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Are Banks Responsive to Exogenous Shocks in Credit Demand? District – level Evidence from India

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Background

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- This research is part of the research agenda on access to finance at the Centre for Analytical Finance (CAF) at the Indian School of Business (ISB)

Presentation scheme

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- Motivation and related literature
- Empirical Strategy
- Data and Variables
  - Bank Credit
  - Rainfall
- Results: Agricultural Credit and Drought
  - Documentation of Increase
  - Dynamics and source of Increase
  - New credit or non-payment of old credit?
  - Different effects for Drought-Prone districts?
- Results: Political Economy of Bank Response
  - Response in election years
  - Government relief expenditure and bank response
- Future Work

Motivation

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- In the existing literature on rural economies, bilateral credit and insurance arrangements with landlords, moneylenders, family and friends or group-based mutual savings and insurance arrangements such as ROSCAs have received much attention (Coate and Ravallion, 1993; La Ferrara 2003; Townsend 1995; Genicot and Ray, 2002)
- However, risks that individual and households face are often correlated, arising from common external shocks like floods and famine. Local arrangements fail to offer adequate diversification opportunities at a reasonable cost.
- As a result, individual decision makers adopt costly and inefficient strategies to smooth income or consumption (McCloskey 1976; Townsend 1993; Kochar 1999; Srinivasan 1989; Genicot 2002; Rosenzweig and Wolpin, 1993)

Motivation

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- "While these studies have advanced our understanding of local bilateral financial contracting and mutual insurance within poor communities, the study of financial intermediation has remained relatively neglected" (Conning and Udry, 2007)
- In this paper we examine whether the commercial banking system in the rural economy of India responds effectively to sudden changes in credit demand due to exogenous shocks
- In the process the paper contributes to several literatures including whether banks channel capital from depositors and other savers to uses with high marginal returns (Banerjee and Duflo 2005, 2008) and certain political economy issues.

Framework

- Rainfall and supply of credit are two key determinants of agricultural output in India
- Cole *et al* (2009) documents a strong relationship between agricultural output and rainfall
- The importance of agricultural credit to farming in India is inherently tied to the heavy dependence of agriculture on rainfall. Development of cost-effective rural credit systems has, therefore, been a top priority of the Indian government (Mohan, 2006)
- Ours is the first study to link poor rainfall to supply of agricultural credit. However, in popular discussions and the press the linkage is often taken as granted

  "Bank of Maharashtra CMD Allen CA Pareira said the bank is working on rescheduling agricultural loans for the (drought) affected farmers…and is organizing credit camps in various areas" (Financial Express, Aug 24, 2009)

Hypotheses

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I. *The amount of agricultural credit outstanding in a district is higher at the end of a drought year compared to a year without a drought.*

II. *The increase in agricultural credit outstanding at the end of a drought year is due to commercial banks extending more new loans rather than borrowers not making timely payments on existing loans.*

III. *In a year of drought, drought-prone districts experience a smaller percentage increase in agricultural credit than districts that are not drought-prone,.*

IV. *The provision of agricultural credit is higher when a drought coincides with a state election than when it does not.*

Data and variables: Rainfall

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I. Standardized Precipitation Index (McKee et al, 1993)

- The standardized deviation from the long period median
- Source: India Meteorology Department (Pai et al, 2010) have computed the SPI for 458 districts from 1901-2003
- Drought corresponds to SPI<-1

II. Percentage below Normal (PN) rainfall

- The percentage deviation from the Long Period Average (LPA)
- Source: National Data Centre, India Meteorological Department; data for 334 districts from 1992-2010
- Drought corresponds to PN>25% (robust to 20% and 30%)

Table 1A: Summary Statistics (Weather Variables)

Variables	N	Mean	SD	P25	Median	P75
SPI-based						
SPI measure	4015	0.039	0.917	-0.5	0.03	0.55
Drought (SPI<-1)	4015	0.110	0.313	0	0	0
PN-based						
Annual Rainfall (mm)	6182	1236.304	838.3516	703.2	1013.95	1490.2
% deviation from LPA	3989	4.498	39.226	-18.134	0.263	19.628
Drought (deviation<-25%)	3989	0.175	0.380	0.000	0.000	0.000

Data and variables: Bank Credit

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- Annual district-occupation data on
  - Amount of credit outstanding at the end of a fiscal year
  - Number of accounts with credit outstanding
  - Source: Basic Statistical Returns (BSR) of the Reserve Bank of India (1993-2010)

Table 1B: Summary Statistics (Bank Credit Variables)

Variables	N	Mean	SD	P25	Median	P75
Credit (in Million INR)						
Direct Agricultural	9152	1673.216	3007.372	222.86	683.2775	1835.815
Total Bank	9152	19402.23	161475.3	1049.257	3160.433	8892.059
Ratio of Direct Agri to Total Bank	9152	0.253	0.187	0.117	0.227	0.365
Number of Accounts						
Direct Agricultural	9152	45721.29	60360.47	12646.5	29194	57458
Total Bank	9152	124225.5	305073.5	35168.5	73128.5	135147.5
Ratio of Direct Agri to Total Bank	9152	0.421	0.179	0.305	0.428	0.541
Average Account Size (INR)						
Direct Agricultural	9151	44130.75	140757	13320.15	24479.22	44326.88
Total Bank	9152	86878.71	133281.4	25050.05	49404.22	95114.48
Ratio of Direct Agri to Total Bank	9151	0.598	1.121	0.377	0.552	0.739

Empirical Strategy

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$$AgriCredit_{dt} = \alpha + \gamma_d + v_t + \delta Drought_{dt} + \beta BankCredit_{dt} + \varepsilon_{dt}$$

- **Sample**
  - SPI-based : 434 districts from fiscal year 1993-2004
  - PN -based: 334 districts from fiscal year 1993-2010
- **Difference in difference (DID) methodology**
  - Wide cross-sectional and time series variation in occurrence of drought
  - Occurrence of drought is exogenous
- **Controls**
  - Log Total Bank Credit to reflect development of overall banking and other macroeconomic features of the district
- **Fixed Effects**
  - District, Year and State-Year

Summary of Results

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- Agricultural credit outstanding in a district is higher in drought years compared to non-drought years
  - No corresponding difference in other kinds of credit
  - No significant change in agricultural credit in neighboring districts
- The increase is driven by an increase in average account size rather than the number of accounts
- The increase seems to be due to new loans rather than non-payment of old loans
  - Increase is unrelated to previous relief expenditure
- Effect is similar in drought-prone and non drought-prone districts
- When a drought coincides with an election year, the effect is not different from that during other drought years
- No observed association between government response and bank response

Test of H1: Does agricultural credit increase?

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- Direct agricultural credit increases significantly in a drought year: 4.1% by SPI measure, 2.3% by PN measure (Table 2)
- In district-years where both measures are available and indicate a drought, the effect is even stronger: 8.3% increase (Table 2)
- In districts that are more rural (higher proportion of agricultural to total credit), the results are economically stronger: 5.1% by SPI, 2.9% by PN and 8.8% by both (Table 3)
- No similar increase observed in the average for neighboring districts (including and excluding drought-affected neighboring districts) (Table 4)
- No significant increase in number of accounts but average account size goes up (Table 5)
- Dynamics of credit: In the years before and after drought, agricultural credit is lower than in the drought year (Figure 1)

Results: Table 2

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Table 2: Agricultural Credit and Drought

Panel A: Log Direct Agricultural Credit

	1	2	3	4	5	6
Drought (SPI)	.045***	.041***				
	{.003}	{.001}				
Drought (PN)			.032**	.023*		
			{.019}	{.086}		
Drought (SPI and PN)					.084**	.083**
					{.046}	{.026}
Log Total Bank Credit	.436***	.376***	.395***	.365***	.383***	.335***
	{.000}	{.000}	{.000}	{.000}	{.000}	{.000}
Year FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
State-Year FE	NO	YES	NO	YES	NO	YES
Adj.R-squared	0.958	0.966	0.966	0.969	0.947	0.956
Observations	3274	3274	3311	3311	1397	1397

Standard errors are cluster adjusted at district level.

P-values are reported in brackets. Level of Significance: * 0.10, ** 0.05, *** 0.01

Results: Table 3

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Table 3: Agricultural Credit and Drought			
	Log Direct Agri Credit		
	1	2	3
Drought (SPI)	.051**		
	{.013}		
Drought (PN)		.029*	
		{.053}	
Drought (SPI and PN)			.088***
			{.001}
Log Bank Credit	.482***	.618***	.578***
	{.000}	{.000}	{.007}
Year FE	YES	YES	YES
District FE	YES	YES	YES
Adj.R-squared	0.955	0.971	0.952
Observations	1659	1722	680
Standard errors are cluster adjusted at district level.			
P-values are reported in brackets.			
Level of Significance: * 0.10, ** 0.05, *** 0.01			

*** Sub-sample of districts with an average ratio of direct agricultural credit to total bank credit above the national median**

Results: Table 4

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Table 4: Drought and Credit in Neighboring Districts

	Average Log Direct Agri Credit in Neighboring Districts		
	1	2	3
Drought (SPI)	-0.014		
	{.369}		
Drought (PN)		-.047***	
		{.005}	
Drought (SPI and PN)			0.053
			{.181}
Log Bank Credit	.349***	.400***	.380***
	{.000}	{.000}	{.000}
Year FE	YES	YES	YES
District FE	YES	YES	YES
State-Year FE	YES	YES	YES
Adj.R-squared	0.968	0.962	0.941
Observations	3227	3380	1398

Standard errors are cluster adjusted at district level.

P-values are reported in brackets.

Level of Significance: * 0.10, ** 0.05, *** 0.01

Results: Table 5

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Table 5: The Source of Increased Agricultural Credit

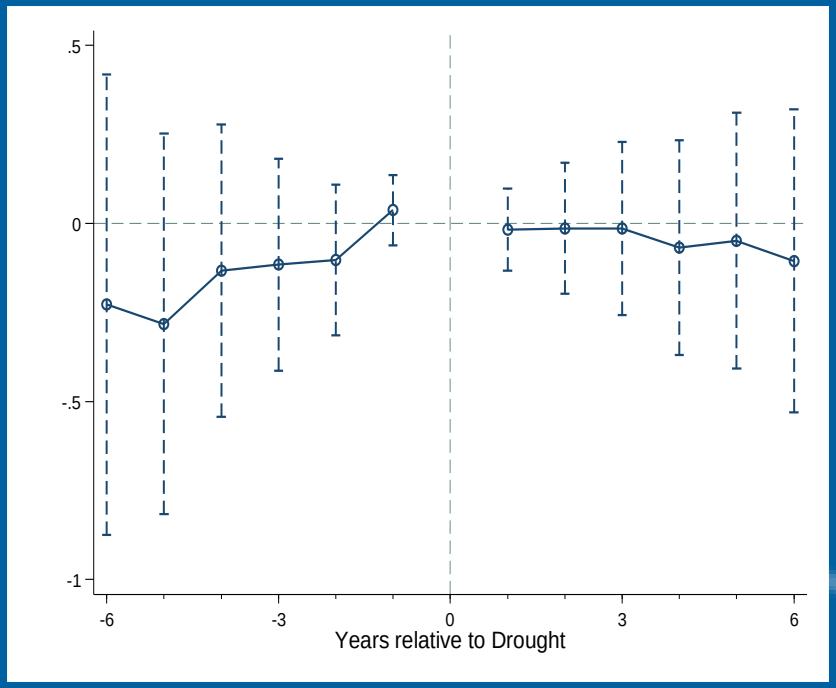
	Panel A: Log Number of Direct Agri Credit Accounts			*Panel B: Log Average Size of Direct Agri Credit Accounts*		
	1	2	3	1	2	3
Drought (SPI)	0.015			.025**		
	{.209}			{.032}		
Drought (PN)		0.014			0.016	
		{.150}			{.130}	
Drought (SPI and PN)			0.006			.081**
			{.777}			{.038}
Log Total Number of Accounts	.901***	.979***	1.023***			
	{.000}	{.000}	{.000}			
Log Average Account Size				.323***	.329***	.348***
				{.000}	{.000}	{.000}
Year FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
Adj.R-squared	0.98	0.972	0.98	0.945	0.964	0.955
Observations	3271	3287	1393	3205	3325	1374

Standard errors are cluster adjusted at district level.

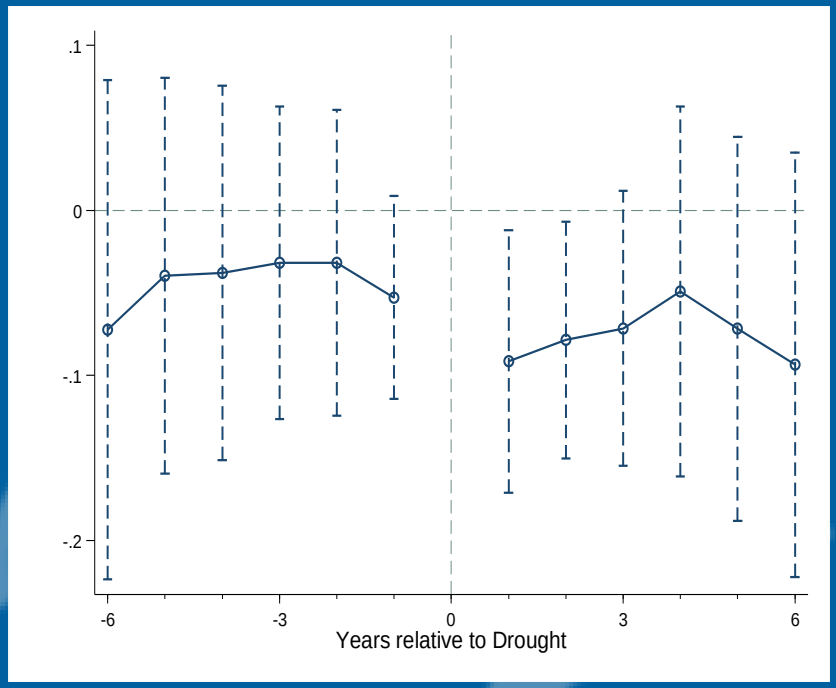
P-values are reported in brackets. Level of Significance: * 0.10, ** 0.05, *** 0.01

Results: Dynamics

$$AgriCredit_{dt} = \alpha + \gamma_d + v_t + \delta_1 D_{dt}^{-6} + \delta_2 D_{dt}^{-5} + \ldots + \delta_{11} D_{dt}^{5} + \delta_{12} D_{dt}^{6} + \beta BankCredit_{dt} + \varepsilon_{dt}$$



(a) Drought using SPI



(b) Drought using PN

* Test conducted only for districts which observed one drought in the sample period

Test of H2: Does increase represent new loans?

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- Increase in credit outstanding could be due to two reasons – new loans or non-payment of interest dues
- We see that personal loans do not show an increase in drought years (Table 6). A farmer in distress would default on agricultural loans as well as personal loans
- However, the farmer might strategically default on agricultural loans anticipating a waiver of farm loans
- We check for the possible basis of such expectations
- Increase in credit outstanding is not higher following years which register high government relief expenditure (Table 7)

Results: Table 6

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Table 6: Other Credit and Drought

	Panel A: Log Personal Loans			*Panel B: Log Total Bank Credit*		
	1	2	3	1	2	3
Drought (SPI)	-0.006			0.002		
	{.614}			{.918}		
Drought (PN)		-0.007			0.007	
		{.584}			{.624}	
Drought (SPI and PN)			-0.003			0.082
			{.919}			{.231}
Log Bank Credit	.392***	.474***	.315***			
	{.000}	{.000}	{.000}			
Year FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
Adj.R-squared	0.978	0.98	0.977	0.962	0.962	0.962
Observations	3272	3350	1397	3274	3363	1397

Standard errors are cluster adjusted at district level.

P-values are reported in brackets. Level of Significance: * 0.10, ** 0.05, *** 0.01

Results: Table 7

Table 7: Agricultural Credit and Government Relief Expenditure in Previous Drought

	Log Direct Agri Credit			
	1	2	3	4
Drought (SPI)	.096**	0.06		
	{.032}	{.155}		
Drought (SPI) * Previous DY Log (NP relief expenditure per capita)	-0.025	-0.008		
	{.138}	{.598}		
Drought (PN)			0.072	0.067
			{.263}	{.256}
Drought (PN) * Previous DY Log (NP relief expenditure per capita)			-0.018	-0.016
			{.386}	{.401}
Log Bank Credit	.480***	.456***	.391***	.384***
	{.000}	{.000}	{.000}	{.000}
Previous Drought Year Log (NP relief expenditure per capita)	-0.012	-0.016	0.034	0.026
	{.712}	{.632}	{.168}	{.268}
Year FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Region-Year FE	NO	YES	NO	YES
Adj.R-squared	0.967	0.97	0.976	0.977
Observations	1365	1365	1613	1613

Standard errors are cluster adjusted at district level.

P-values are reported in brackets.Level of Significance: * 0.10, ** 0.05, *** 0.01

Test of H3: Is the effect different for drought prone districts?

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99 drought prone districts identified from the Compendium of Environment Statistics, 2002

Table 8: Drought Prone Districts

	Log Direct Agricultural Credit					
	Panel A: Full Sample		*Panel B: Drought Prone Districts*		*Panel C: Non Drought Prone Districts*	
	1	2	1	2	1	2
Drought (SPI)	.039***		0.052		.040***	
	{.002}		{.199}		{.001}	
Drought (SPI)*Drought Prone	0.011					
	{.785}					
Drought (PN)		.035**		0.012		.033**
		{.027}		{.652}		{.041}
Drought (PN)*Drought Prone		-0.05				
		{.104}				
Log Bank Credit	.376***	.366***	.365***	.355***	.374***	.372***
	{.000}	{.000}	{.004}	{.003}	{.000}	{.000}
Year FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
Adj.R-squared	0.966	0.969	0.952	0.968	0.968	0.97
Observations	3274	3311	751	682	2523	2629

Standard errors are cluster adjusted at district level.

P-values are reported in brackets. Level of Significance: * 0.10, ** 0.05, *** 0.01

Test of H4: Is the effect different in election years?

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Dates of state elections obtained from the Election Commission of India website

Table 9: Elections

Log Direct Agricultural Credit

	Panel A: Whole Sample		*Panel B: Election Years*		*Panel C: Non Election Years*	
	1	2	3	4	5	6
Drought (SPI)	.041***		0.098	.044***		
	{.004}		{.210}	{.005}		
Drought (SPI)*Election Year	0.014					
	{.664}					
Drought (PN)		0.021			0.058	0.019
		{.172}			{.259}	{.237}
Drought (PN)*Election Year		0.017				
		{.488}				
Election Year	0.005	-0.014				
	{.550}	{.154}				
Log Bank Credit	.386***	.385***	.463***	.390***	.330***	.396***
	{.000}	{.000}	{.008}	{.000}	{.000}	{.000}
Year FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Region-Year FE	YES	YES	YES	YES	YES	YES
Adj. R-squared	0.962	0.967	0.95	0.962	0.961	0.967
Observations	3258	3311	664	2594	734	2577

Standard errors are cluster adjusted at district level.

P-values are reported in brackets.Level of Significance: * 0.10, ** 0.05, *** 0.01

Results: Interaction between Government Response and Bank Response?

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Data on state-wise relief spending from the RBI's Handbook of State Government Finances

Table 10: Agricultural Credit and Government Relief Expenditure

	Log Direct Agri Credit					
	1	2	3	4	5	6
Drought (SPI)	.097**	.087*				
	{.045}	{.064}				
Drought (SPI) * Log (Non-plan relief expenditure per capita)	-0.021	-0.017				
	{.287}	{.340}				
Drought (PN)			0.005	0.013		
			{.909}	{.787}		
Drought (PN) * Log (Non-plan relief expenditure per capita)			0.009	0.004		
			{.526}	{.807}		
Drought (PN and SPI)					0.051	0.101
					{.694}	{.523}
Drought (PN and SPI) * Log (Non-plan relief expenditure per capita)					0.012	-0.011
					{.809}	{.854}
Log Bank Credit	.439***	.388***	.393***	.384***	.383***	.363***
	{.000}	{.000}	{.000}	{.000}	{.000}	{.000}
Year FE	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Region-Year FE	NO	YES	NO	YES	NO	YES
Adj.R-squared	0.956	0.961	0.966	0.967	0.947	0.953
Observations	3242	3242	3262	3262	1397	1397

Standard errors are cluster adjusted at district level.

P-values are reported in brackets.Level of Significance: * 0.10, ** 0.05, *** 0.01

Future Work

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- Test whether results influenced by specific instances of past farm loan waivers
- Is bank response similar for excessive rainfall (floods)?
- Extend the time period covered to pre-liberalization era; check whether the response changed after liberalization