more than one shock in the same year or multiple shocks in the consecutive years).
- Next we can try to obtain if the household is still dealing with the after effects of the shock in the next year; if there is partial or total recovery.
- We do it again for the third year and the fourth year.
- Normally, by intuition, the phenomenon of total recovery will be experienced by the end of the $4^{th}$ year.

Therefore If,

Shock is an event that can trigger decline in well-being, which can affect individuals, a community, a region, or even a nation. – Word Bank

And,

Recovery is the process by which the household regains its original position in terms of asset base, income and consumption expenditure to reach the previous standard of living, from which it had slipped on account of exposure to a particular shock whether climatic or idiosyncratic.

Then,

Cost of recovery can be measured using simple microeconomic concepts called- Income elasticity of Demand (IED) and Demand estimation. IED is the %age change in the quantity demanded of a certain good due to a %age change in income. A shock would without a doubt change the level of income. The change in income would spill over to the level of demand.

\We can break demand into 2 goods basket: core consumption goods and other goods normally consumed by households. This will help to identify the class of shock. Higher IED for the core basket indicates a shock of class IV, while a lower IED of the first basket and a higher IED of the second basket would indicate shock of class II and III.

To obtain the IED we would have to regress Log(Q i.e. Quantity demanded) upon Log (I i.e. Income), giving us the regression equation, $LogQ= a+bLog(I)$, where b is the IED.

From past experiences we know that recovery on an average takes 3-4 years. Hence, we can set 3 as the target period for recovery.

Then,

1. We forecast the production value of the farming household in the target period.
2. Use the forecast and IED to project a demand for productive assets.
3. Forecast inflation in target period.
4. Use forecast of inflation and cost of per unit of asset to project cost of assets.
5. Multiply cost of assets with demand for assets.

Thus, we generate cost of recovery i.e. the expenditure incurred to go back to the original level of asset base and consumption.

## 7. Impact of Government Schemes Such as the National Rural Employment Guarantee Scheme on Resilience of Smallholder farmers against Shocks

Resilience and Vulnerability are fundamentally similar approaches to make the rural and farming communities more rigid and adaptable to shocks. Yet it is imperative to look at the grappling unpreparedness, against shocks, of farm families from the perspective of vulnerability as it points out the most susceptible class of households, thus giving greater scope for an efficient mechanism of redressal.
Resilience can be defined as adaptability to shocks, while vulnerability is just the absence of it.
e.g.: Rain water Harvesting can make a farming household immune to drought.

Agricultural communities face a hoard of challenges due to their heavy dependence on the mercy of weather conditions. They lie exposed to climatic fluctuations and even extremes and harsh weather conditions. Not only that, fluctuations in markets (local, national and international), change in government policies are all critical issues that determine the fate of farming households. The recent embargo on the Alphonso Mango in the European Union due stringent export policies is a case in point. (Times of India, Mar 15, 2014)

Over use of natural use and environmental degradation is another concern that hovers over these households. Exploitation of water resources, loss of soil fertility, soil salinity, water logging are excruciating issues that need immediate attention. These factors hold back optimal production and make the input-output ratio lopsided in favour of high productions costs. Not only that, these factors are also a deterrent against inducement of Horticulture, cash crops and other high value crops, making the farmers risk averse.
NSS report of 2003 shows that small and Marginal farmers against medium and large farmers have dis-savings, despite the same revenue per hectare.

**A vulnerable community or household typically has the following features:**

- Low savings (often dis-savings)
- Poor asset base
- Mortgages/Debts
- Small land holdings
- Subsistence/ semi-subsistence farming
- Household below or marginally above poverty line
- Typology of farmer and farming conditions

However, household with features converse of the mentioned above are also not entirely safe. Natural calamities and hazards of very high magnitude do not differentiate between income classes and land holding. We have intuitive known that in a natural calamity the rich are impacted more in terms of absolute numbers but proportionally the poor are brunt of the poor is far worse. This hypothesis has also been proved empirically by Christophe Bene in his paper 'Towards a Quantifiable Measure of resilience'.

When we classify the consequences of vulnerability based on severity, two broad consequences stand out that are then dealt with in a reverse mechanism of recovery:

- Effect on consumption ( food and non-food)
- Sale of assets/ reduction of stock

**How does a scheme like the NREGS help in reversing the effect of the consequences?**

The scheme works in 3-terms. In the short term the main objective of the scheme is to provide immediate employment in terms of casual labour. In the medium term this casual labour creates a community resource that can help in adapting to natural hazards and providing immunity. In the longer run, the scheme increases profitability by providing adequate physical overheads.

Resilience is the stepping stone for higher profits; however resilience itself doesn't come without a certain cash income. Thus, the scheme in a sense sets off the journey to resilience by providing cash income and profitability. The potential of the scheme is immense if channelized in the right direction. As per the article on impacts of NREGS in the EPW dated 28/12/2013 bulk of the works under NREGS are linked to natural resources, with water-works ruling the roost.

We can safely conclude that a scheme such as the NREGS brings outs a four-fold latent pathway for resilience and against vulnerability for rural households;

a) Cash income partly necessary for resilience
b) Alternate employment as a reverse mechanism of recovery
c) Backbone of resilience in terms of Asset building
d) Environmental restoration in under mechanized regions

An attempt at quantifying the impacts of the NREGS in the state of Andhra Pradesh has been made in a paper by Deininger and Lui based a Three-round survey of 4000 households in approximately 480 villages across 5 districts. Some of the interesting findings of the authors have been a follows:

- Income from NREGS improved protein intake in the short run 12%.
- Administrative data puts mean NREGS incurred transfers to programme participants in July'07 to June'08 period at Rs.3340 per Household, close to the increase in income of total casual labour (Rs.3304). This suggests that NREGS work is unlikely to have crowded out other forms of Casual employment.
- Levels of investment were uniformly higher during the programme period computed before; possibly reflecting the impact of NREGS related investment incentives while there was no significant pre-programme difference in the propensity to invest in land improvement between programme participants and non-participants in the pre-programme periods, the scene changed remarkably once NREGS came into the picture. The size of estimated impact has been 22.2% for all all HH, versus 22.6% for SC & ST Household and 22.0% for other caste households. This suggests uniformity in impact on all households regardless of castes.
- The regression run by Deingninger and Liu showed lack of significance for the programme participation dummy with pre-programme investment. This supports the notion that these are programme effects rather than pre-programme differences.

The NREGS, apart from building public works also builds private works on the lands of the marginalized sector. The marginalised sector has discussed above has a higher input cost. These private works can bring down their production cost eventually making them more profitable, thus, laying the foundation of resilience. The pioneering Ratanjoy project under

the NREGS, in Chattisgarh, serving the purpose of afforestation and prompting the production of biodiesel, has found a mention in the Limca Book of records.

**Special Case of a symbiotic relationship:**

The state of Punjab, that is the most advanced in terms of agriculture in India, has seen a unique phenomenon of reverse tenancy. The large farmers in the state of Punjab,lease in lands of the small and marginal farmers, to increase the economies of scale of scale from larger farm lands. This system provides the small and marginal farmers who were either practicing subsistence/ semi-subsistence farming or were incurring losses, a stable income I form of rent. They also invest their labour hours in casual labour either on their own land or on the lands of other big farmers. This way the large and medium farmer optimize production by expanding land under cultivation and using technology on the lands that would have otherwise been dissipated of its potential. This model of reverse tenancy can be emulated in other states where NREGS works find potent use in order to create self-sustaining systems that are mutually beneficial.

**The following table is a SWOT analysis of NREGA with reference to Resilience**:

| **Strengths** | **Weaknesses** | **Opportunities** | **Threats** |
|---|---|---|---|
| Long term assets | Administration | Growing population | Transfer of labour |
| Savings for unforeseen circumstances | Asset Quality Compromised | Heavy urbanization | Leakages in implementation and fractured bureaucracy |
| Financial Security for destitute | Completion of Work | Need for energy | Risk of unplanned growth |
| Climatic shock proofing | No guarantee of socio-economic impact | Need for food Security | Unproductive employment |
| - | - | Increase in GCA | - |
| - | - | High value crops and processing units | - |

**Table 11:Swot Analysis of the NREGS**

**Success Stories from the NREGS:**

In a village not far away from Sundarban Tiger Reserves, a rainwater channel built under NREGA has changed the face of the village's economy. So much so that the village which was once dependent upon illegal fishing, now has the irrigation facility to grow an extra crop each year.

Hiware bazaar, Ahmadnagar, Maharastra has an even better story to tell. The village has made use of the Employment Guarantee Scheme (EGS) for 14 consecutive years, until 2005, to increase per capita income by a staggering 16 times.

This one is a special case of Parsa Para gram-panchayat coming under Sarguja district, Chattisgarh, where a stop dam Kho-nalla was built in the year 2005-06, under the water conservation programme sanctioned under NREGA. Before the construction of the stop-dam the farmers grew just single crop in a year, as no means of irrigation were available. However with the construction of this stop dam, the agriculte of the village has revolutionized. Farmers have adopted double cropping. Apart from growing just paddy and wheat they started growing tomatoes, gram, onions, horticulture crops and cash crops like sugarcane, etc. Besides this the water table of the village has also improved.

The Chattisgarh Government, in 2006, took up a massive plantation programme under the NREGA that prompted production of Bio-diesel through sowing Ratanjot plants with an impressive survival rate of 98%.

….This is just a glimpse of the untapped potential of this programme.

The thought behind the NREG programme is to "hold the villagers by offering jobs in the villages in the short term while using their labour for building long term productive assets". The programme's main intention being- increasing the agricultural productivity of 60% the country's net sown areas that directly depends on rains.

**Conclusion**:

Resilience or vulnerability needs a generic index to ensure immediate action from policy and decision makers, a scheme such as NREGS can then be unleashed in its full potential. The demand for work under the NREGS is an indicator of growth in economic opportunities and not just that but also an indicator of rational expectations of households in terms of income. Given that, NREGS has had huge impacts on a variety of aspects such as nutrition, given the increase in consumption of proteins, cash income, community assets, private assets, natural

resource restoration and even resilience, it is inexcusable to let the potential fizzle out and keep the many vulnerable rural communities from benefiting.

## 8. Village Profile: Dokur

Dokur, a village in Mahboobnagar, Telangana was chosen for village-level studies by ICRISAT in 1975. The village has medium to shallow alfisol soil and experiences annual rainfall in range of 600-800mm. However, the rainfall distribution is erratic and has caused a major shift from farm sources to non-farm sources of income. The major crops grown in Dokur are generally paddy, castor, cotton and pigeon pea. Also, groundnut is grown between October to mid-February months.

Until 20 years back, maize and pigeon pea constituted 90% of the total area under cultivation. But today, there is a greater leaning towards growing castor and cotton.

The sources of income in the village vary from farm income to livestock, to migratory labour and even NREGS. In fact, the villagers grab every opportunity to make whatever money they can, including temporary employment opportunity. While rent is a common source of income for some of the wealthy families in the village, crop income and income from farm labour are the major sources of income for majority of the villagers during the main cropping season of July-February. Migration is also a common phenomenon during the peak season making farm labour very expensive.

Since the months of March and April are too hot, they are spent either as vacation time or for doing odd jobs under the NREGS. It is for this reason that the months of March, April and May are very tight as far as the household budget is concerned. In most households the non-food consumption dips during this period and even if it doesn't, it is actually maintained with the help of loans from family and friends.

On an average, a farmer in Dokur invests an amount of Rs. 10,000/- per acre in July to reap it's revenues in the month of January which is about Rs/-25,000 per acre. The same amount of Rs. 10,000 is then ploughed back into the farm during the next cropping season while the remaining amount is spent on food consumption, education of children, consumer durables like two-wheelers etc. and especially expenses during the festivals.

The main festive season in Dokur falls during January on account of 'Makarsankranti' and in February on account of the Hindu New Year. The month of February sees a 15- day celebration called 'Jatra' and involves huge expenses by every village household. The remaining amount from the revenue generated by crop income is used for repaying loans, investing in LIC polices and participating in private chit-funds by the Mahila Group.

The wealthy farmers manage during shocks but the poor and landless labourers definitely have to migrate in order to survive. Labour work comes down heavily so landless labourers

suffer the most. In an attempt to escape the misery of unemployment, most of the landless farmers shift to the cities in search of masonry work. Hyderabad being the closest city, most labourers, men and women, migrate to beat the seasonal or frictional unemployment. Semi-skilled labourers, who can practice caste occupation also go further away to cities like Mumbai, Pune, Panjim and come back only during festival seasons. The villagers point out that the landless labourers who had migrated actually end up earning more than the farmers now.

The price of land here has been increasing for the past 8 years. Despite experiencing droughts year after year, the farmers continue to be in agriculture because they hope for better days, ahead of the difficult times. In the 9 years while the Chandrababu Naidu government remained in power, there was drought every year, but no help came from the government. Even electricity was a major concern as it remained elusive during the major part of the day with power failure remaining a daily feature.

Finance is another big problem for the poor villagers as they have to take it from private banks at interest rates of 2-3% per month. Even the local 'Sahukars' charge interest rates at par with the private banks. In fact, during droughts the 'Sahukars' waive off interest of 1-2 months. But during droughts, nobody gives more loans, neither institutional nor non-institutional sources. As a result, a few farmers, particularly the smaller ones often lose their assets and are never able to recover it. The overall consumption of goods goes down but the consumption of food and liquor is maintained by the poor villagers at any cost.

There used be droughts before also like when there was a major drought in 2005 but there weren't enough options or alternative sources of income for the villagers But now luckily there is the National Rural Employment Guarantee Scheme, plus the proximity to cities and easy commuting options helps them find work in nearby villages. "The barbers go to Goa, their houses here in the village are like the ones in Banjara Hills. But they don't live here, they only come during vacations" remarked an elderly village person. "When there is a drought, migration soars, but even when there isn't a drought migration still persists. In fact, 10% of the village population has already migrated in search of better livelihood", says the Sarpanch.

Another major issue that the village suffers from is the expenditure on alcohol. The men in the village consume alcohol at least 5 days in a week. A small village comprising 3400 Acres, has as many as 20 alcohol chain shops. Not only does it bring down the productivity as confessed by the men during the focused group discussion, it also reduces their spending on other necessary items and cuts into their savings. The Mahila groups come in handy in these

situations as they engage in regular savings. There are 35 SHGs in the village with 15 members in each group.

The village also has a hospital called The Institute for Rural Health Studies, donated by Dr. P Bidinger, a former scientist at ICRISAT. The hospital has stacked medical records of its patients since 1985 and also has monthly visits by a psychologist and a dentist. The hospital is maintained quite impressively and even the government hires its services for government programs. The hospital gives out medicines at nominal charges to patients of Dokur and a neighbouring village called Kotakadra.

An exemplary case in point is the household of a famer called Narayan Reddy. He not only is a very successful farmer but also supplements his crop income by rearing livestock. He has two poultry farms with a capacity of holding 3000 chickens in each. The margin on every chicken is Rs.4 and the gestation period is 60 days, including a break of 20 days between two successive batches. Narayan Reddy also owns two oxen that help him sell 10 litres of milk every day. With this effort, Mr.Readdy has managed to educate one son from his household who is working as in Engineer in New York. His sister is just back from a 6months stay in the United States. He is an example of the great potential that the agricultural sector holds. There are many more such smart farmers who have managed to improve their own lives by moving forward in the right direction towards a more developed agricultural setup.

## 9. Comparison: Aurepalle, a village receiving consistent rainfall and Dokur, a village infamous for its climatic Volatility

Aurepalle and Dokur are two villages from the Mahboobnagar district of Telangana that are 70 and 130km away from the Hyderabad city, respectively. ICRISAT, in 1975, set up village level studies (VLS) in 6 different locations in India, Aurepalle and Dokur being two of those. Aurepalle has medium to shallow alfisol soil and rainfall of about 700mm annually. Dokur on the other had has a similar soil composition but a different story to tell in terms of rains. The average annual rainfall in Dokur, between 2005-08 ranged between 225-271.5mm(calculated from statistical citation in Dokur Village Profile). Also delayed monsoon and uneven rainfall during cropping season have become a major cause of misery in the recent years. Dokur experiences a drought every 3 out 5 years. Traditionally both Aurepalle and Dokur have been dependent on agriculture and the sector still remains to be the main stay of the village in terms of employment.

| | **Aurepalle** | **Aurepalle** | **Dokur** | **Dokur** |
|---|---|---|---|---|
| **Sources of income(%age)** | **1975-78** | **2001-2006** | **1975-78** | **2001-06** |
| Crops | 29.8 | 3.5 | 46.1 | 8 |
| Livestock | 25.5 | 7.6 | 2 | 7.3 |
| Farm labour | 32.8 | 13.2 | 46.3 | 11.1 |
| **Farm Income** | **88.1** | **24.3** | **94.4** | **26.4** |
| Non-farm sector | 11.9 | 44.9 | 5.6 | 49.8 |
| Caste occupations | 0 | 16.9 | 0 | 5 |
| Out migration | 0 | 13.9 | 0 | 17.4 |
| **Total** | **100** | **100** | **100** | **100** |

Table 12 : **sources of income- comparison between Aurepalle and Dokur**

**Source: VLS data**

The following chart compares the sources of income in the two villages during the years 2001-06:


**Figure 9 : income sources- comparison between Aurepalle and Dokur**

**Source: VLS data**

| Year | Total income in Aurepalle | Total income in Dokur |
|---|---|---|
| 2005 | 94879.18 | 75307.86 |
| 2006 | 94287.2 | 108878.7 |
| 2007 | 140860.6 | 140487.4 |
| 2008 | 97311.82 | 121694.2 |
| 2009 | 125410.7 | 138162.9 |
| 2010 | 160143.1 | 114577.8 |
| 2011 | 114069.8 | 169644.4 |

**Table 13 :Total Income –comparison between Aurepalle and Dokur**

Source: VLS Data

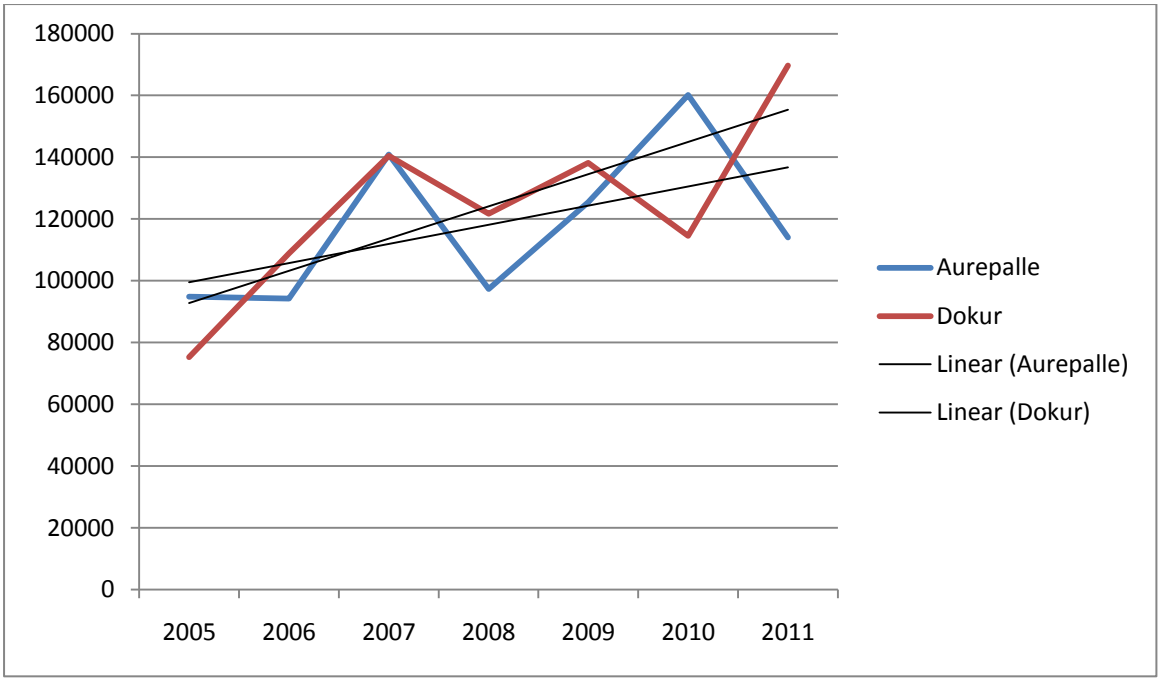


**Figure 10: total Income- Comparison between Aurepalle and Dokur**

Source: VLS data

The following table is a schedule of share of incomes in Dokur for the period 2005-11:

| Year | **share of crop income** | **share of live-stock income** | **Share of labour income** | **Share of salary income** | **Share of non-farm income** |
|---|---|---|---|---|---|
| 2005 | 0.273967 | 0.205104 | 0.138674 | 0.055688 | 0.326568 |
| 2006 | 0.235873 | 0.180879 | 0.070387 | 0.051493 | 0.461367 |
| 2007 | 0.278 | 0.172282 | 0.04694 | 0.08508 | 0.417698 |
| 2008 | 0.171874 | 0.180129 | 0.102907 | 0.081625 | 0.463465 |
| 2009 | 0.22788 | 0.202831 | 0.06169 | 0.076125 | 0.431474 |
| 2010 | 0.179945 | 0.181516 | 0.075759 | 0.072821 | 0.489959 |
| 2011 | 0.213627 | 0.263954 | 0.084225 | 0.087283 | 0.350912 |

**Table 14:Share of incomes in Dokur**

**Source: VLS data**

The following table is a schedule of share of incomes in Aurepalle for the period 2005-11:

| **Year** | **Share of farm income** | **Share of non-farm income** | **share of live -stock income** | **share of labour income** | **share of salary income** |
|---|---|---|---|---|---|
| 2005 | 0.288889 | 0.349776 | 0.228689 | 0.073362 | 0.059284 |
| 2006 | 0.314667 | 0.285732 | 0.23838 | 0.063004 | 0.098217 |
| 2007 | 0.409699 | 0.231762 | 0.22295 | 0.053995 | 0.081593 |
| 2008 | 0.180087 | 0.412386 | 0.264058 | 0.067244 | 0.076224 |
| 2009 | 0.164059 | 0.428842 | 0.28754 | 0.046891 | 0.072667 |
| 2010 | 0.265243 | 0.412822 | 0.18416 | 0.055927 | 0.081848 |
| 2011 | 0.148282 | 0.418853 | 0.27441 | 0.055062 | 0.103393 |

**Table 15: Sources of income in Aurepalle**

**Source: VLS data**

The following tables are correlation matrix of Share of incomes for Aurepalle and Dokur respectively:

| | *Share of farm income* | *Share of non-farm income* | *share of live-stock income* | *share of labour income* | *share of salary income* |
|---|---|---|---|---|---|
| Share of crop income | 1 | | | | |
| Share of non-farm sources | -0.92194 | 1 | | | |
| share of live-stock income | -0.66807 | 0.364693 | 1 | | |
| share of labour income | 0.161789 | -0.14524 | -0.22622 | 1 | |
| share of salary income | -0.10162 | -0.08784 | 0.125918 | -0.34153 | 1 |

| | *share of crop income* | *share of live-stock income* | *Share of labour income* | *Share of salary income* | *Share of non-farm income* |
|---|---|---|---|---|---|
| share of crop income | 1 | | | | |
| share of live-stock income | -0.03136 | 1 | | | |
| Share of labour income | -0.01711 | 0.224196 | 1 | | |
| Share of salary income | -0.29733 | 0.277131 | -0.39286 | 1 | |
| Share of non-farm income | -0.58857 | -0.67372 | -0.51023 | 0.0217 | 1 |

**Table 16:correlation matrix between crop and non-crop income- Aurepalle &Dokur**

Source: VLS Raw data

From the share of incomes we observe that in Aurepalle the share of crop income ranges between 15%-40% (approx.) and in Dokur it rather plummets to 17%-28% (approx.). The share of non-farm income is steady in both villages at a staggering 40%+. Despite agriculture being the main stay of people of Aurepalle & Dokur and frantic rains being experienced by farmers, the trend line of average annual income for both villages is upward sloping. We can comfortably say that this phenomenon occurs because both these villages are in close proximity to Hyderabad and have opportunities galore in the form of an International Airport, Fabcity( Computer chips manufacturer) and hoard of other IT sector companies. This has increased the shift from crop income to non-crop income as evidenced by by the strong correlation between share of crop income and share of non-crop income. In case of Aurepalle the correlation coefficient is a staggering -0.92 and in Dokur -0.58. This states that there is an inverse causal relationship between crop and non-crop income as a dip in the crop income leads to the income from employment in the non-crop sector, which is evidently available due to the proximity to the city.

## 10. Prototype: Smart Farmers

Case 1:

Name- Chittapala Malaya Pedda

Village- Aurepalle

No. Of Income sources- 3

This household grows cotton and paddy, depending on the rainfall and have their own bore-well. Besides they rent toddy trees at Rs.100/tree for a month and climb 10 such trees to collect juice worth Rs.25,000-45,000 annually. The months of June-July are very tough on expenses because most of the agri-inputs have to be bought during months, thus to supplement their investment the husband-wife duo take up work under the NREGS.

Case 2:

Name- Narayan Reddy

Village- Dokur

No. of Income Sources- 3

He not only is a very successful farmer but also supplements his crop income by rearing livestock. He has two poultry farms with a capacity of holding 3000 chickens in each. The margin on every chicken is Rs.4 and the gestation period is 60 days, including a break of 20 days between two successive batches. Narayan Reddy also owns two oxen that help him sell 10 litres of milk every day. With this effort, Mr.Readdy has managed to educate one son from his household who is working as an Engineer in New York. His sister is just back from a 6months stay in the United States. He is an example of the great potential that the agricultural sector holds.

There are many more such smart farmers who have managed to improve their own lives by moving forward in the right direction towards a more developed agricultural setup.

## 11. Conclusion and Discussion

The RDI uses individual parameters that have been chosen based on the consequence of shock they represent. The framework for the consequences of shocks, which was provided by Dr. Hans Binswanger included the following as immediate consequences of a shock, that could be either generic or idiosyncratic in nature: Fall in total consumption, Fall in food consumption, Decline in total Savings, Increase in total Debts, Sale of productive assets and Search for alternate employment. Apart from the consequences mentioned the RDI also considers the consequences that were gathered from review of literature on Resilience and Vulnerability of Small holder farmers.

In this study, RDI has been calculated for the Village Aurepalle for 7 consecutive years beginning from 2005 until 2011. The years 2005 and 2011 from the Village Level Studies data are known to be drought years, and hence the RDI sees its two peak points in these two years.

On running a regression with RDI as the dependent variable and components of RDI as the independent variable, we observe that the p-value for proportion spent on food is insignificant. The reason for this behavior of the variable is the almost-free food grains available from Public Distribution System. Also the respondents in Dokur maintained that even in the face of financial shocks their expenditure on food and beverages remains unaffected.

The RDI does not incorporate or explain the role of community organizations, but the concept of social-capital can explain certain fluctuation in the RDI. In their review, Bhattamishra and Barrett (2010) identified several different risk-management functions for community based organization; mutual insurance, insurance for major life events, savings and credit facilities, social assistance facilities, and public goods and services. Within these functions and groups a diversity of arrangements exists, from those with more formal codified rules to informal organizations that depend on social enforcement mechanisms. However, all are based upon bonds of trust and interpersonal relationships

The RDI still remains an exploratory concept and may have missed a few variables that add to resilience of farm households. However, if the concept is taken further, then it can prove to be a useful tool for decision makers in understanding the responses of farm households to shocks, their coping mechanism and gaps that need to be filled with policy changes.

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Zak, Bill, Robert Jose, Erika Kai, Juan Harry, and Kathleen Emily. 2000. “Lorenz Curve and Gini Coefficient ANSWER KEY 1 . Arrange the Data from Lowest to Highest . 3 . Divide into Quintiles . 10 / 5 = 2 Earners in Each Quintile . Bill and Zak Compose the Lowest Quintile or 20 % of Income Earners; Robert and Jose Compose the S”: 1–4.