INFORMAL RISK SHARING WITHIN CASTES IN INDIA

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DECLARATION

I hereby declare that this thesis is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.

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Summary

The Caste system in India is one of the oldest and enduring hierarchical systems of social stratification. Various studies have acknowledged the existence of caste-based risk sharing network and worked on its implications on migration and risk taking capabilities of individuals and households. In this study, I investigate the disparities in risk sharing faced by the members of different caste groups in rural India. I use the second wave of India Human Development Survey (IHDS) data to estimate the effect of caste on households' ratio of relative consumption and relative income, which I use as a measure of risk sharing. I find that among people belonging to the same income group, those from higher castes are better insured than the lower castes. I also find that credits from relatives form an important channel of risk sharing within castes. This implies that improved access to formal credit and insurance market, irrespective of their caste affiliations, would better insure households in rural India. This would help achieve better equality of opportunities and would reduce caste-based discrimination.

Keywords: risk sharing, consumption-income ratio, consumption smoothing, risk sharing networks, caste system, India

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1. Introduction

The accessibility of formal credit in the rural and agrarian areas of developing countries has been predominantly low. This situation is exacerbated by the fact that the agriculture based economies are exposed to higher risks due to their dependence on rainfall for irrigation and crop yield. This high risk, coupled with factors like informational asymmetry and moral hazard, prove to be deterrents to the establishment of formal credit market institutions in these areas. Also, people in these areas face consumption risk, which is even more difficult to insure against through formal channels. To deal with this absence of formal credit availability, rural economies tend to devise informal instruments for risk mitigation and are dependent on these measures despite their various shortcomings.

There is a large body of work which attempts to study the diverse informal insurance mechanisms and their efficacy in managing risks. According to the literature, these mechanisms can usually be classified into three major categories- 1. **Diversification**, with respect to crops or occupation. Diversification helps in managing risk but may lead to reduced average income. 2. **Consumption smoothing**, i.e. saving during the period of high income and consuming the saved income during low income period, so that consumption does not fluctuate as much with income. It includes buying and selling of assets to ensure even consumption. 3. **Risk sharing**, which involves mutually insuring members of a community or a village based network.

In managing risks, such informal risk mitigation mechanisms are common in Indian villages because of lack or absence of formal insurance market and acute shortage of proper irrigation system. Around half of India's farmland lacks

proper irrigation and the farmers are dependent on rainfall for irrigation (*RBI Bulletin, May* 2015). As for the availability of formal credit and insurance, there have been several attempts by the government to improve their accessibility in villages, like encouraging micro-finance schemes, introduction of 'Kisan Credit Cards' etc., but informal credit continues to constitute a significant part of total borrowing. Moreover, there is very little or no social security or safety net system provided by the government so as to insure people against consumption risk. According to Swaminathan(2012), access to formal credit is disproportionately low for the socially oppressed and marginalised classes and castes. Most of the formal credit has been obtained by the rich and high caste borrowers. Therefore, informal mechanisms to mitigate risk are still prevalent in rural India.

There have been various studies which try to analyse the effect and effectiveness of risk sharing in Indian villages within a caste based community network, which seems to operate quite strongly.

Risk sharing operating through caste might give rise to some differential effects, which might end up worsening the caste divide. This study assesses how risk sharing and insurance varies across castes in rural India.

To understand this, there is a need to understand the structure of the caste system in India, which has been elaborated in the next section. The following section includes the mechanism through which caste system operates and its potential effects on risk sharing. Section 3 provides a brief summary of the literature focussing on informal mechanisms for risk sharing, especially in developing economies. Section 4 describes the data used in the study and in Section 5, I

perform a preliminary analysis to investigate the potential effects of caste on risk sharing and the channels of risk sharing that might be at work. Section 6 introduces the model and methodology adopted for estimation, while Section 7 compiles and analyses the results obtained, followed by the policy implications of the study. Section 9 concludes the study.

2. Caste system and its effects on risk sharing

The Indian caste system is a complex hierarchical structure, which divides the population into endogamous groups. Each caste is further divided into sub-caste or 'jatis'. There are around more than 3000 jatis.

Assignment of caste is based on the 'accident of birth'. A child born to parents of certain caste would belong to the same caste. The basis of this stratification was occupation. Each caste was expected to perform certain tasks. There are five broad divisions in the caste system, with 'Brahmins' being the highest caste comprising of priests followed by 'Kshatriya', the warrior caste, 'Vaishya', the merchant caste, 'Shudras', the servant caste and 'Dalits', the untouchables. The lower castes did not have access to education and were expected to perform menial jobs.

This system of stratification has been sustained by endogamy, i.e. individuals are not allowed to marry out of their own caste group. In their study, Bidner and Eswaran (2015) propose the origin of caste system to be related to gender roles. They explain various aspects of castes including endogamy using the gender-based theory.

This 3,000 years old system has resulted in systemic discrimination and oppression of the lower castes and tribes. The Indian Constitution regards

discrimination based on caste illegal, and to provide the backward castes with equal opportunity, it specifies quotas for admission to educational institutions and applicants for government jobs. For this purpose, the constitution lists the castes which are eligible for the caste based reservation based on the disadvantage they face in the society. This gave rise to four major caste categories. The castes mentioned in the scheduled lists are called Scheduled Castes (SCs) and the listed tribes are called Scheduled Tribes (STs), these form the group of most disadvantaged sections. A few other castes which are not in as disadvantaged position as scheduled castes, but are still backward and need stimulus are called Other Backward Castes (OBCs). All other castes are called General/Forward Castes.

Even though laws against caste based discrimination are in place, Indian society remains to be largely divided on the basis of castes, and various studies have shown that backward castes still face lower social as well as economic status.

In the specification of caste as a unit of risk sharing, marrying within the sub-caste or jati plays a pivotal role. It enables the network to be closely tied and removes the barrier of information asymmetry to a certain extent. Also, it connects various households from different villages covering a wider area and ensuring better risk management.

Not complying with the caste rules or marrying outside the caste would make the risk sharing network inaccessible and this fear of losing the social and economic security might be an incentive to comply with the caste rules even for the lower caste.

Since this network works along caste lines and the lower castes are economically disadvantaged, I suspect differential effect of caste on consumption insurance. Most of the studies on insurance networks have focussed on its implications on migration, out marriage (marriage outside caste), or its effectiveness on an aggregate level. In this study, I would like to investigate if different castes are affected differently because of variation in the extent of insurance for each caste.

Difference in the level of risk sharing among castes would have significant implications for the welfare of individuals of that caste group. A better insured individual can not only enjoy stable consumption but can also take more risks, which could lead to higher payoffs. Thus, difference in insurance availability would affect the welfare of members of certain castes by not only affecting the consumption stability but also their risk-taking ability.

3. Literature review

Over the years of research focussing on income risks faced by the rural areas of developing countries, the risks have been identified to be consisting of a collective component and an idiosyncratic component. The collective component consists of common risks faced by the households living in the same region while the idiosyncratic risks are individual specific income risks (Dercon 2002; Dercon 2005; Townsend 1994).

This identification has enabled researchers to analyse the efficiency of the informal risk mitigation arrangements. For e.g.- Mace (1991) tests for the full consumption insurance by contending that there is full consumption insurance if individual consumption responds to aggregate risks but not to idiosyncratic

risks. The findings are mostly indecisive regarding acceptance of full insurance hypothesis, but there seems to be substantial insurance through informal measures. In this study, Mace did not try to identify the source of insurance.

Various other studies like- Townsend (1994), Townsend (1995), De Weerdt and Dercon (2006), Alderman and Paxson (1992), etc. have also tried to test for the full insurance hypothesis. Townsend (1994) uses the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) survey data for three villages in southern India and finds that although the hypothesis of full insurance is rejected, but each household's consumption is highly correlated with average village consumption. According to Alderman and Paxson (1992), the hypothesis of full risk sharing is extreme, requiring absence of moral hazard, information asymmetry and enforcement costs.

As mentioned earlier, majority of the instruments considered in the literature for informal insurance fall under the three categories of- diversification, (Binswanger and Rosenzweig 1993), which is used ex-ante i.e. before an individual faces risk, and two ex-post instruments of consumption smoothing (Coate and Ravallion 1993) and risk sharing (Fafchamps and Lund 2003; Rosenzweig 1988). Townsend (1994) also tries to pin down the instrument which contributes the most in insuring the income in the three south Indian villages studied. He finds that the largest contributors are credit and gifts. He has used a general equilibrium framework while testing for full insurance hypothesis since the use of various instruments and the markets concerned are interdependent. This study has set the benchmark of considering the pooled income of the community as a determinant of a household's consumption for the subsequent studies on risk sharing.

Since my work focuses on differential in risk sharing, following section concentrates on the literature on risk sharing.

Various studies on risk sharing consider different risk sharing networks which also depends on the social and cultural practices of the region studied. Studies like Townsend (1995) consider risk sharing at the level of village, Fafchamps and Lund (2001) contends that most risk sharing in rural Philippines takes place through a network of relatives and friends, Rosenzweig (1988) observed considerable risk sharing through family ties in village India and that these transfers are preferred over the use of credit markets. While, Munshi and Rosenzweig (2016) propose using the caste based risk sharing network for India.

Townsend (1995) looks at three economies comprising of, a set of counties of Thailand, sampled by Thai Socio-Economic Survey (SES); three villages in south India, surveyed by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and a set of villages in Cotê d'Ivoire, sampled by World Bank's Living Standards Measurement Section (LSMS), to examine the contribution of collective and idiosyncratic risk in the total income fluctuation and draw conclusions about the insurability of the income risk through various informal instruments available for risk mitigation. The study concludes that the incomes do not commove a lot even for households in the same village, which implies that idiosyncratic risks are more common as compared to collective risks and risk sharing at the village level is quite effective.

More recent studies try to build on the previous literature by analysing the effects of risk sharing, especially on migration. Morten (2016) contends that

migration acts as a measure of self-insurance and reduces the need for risk sharing while informal insurance reduces the need for migration. Specifically, if risk sharing increases, the level of migration is reduced by 21 percentage points. Morten finds that temporary migration is highly prevalent in rural India as it helps them insure during periods of economic shock without having to give up the safety net of risk sharing network.

Our study draws heavily from the methodology used by Munshi and Rosenzweig (2016) to measure risk sharing and redistribution. They try to explain the low rural-urban migration rate in India despite large spatial wage gap using a model of trade-off between consumption smoothing and income gains from migration. They contend that there are well-functioning rural insurance networks which are based along caste. They also propose using relative consumption and relative income ratio as a measure of risk sharing within castes.

Udry (1994) studies risk sharing through informal loans and contracts among people belonging to a community network. His study reports that in North-Nigeria risk sharing operates through these state contingent contracts which are extremely flexible between people who know each other well. The informal loans are negotiable with respect to the time of payment as well as the interest rate.

Few other studies use different methods like Euler equation (Deaton 1992) and repeated game models (Coate and Ravallion 1993) to analyse the effects and efficacy of risk sharing.

4. Data

I use the data from India Human Development Survey- II, covering the period from 2011 to 2012. It is a nationally representative survey of 42,152 households in 1420 villages and 1042 urban neighbourhoods across 35 states and union territories (Telangana was not established during the period of the survey) of India. This survey was jointly conducted by University of Maryland and National Council of Applied Economic Research (NCAER).

The survey questionnaire is divided into two sections- 1. Income and social capital questionnaire, which provides information about the household's location, composition, assets, production, expenses, wages, income and sources, education, consumption, debt, social network, etc. and; 2. Education and health questionnaire, which looks at aspects such as expenditure on education, condition of education for children between 8-11 years of age, marriage practices, water, sanitation and hygiene, morbidity, fertility, natal care and gender relations. For my study, I examine the data available from Income and social capital questionnaire.

The survey also includes the caste information for each household in the form of five categories which includes the four broad caste categories of Forward/general castes, Other Backward Castes, Scheduled Castes and Scheduled Tribes and an additional category of Brahmins. Brahmins form the top-most rung of the ladder of the caste hierarchy and the Forward/general caste category of the survey includes all forward castes except Brahmins. I drop the observations for which caste is either not specified or is categorised as 'other'.

For the analysis, I only examine Hindu households living in rural areas because caste system is predominantly a Hindu phenomenon[1] and Hindus form the majority of Indian population. According to the 2011 Census of India, 79.80% of the population are Hindus and according to the 2001 Census, it was 80.5%. For IHDS dataset, around 81.62% of the households are Hindus.

For regression analysis, I combine the categories of Brahmins and Forward/ General castes (except Brahmins) into a single category called Forward/General castes because the sample size of Brahmins is just 458, which is very small as compared to other caste categories and Brahmins form a particular caste among the group of Forward castes. So, it is justified to combine them with other forward castes.

However, for preliminary analysis, I analyse Brahmins separately because for preliminary analysis, I average the income and consumption for each quintile, so the sample size of Brahmins does not pose a problem and also Brahmins provide a good comparison, being the highest group in the caste hierarchy.

The annual per capita consumption is calculated by estimating the total consumption of the household, divided by the number of people in the household. To estimate the total consumption, monthly consumption expenditure on consumables like rice, wheat, sugar, oil, cereals, fuel, entertainment, etc. is multiplied by 12 and added to the annual expenditure on

[1] Although, the caste system has permeated to other religions in India, sometimes due to conversion of lower caste Hindus into other religions who were seeking asylum from caste based discrimination but including that would have complicated the analysis as there would be very little or no risk sharing within people of same cate group but different religion.

consumer durables such as jewellery, furniture, repair, school/college fee, vacations etc.

I drop the observations for which annual consumption per capita is either not specified or is non-positive as negative or zero consumption is theoretically inconsistent. I also drop those observations with unspecified or non-positive annual per capita income. Negative or zero income is mainly attributed to negative farm income, due to crop failure and high costs, but including that in regression analysis will not be appropriate, as I compare the ratio of relative consumption and relative income of each household as a measure of risk sharing[2]. Including negative values of income would make the ratio negative, wrongly implying lower risk sharing within castes.

As seen in Table 1, the annual per-capita consumption of households is quite varied, with a range of 99,457.3 INR and a standard deviation of 13,878.68 INR but the variation in consumption figures is much smaller as compared to the variation in annual per-capita income which has a range of 1,46,525 INR and a standard deviation of 19,908.25 INR. Minimum annual consumption is much higher than the minimum annual income, which suggests that there must be a mechanism in place to insure people against bad income period. The variation in income and gap between income and consumption is an under estimate, as I have dropped the observations with non-positive income values. I also trim the values of consumption and income at 1st and 99th percentiles to ensure that the outcome is not affected by outliers.

[2] Rationale for this is explained in Section 5.1 Risk sharing across castes.

I divide each of the four caste categories into 5 income quintiles. Relative consumption and relative income are calculated with respect to the average consumption and average income of the highest earning quintile of the respective caste.

Table 1: Summary statistics

Variable	Obs.	Mean	Std. dev.	Min.	Max.
Per-capita consumption	21,543	20,396.2	13,878.68	4,659.2	104,116.5
Per-capita income	21,543	19,690.53	19,908.25	960	147,485
Relative consumption	21,543	0.68	0.44	0.12	4.18
Relative income	21,543	0.40	0.39	0.014	4.03
Rel C/Rel Y	21,543	2.99	4.04	0.11	142.05
Household assets	21,538	12.88	5.87	0	31
Debt owed	20,136	41,254.64	130,569.2	0	6,000,000
Govt. benefits	21,543	1,405.07	3,588.87	0	126,700

5. Preliminary analysis

5.1 Risk sharing across castes

To check for the patterns of risk sharing across different castes I compare the ratio of relative consumption and relative income, averaged across households belonging to same income quintile and caste in Table 2[3].

[3] The dataset for preliminary analysis includes non-positive income values as I average the income across castes for each quintile and not compare the ratio of relative consumption and relative income for each household.

Note that,

$$\frac{Relative\ Consumption}{Relative\ Income}$$

$$= \frac{Consumption\ of\ Q_i\ household \Big/ Consumption\ of\ Q_5\ household}{Income\ of\ Q_i\ household \Big/ Income\ of\ Q_5\ household}$$

$$= \frac{Consumption\ of\ Q_i\ household \Big/ Income\ of\ Q_i\ household}{Consumption\ of\ Q_5\ household \Big/ Income\ of\ Q_5\ household}$$

$$= \frac{Absolute\ consumption\ income\ ratio\ of\ Q_i\ household}{Absolute\ consumption\ income\ ratio\ of\ Q_5\ household}$$

where Q_i represents i^{th} Income Quintile

The ratio being greater than one implies that there is risk sharing because if there is no risk sharing, then, on average, the relative consumption income ratio would be 1 for all income classes i.e. people would consume what they earn. If there is risk sharing, then lower income class would consume more than they earn i.e. their absolute consumption income ratio would be greater than 1 while for high income class it will be less than 1. So, the relative consumption income ratio of lower income class would be greater than 1.

This claim is true under the assumption that there are no savings. The savings rate in rural India is extremely low, therefore this assumption holds (Munshi and Rosenzweig 2016; Breza and Chandrasekhar 2015).

This table is a replication of Table 5 in Munshi and Rosenzweig (2016), except for the fact that they average relative consumption and relative income across castes and any caste based differentials cannot be deciphered.

It can be seen from Table 2 that the relative consumption-income ratio is decreasing across quintiles for each caste. The ratio is 1 for the 5th quintile of

each caste since I calculate the relative consumption and relative income for each quintile with respect to the respective average for the 5th quintile.

Similar decreasing pattern can be noticed in absolute consumption- income ratio as well, and for most of the castes, all quintiles, except the fifth, consume more than what they earn on average. This seems to confirm that there is risk sharing and consumption smoothing within the caste network.

Comparing the ratio of relative consumption to relative income, across castes, for respective quintiles, risk sharing seems to be highest among Brahmins, followed closely by the forward castes and other backward castes. Scheduled castes and scheduled tribes seem to be lagging behind in risk sharing.

However, it is worth noting that the absolute consumption income ratio is the highest among other backward castes. This doesn't necessarily imply that there is higher risk sharing among them than Brahmins since that might be through other sources like loans from money lenders etc. I suspect this because even the higher income quintiles of OBCs have higher propensity to consume. The lower resource pool available to the OBCs, which can be demonstrated by comparing the total per-capita income available to the members of each caste [4], might cause lower risk sharing within lower castes. Therefore, it is better to consider the ratio of relative consumption and relative income instead of the absolute consumption income ratio.

There is a huge difference between the average income of the highest earning quintile of Brahmins and OBCs (around 19,400 INR) while the difference between their average consumption is mere 6,257 INR (approx.). So, relative

[4] Total per capita income is calculated by dividing the total income of each caste by the population of each caste. Total per capita income for each caste is summarized in Table A.1 in the appendix.

consumption-income ratio is a better measure of risk sharing than absolute consumption-income ratio since it normalizes the consumption-income ratio of each quintile with respect to the consumption-income ratio of the highest earning quintile. While the absolute consumption-income ratio depicts the propensity to consume.

Table 2: Average relative and absolute consumption-income ratios for each quintile of different caste categories

Caste	Quintile	Average Income (in INR)	Average Consumption (in INR)	Relative cons-inc ratio	Absolute cons-inc ratio
Brahmin	1	4135.354	17216.71	7.604523	4.163297
	2	10521.87	19959.83	3.464962	1.896985
	3	18077.38	23576.16	2.382166	1.30418
	4	29990.65	29711.08	1.809535	0.990678
	5	67424.96	36913.58	1	0.547477
Forward (except Brahmin)	1	4847.836	19117.1	7.252125	3.943429
	2	11534.02	20534.08	3.274052	1.780305
	3	18911.98	23401.83	2.275643	1.237408
	4	30967.13	28508.97	1.693058	0.92062
	5	70186.79	38164.9	1	0.543762
OBC	1	3572.603	15823.79	6.937091	4.429205
	2	8149.031	16420.4	3.155945	2.015013
	3	12838.88	19044.52	2.323242	1.483347
	4	20280.83	22696.76	1.75279	1.119124
	5	48014.45	30656.34	1	0.638482
SC	1	4157.855	13560.52	5.256796	3.261423
	2	8381.106	14445.58	2.778099	1.723589
	3	12413.51	16008.19	2.078557	1.289579
	4	18421.45	18775.66	1.642802	1.019228
	5	39430.39	24463.42	1	0.62042
ST	1	2962.373	10773.03	5.639731	3.636623
	2	6302.641	11539.96	2.839502	1.830973
	3	9666.272	13181.67	2.11481	1.363676
	4	14842.5	15461.12	1.615453	1.041679
	5	35720.83	23033.58	1	0.644822

5.2 Channels of risk sharing

The main channel for risk sharing in family networks has been considered to be through gifts and transfers but caste loans also seem to be quite prevalent, especially for contingency consumption such as marriage and medical expenses. Using the IHDS-2 dataset I have calculated the percentage of loans taken from different sources for various purposes by households of different castes. Since the data doesn't provide with category for caste loans, I have considered loans taken from relatives as caste loans. Generally, people in the family networks belong to the same caste because of endogamous nature of caste system. So, my results will still be an underestimation of caste based loans as I just capture people belonging to the same family, ignoring other caste based networks. On the other hand, relatives come from the same caste as inter caste marriages in rural households are extremely rare.

It can be observed from Table 3[5] that loans from relatives constitute a considerable portion of loans taken for contingencies. Loans from banks form a major portion of total loans for all purposes, but for purposes where it is difficult to acquire a formal loan, like contingencies and consumption, loans from relatives play a significant role. Also, the caste loans form major source of loans given out at zero interest rate. Table A.2 summarizes the amounts lent at zero interest rate by different sources.

[5] In Table 3, investment includes house, land, business, education, etc., operating costs include agriculture/equipment, contingencies include marriage, medical expenses and consumption includes household consumption and automobiles.

Table 3: Percentage of loans by source and purpose for each caste

Purpose	Source	Brahmin	Forward	OBC	SC	ST
Investment	Employer	0.37	0.53	0.56	1.99	2.85
	Money Lender	31.45	9.33	15.14	18.08	15.68
	Friend	2.99	4.25	4.26	4.58	3.30
	Relative	4.41	10.14	10.75	11.33	11.41
	Bank	56.48	61.67	59.35	54.53	55.55
	Others	4.30	14.07	9.93	9.48	11.21
		100.00	100.00	100.00	100.00	100.00
Operating Cost	Employer	0.00	0.00	0.32	0.14	0.00
	Money Lender	5.55	6.52	10.14	12.59	9.99
	Friend	4.74	1.30	1.65	4.57	2.09
	Relative	3.00	3.20	2.83	5.96	3.27
	Bank	70.73	73.26	66.38	57.17	69.26
	Others	15.99	15.72	18.67	19.56	15.39
		100.00	100.00	100.00	100.00	100.00
Contingency	Employer	0.70	1.10	0.88	3.83	2.26
	Money Lender	14.25	19.11	34.24	38.32	31.55
	Friend	6.15	5.49	8.82	13.79	6.94
	Relative	30.21	26.70	26.61	20.36	17.51
	Bank	40.34	42.14	23.75	17.59	28.34
	Others	8.35	5.46	5.70	6.11	13.41
		100.00	100.00	100.00	100.00	100.00
Consumption	Employer	0.07	0.18	0.30	1.95	1.67
	Money Lender	4.47	4.55	13.81	26.57	26.28
	Friend	13.77	2.72	6.65	5.82	4.27
	Relative	16.16	5.22	11.12	9.63	10.42
	Bank	57.72	81.40	52.60	40.52	33.93
	Others	7.82	5.93	15.52	15.52	23.43
		100.00	100.00	100.00	100.00	100.00

6. Empirical framework

To analyse the differential effect of caste on risk sharing, I consider the following specification-

$$\left(\frac{Rel.\ C}{Rel.\ Y}\right)_i = \theta_0 + Frwd_i \sum_{j=1}^{5} \alpha_j Q_{ji} + OBC_i \sum_{j=1}^{5} \beta_j Q_{ji} + SC_i \sum_{j=1}^{5} \gamma_j Q_{ji} + ST_i \sum_{j=1}^{4} \delta_j Q_{ji} + \theta_1 Assets_i + \theta_2 Debt\_Owed_i + \theta_3 Inc\_Gov_i + \varepsilon_i \quad (1)$$

This specification, enables us to determine the effect of caste on risk sharing for each income quintile. The variables on assets and debt owed by the household would control for the difference in risk sharing due to reasons other than difference in caste. Townsend (1994) also finds that landless households are less well insured, this forms the basis of my specification.

I take the ratio of relative consumption and relative income as a measure of risk sharing (Munshi and Rosenzweig 2016), which is equivalent to the ratio of consumption income ratios. *i* represents household specific variables.

Rel. C stands for relative consumption and Rel. Y is for relative income. Relative consumption and relative income have been taken with respect to the average consumption and average income of the 5th quintile respectively.

I interact the dummy variables for caste with dummies for income quintiles to identify the effect of caste for different quintiles. So effectively, I have 19 dummy variables, Scheduled Tribes from fifth quintile being the base category. Frwd, represents forward/general castes, OBC for other backward castes, SC for scheduled castes and scheduled tribes are represented by ST. $Q_1, Q_2, Q_3, Q_4\ and\ Q_5$ represent the 1st, 2nd, 3rd, 4th and 5th quintile respectively. To asses if there is a significant difference in the degree of risk sharing between households belonging to same income quintile but different

castes, I check if values of (αj – βj), (αj – γj), (αj – δ j), etc. are significantly different from zero.

I control for income received through government programs using the variable *Inc_Gov* and for long term economic level of the household using the variable *Assets,* which is a scale that sums the number of possessions of a household on a scale of 0 to 31 which includes items like- pucca wall, pucca flooring, sewing machine, air conditioning, television etc. I also control for the debt owed by the household at the time of the survey.

Inc_Gov (which includes pension schemes, drought/flood compensation etc.), controls for the risk insurance provided by the government. *Assets* and *Debt_Owed* affect the loan taking capacity of the household, while the *Debt_Owed* might also affect the consumption decisions of the household.

I expect the relative consumption income ratio for higher income quintiles to be lower as compared to the lower income quintiles for the same caste.

7. Results and discussion

7.1 Regression results

I first estimate equation (1) but the results suffer from heterogeneity, so I calculate robust standard errors clustering over the district to which each household belongs. I choose to cluster over district as the traditional caste system implies spatial segregation of castes and remnants of which can still be observed (Deliège 1995; Dupont 2004). The results are presented in Table A.3. To analyse the differential effect of caste I need to compare the coefficients for different caste but same quintile, which would be given by the difference in

coefficients like α_1-β_1 for difference between Forward Castes and Other Backward Castes belonging to first quintile.

Table 4 summarizes such differences with respect to the Forward castes for each quintile. I find that for the first quintile the differential effect of belonging to Forward Caste is positive, significant and large in magnitude. On average, the ratio of relative consumption to relative income will be higher by 0.775 units for households belonging to Forward Caste as compared to the household of other backward castes, when both are from first income quintile. This difference in ratio becomes 2.075 when the Forward Caste household is compared to the household of Schedule Caste and 1.808 for Scheduled Tribes.

I infer that the situation is worse for Scheduled Castes, which includes Dalits and untouchables. These are the castes who face higher social stigma and hence the results seem to be consistent with the social structure.

The differences are insignificant for households belonging to the second quintile. The differences for third, fourth and fifth quintile are negative and significant. For third and fourth quintile, this might be the case because higher castes tend to have higher income and hence they do not require caste loans or transfers. This can be demonstrated by the fact that the average consumption income ratio of upper caste households of fourth quintile is less than 1, while it is greater than 1 for households of lower castes.

Comparing the values for fifth quintile, higher negative values of the difference depict that there is higher risk sharing among households of higher caste.

Table 4: Relative effect of caste on relative consumption income ratio w.r.t Forward Castes

Quintile / Castes Compared	Q1	Q2	Q3	Q4	Q5
Frwd-OBC	0.775**	-0.027	-0.357***	-0.389***	-0.255***
Frwd-SC	2.075***	0.162	-0.23***	-0.461***	-0.572***
Frwd-ST	1.808***	-0.125	-0.573***	-0.701***	-0.827***

***difference is significant at 1% level of significance
** difference is significant at 5% level of significance

7.2 Robustness checks

To check for robustness of the results, I try to control for some other variables which might affect risk sharing by affecting the riskiness of households or the resources available to the castes. So, to check for robustness I run the following augmented model-

$$\left(\frac{Rel.\ C}{Rel.\ Y}\right)_i = \theta_0 + Frwd_i \sum_{j=1}^{5} \alpha_j Q_{ji} + OBC_i \sum_{j=1}^{5} \beta_j Q_{ji} + SC_i \sum_{j=1}^{5} \gamma_j Q_{ji} + ST_i \sum_{j=1}^{4} \delta_j Q_{ji} + \theta_1 Assets_i + \theta_2 Debt\_Owed_i + \theta_3 Inc\_Gov_i + \theta_4 tota_{inc_{pc}} + \theta_5 perc_{irr} + \theta_6 Migrant + \varepsilon_i \quad (2)$$

a. Total income per capita (*total_inc_pc*)

I control for the per capita income of each caste within each district. This is to control for the resource pool available to some extent as most of caste based transfers or loans take place among people living close by. The coefficient for this variable is very small and insignificant. Also, adding this variable doesn't change other coefficients much.

b. Percentage of land irrigated (*perc_irr*)

I also include the percentage of land area irrigated out of the total land cultivated by the household. Agriculture is the main contributor to the income of most households in rural India and hence, agricultural risk is one of the major determinants of the risks faced by the rural households. For those households, which do not cultivate their own land, total irrigated land area affects their livelihood indirectly as they might be agricultural labourers or even for businesses in the region with poor irrigation facilities and bad monsoon might face losses due to decreased demand.

So, for this variable, I have calculated the percentage of irrigated land out of total area cultivated for households which cultivate on their own land. For households which do not cultivate on their own land, I have taken average of the percentage of land irrigated out of the total land cultivated in the district they belong to. The land cultivated and part irrigated also depends on the season, i.e. Rabi, Kharif and Summer. I have averaged the percentage of land irrigated across all three seasons.

I suspect that this might affect caste based risk sharing through the channel of caste loans because there is higher risk involved if there are poor irrigation facilities. Although, the coefficient on *perc_irr* is significant at 10% level of significance it doesn't affect the other estimates much. So, the estimates are robust to the percentage of land irrigated.

c. Migrant member in a household (*Migrant*)

Migrant is a dummy variable which takes the value 1 if the household has a member living outside the village. It includes temporary as well as permanent

migrant members. I include this as a control variable as many other studies suspect a negative relationship between migration and caste based risk sharing. I find that migration is negatively related to risk sharing but the effect doesn't seem to be significant. Also, the other estimates remain more or less unaffected by the addition of this variable.

The results of estimation with added controls are summarized in Table A.4 of the appendix.

8. Policy implications

The differential effect of caste on risk sharing makes the poor from lower castes doubly disadvantaged and renders them more vulnerable to income shocks. As Morduch (1999) pointed out, the informal insurance systems are very limited and public policy programs can be more effective in insuring consumption. These public policy programs should either target improvement in credit and insurance availability or try to reduce the risk faced in agricultural production.

Efforts should be made to improve formal credit availability for all, irrespective of caste and economic status. Issuance of Kisan Credit Cards(KCC) has been one of the major steps taken towards credit availability for agricultural sector. It also includes crop insurance to some extent, although the coverage for this program has often been questioned. Government can also regulate Non-Banking Financial Companies (NBFCs) to provide credit at lower requirements as they have a wider reach in remote areas as compared to banks.

Countries like Kenya have implemented an innovative mobile money service which facilitates payments and money transfers using mobile phones called M-Pesa without the need of smart phones and internet (Hughes and Lonie 2007). Such services facilitate more inclusive and easy money transfers, with reduced

transaction costs. Although, there are lessons to be learnt from the development of such services in Kenya. Mbiti and Weil (2011) find that most frequent users of M-Pesa are the urban, educated and affluent members of the society. While development of such services, the government should ensure that these are accessible to the lower sections as well, otherwise such steps could prove counterproductive and widen the gap in risk sharing between the members of higher and lower caste groups. Such easy and flexible money transfer services might also facilitate rural-urban migration as it will allow easy remittance.

The government of India has launched an app called Bharat Interface for Money (BHIM) for mobile money transfer but it is only available for android mobile phone users and requires an internet connection. Also, other money transfer services which do not require a smart phone or internet connection, do require the customer to have a bank account, which restricts the accessibility of such services. These services also need to be promoted more widely and illiterate and semi-literate people need to be taught how to use it.

There is a need for improvement in irrigation facilities to reduce agricultural risks since India's agricultural output varies enormously with the amount of rainfall experienced. Irregularities in monsoon makes households more vulnerable and dependent on informal sources of credit and transfers. This makes individuals more tightly bound by the restrictions of caste.

Index insurance is another innovative technique to insure households which face climate risk. Under such arrangement, insurance is paid out based on the index decided upon, for e.g. amount of rainfall experienced over an agreed period. This reduces the problem of adverse selection and moral hazard substantially making insurance more viable. Although, such contracts and products should

be designed carefully as there should be strong correlation between the index used and actual loss suffered (for details, see Barnett, Barrett, and Skees, 2008 and Hellmuth et al., 2009)

Another way to reduce farm risks is to promote diversification. More employment opportunities should be generated in non-agricultural sector in rural areas. Diversification would reduce the income and consumption risks faced by the households (Barrett, Reardon, and Webb 2001; Dercon 2002). Government can launch training programs and incentives to make individuals employable outside agriculture.

Though there have been efforts by the government to promote vocational training through various programs and by setting up vocational training institutes, but the employment rate of vocationally trained individuals in India has been low (Agrawal 2012). Training should be more quality oriented and relevance of the job training should be taken care of. There is a need for job creation for these trained individuals within their villages as low rate of rural-urban migration in India has been observed (Munshi and Rosenzweig 2016).

There is also a need for better social security system to insure poor against consumption risks. Workfare programs like Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) have been implemented, which promises 100 days of employment, otherwise they are provided with unemployment allowance. Such schemes can prove to be quite effective if implemented properly. A lot still needs to be done regarding the beneficiaries and the adequacy of the social security in India.

9. Conclusion

Most of the literature on risk sharing focuses on testing the efficiency and effects of risk sharing. This study tries to test the possibility of lower risk sharing among disadvantaged communities which are the backward castes in the context of Indian villages.

I find that backward castes have lower income, hence smaller resource pool, as well as lower proportion of risk sharing from the available resource pool. I start with analysing the consumption and income behaviour of households belonging to different income quintiles which hints towards risk sharing since households from low income quintiles tend to consume more than they earn, while those from higher quintiles consume less than what they earn. I also analyse the sources and purpose of loans taken by households from different caste groups. Caste based loans form a major source of contingency credit, which shows that caste based risk sharing operates not only through gifts and transfers but also through caste loans.

For the empirical analysis, I find that there is indeed a differential effect of caste on risk sharing and the network's tendency to facilitate consumption for households facing a bad income shock is constrained by the caste it belongs to. I find that the relative consumption income ratio for a household belonging to the lowest income quintile will be lowered by 0.775 units if it is an OBC household as compared to the upper caste household. This differential increases to 2.075 if a SC (which includes Dalits and untouchables) household is compared with an upper caste household.

Therefore, there is an urgent need for the government to improve access to credit markets or to introduce better methods of risk mitigation. Also, for other studies,

there is a need to take into account these differential effects faced by the disadvantaged communities while analysing the effects of informal insurance systems.

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Appendix

Table A.1: Income per capita available for each caste

Caste	total_inc_pc
Brahmin	27213.13
Forward	33674.02
OBC	21768.47
SC	16660.78
ST	13611.29

Table A.2: Amounts lent at zero interest rate by different sources

Source	Amount (INR)
Employer	1,632,000
Money Lender	1,794,300
Friend	10,199,450
Caste	32,825,850
Bank	6,293,900
NGO	130,000

Table A.3: Regression results (clustered over district)

VARIABLES		(1) Basic	(2) With Assets	(3) With Assets and Debt_Owed	(4) With Assets, Debt_Owed and Inc_Gov
Caste	Quintile				
Frwd	Q1	7.003***	6.986***	7.036***	7.036***
		(0.197)	(0.195)	(0.207)	(0.207)
Frwd	Q2	2.204***	2.065***	2.078***	2.078***
		(0.197)	(0.195)	(0.206)	(0.206)
Frwd	Q3	1.158***	0.822***	0.847***	0.848***
		(0.197)	(0.196)	(0.207)	(0.207)
Frwd	Q4	0.606***	0.0686	0.0729	0.0730
		(0.197)	(0.197)	(0.208)	(0.208)
Frwd	Q5	-0.0634	-0.843***	-0.828***	-0.827***
		(0.197)	(0.198)	(0.210)	(0.210)
OBC	Q1	6.013***	6.237***	6.260***	6.261***
		(0.180)	(0.178)	(0.189)	(0.189)
OBC	Q2	1.992***	2.114***	2.104***	2.105***
		(0.180)	(0.178)	(0.188)	(0.188)
OBC	Q3	1.181***	1.191***	1.204***	1.205***
		(0.180)	(0.178)	(0.188)	(0.188)
OBC	Q4	0.624***	0.459***	0.461**	0.462**
		(0.180)	(0.178)	(0.189)	(0.189)
OBC	Q5	-0.0281	-0.530***	-0.573***	-0.572***
		(0.180)	(0.179)	(0.191)	(0.191)
SC	Q1	4.554***	4.931***	4.960***	4.961***
		(0.191)	(0.189)	(0.201)	(0.201)
SC	Q2	1.643***	1.881***	1.915***	1.916***
		(0.191)	(0.189)	(0.200)	(0.200)
SC	Q3	0.936***	1.047***	1.076***	1.078***
		(0.191)	(0.189)	(0.199)	(0.200)
SC	Q4	0.507***	0.494***	0.532***	0.534***
		(0.191)	(0.189)	(0.200)	(0.200)
SC	Q5	-0.0461	-0.278	-0.257	-0.255
		(0.191)	(0.189)	(0.200)	(0.201)
ST	Q1	4.643***	5.175***	5.227***	5.228***
		(0.226)	(0.225)	(0.237)	(0.237)
ST	Q2	1.696***	2.179***	2.202***	2.203***
		(0.227)	(0.225)	(0.238)	(0.238)

ST	Q3	1.018***	1.392***	1.420***	1.421***
		(0.226)	(0.225)	(0.238)	(0.238)
ST	Q4	0.489**	0.751***	0.773***	0.774***
		(0.226)	(0.224)	(0.236)	(0.236)
Assets			0.101***	0.0955***	0.0955***
			(0.00471)	(0.00497)	(0.00497)
Debt_Owed				1.75e-06***	1.75e-06***
				(1.90e-07)	(1.90e-07)
Inc_Gov					-2.36e-06
					(6.73e-06)
Constant		1.140***	-0.121	-0.128	-0.126
		(0.160)	(0.169)	(0.179)	(0.179)
Observations		21,543	21,538	20,131	20,131
R-squared		0.264	0.279	0.278	0.278

Table A.4: Regression results with added controls (clustered over district)

VARIABLES		(1) Basic	(2) With total_inc_pc	(3) With perc_irr	(4) With migrant
Caste	Quintile				
Frwd	Q1	7.036***	7.049***	7.001***	6.944***
		(0.349)	(0.365)	(0.366)	(0.372)
Frwd	Q2	2.078***	2.092***	2.046***	2.048***
		(0.0958)	(0.140)	(0.135)	(0.137)
Frwd	Q3	0.848***	0.862***	0.805***	0.804***
		(0.0663)	(0.118)	(0.121)	(0.121)
Frwd	Q4	0.0730	0.0879	0.0308	0.0348
		(0.0774)	(0.134)	(0.135)	(0.130)
Frwd	Q5	-0.827***	-0.812***	-0.880***	-0.886***
		(0.105)	(0.137)	(0.137)	(0.129)
OBC	Q1	6.261***	6.264***	6.234***	6.198***
		(0.241)	(0.244)	(0.244)	(0.220)
OBC	Q2	2.105***	2.108***	2.078***	2.074***
		(0.0753)	(0.0794)	(0.0782)	(0.0800)
OBC	Q3	1.205***	1.209***	1.176***	1.178***
		(0.0665)	(0.0728)	(0.0691)	(0.0717)
OBC	Q4	0.462***	0.467***	0.433***	0.434***

		(0.0516)	(0.0573)	(0.0548)	(0.0538)
OBC	Q5	-0.572***	-0.567***	-0.615***	-0.618***
		(0.0868)	(0.0911)	(0.0889)	(0.0872)
SC	Q1	4.961***	4.961***	4.931***	4.916***
		(0.183)	(0.183)	(0.180)	(0.183)
SC	Q2	1.916***	1.918***	1.890***	1.887***
		(0.0856)	(0.0849)	(0.0851)	(0.0851)
SC	Q3	1.078***	1.080***	1.059***	1.064***
		(0.0577)	(0.0566)	(0.0541)	(0.0575)
SC	Q4	0.534***	0.536***	0.520***	0.521***
		(0.0496)	(0.0492)	(0.0457)	(0.0483)
SC	Q5	-0.255***	-0.253***	-0.276***	-0.275***
		(0.0508)	(0.0491)	(0.0500)	(0.0502)
ST	Q1	5.228***	5.225***	5.244***	5.231***
		(0.319)	(0.320)	(0.318)	(0.321)
ST	Q2	2.203***	2.201***	2.207***	2.213***
		(0.115)	(0.119)	(0.116)	(0.120)
ST	Q3	1.421***	1.420***	1.430***	1.445***
		(0.0959)	(0.0967)	(0.0980)	(0.0997)
ST	Q4	0.774***	0.773***	0.773***	0.780***
		(0.0746)	(0.0752)	(0.0763)	(0.0787)
ASSETS		0.0955***	0.0957***	0.0957***	0.0956***
		(0.0101)	(0.0102)	(0.0102)	(0.0102)
Debt_Owed		1.75e-06***	1.75e-06***	1.73e-06***	1.77e-06***
		(4.87e-07)	(4.86e-07)	(4.78e-07)	(4.99e-07)
inc_gov		-2.36e-06	-2.35e-06	-2.35e-06	-3.86e-06
		(6.10e-06)	(6.11e-06)	(6.14e-06)	(5.60e-06)
total_inc_pc			-1.22e-06	1.11e-06	1.30e-06
			(9.34e-06)	(9.17e-06)	(9.30e-06)
perc_irr				0.262*	0.240*
				(0.138)	(0.141)
Migrant					-0.0248
					(0.108)
Constant		-0.126	-0.109	-0.207	-0.199
		(0.125)	(0.173)	(0.181)	(0.175)
Observations		20,131	20,131	20,131	19,808
R-squared		0.278	0.278	0.278	0.281