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Farmer Suicides in India and the Weather God

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Abstract

This paper examines the reasons for farmer suicides in India. Inability to get the right price, crop failures, and insurmountable debt are the factors that may drive the farmers to take this extreme step. A key factor for farmers being unable to get market prices is inefficient agriculture supply chain management. We find that the reasons for inefficient supply chain management include lack of reforms in the Agricultural Produce Market Committee (APMC) Act, low bargaining power due to small farm size, and lack of warehousing facilities. Crop failures happen because of poor irrigation facilities. Considering agricultural output and rainfall data from four different states in India we find evidence in favor of association between the cyclical component of agricultural output and rainfall data. Understanding this linkage is important from the perspective of formulating demand management policies (read, intervention by the government and central bank).

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Keyowrds: Agriculture output; Beveridge-Nelson Decomposition; APMC Act; Rainfall; India;

1. Introduction

Between 2012 and 2015 over 10,000 farmers committed suicides in India (Tiwary, 2017). When large numbers of suicides occur, it generates heated political debate. The ruling party typically defends its interventions such as farm loan waiver schemes, higher minimum support price (MSP), fertilizer subsidies, and tax free agricultural income, while the opposition parties criticise the government for not doing enough on the ground. MSP is the minimum price for a product established by the government and supported by payments to producers in the event of the market price falling below the specified minimum. While Dev (2009) attributes lacks of investment in rural infrastructures such as road connectivity (linking village markets to nearby wholesale market) and lack of cold storage facilities as factors prohibiting price discovery for agricultural produce, Kennedy and King (2014) find farmers' indebtedness resulting from crop failures and inability to sell, as reasons for suicides.

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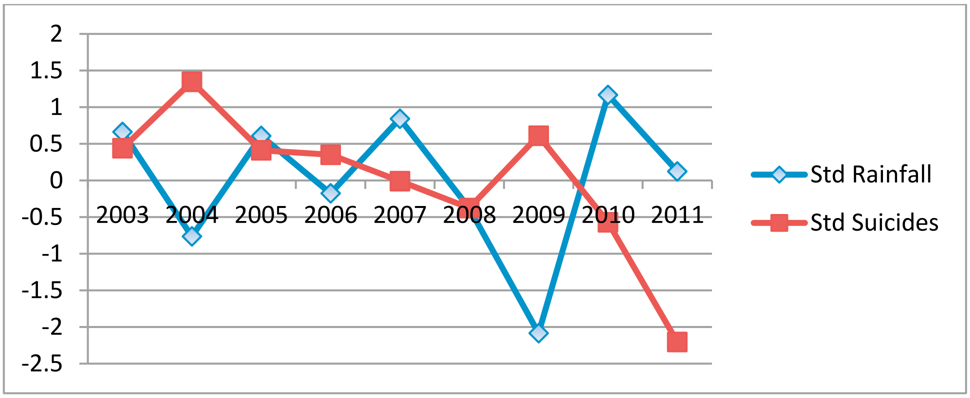
There is no comprehensive study that considers these factors together, and associates them to farmer committing suicides. This paper does that. Figure 1 shows, likelihood of a farmer committing suicide is more during bad-rain years. To have a meaningful comparison, we standardized rainfall and suicide data with respect to mean and variance, to make them unit free (read, std. rainfall and std. suicide).



Source: Rainfall Data (https://data.gov.in/keywords/annual-rainfall) and Farmers Suicide Data (http://agrariancrisis.in/2012/02/29/farmers-suicides-data-from-1995-2010-state-wise-gender-deseggregated/).

Figure 1: Rainfall and Farmers' Suicide

Subsequently, we test this hypothesis whether farmer suicide rates are strongly and negatively correlated with rainfall data. In the events of drought and floods, there is a likelihood about farmers' facing crop failure. The mechanism of this relationship is driven by the relation between cyclical component of agriculture output (read, volatility of agricultural output) and rainfall.

Additionally, other factors such as lack of reforms to the Agricultural Produce Market Committee (APMC) Act, low bargaining power resulting from small farm size, and lack of warehousing facilities are also responsible for as to why farmers may not realize the market price. The rest of the paper is organized as follows. Section II deals with issues leading to inefficient supply chain management. In Section III, we look at the effect of rainfall on the cyclical component of agriculture output. Section IV is about conclusion and policy recommendations.

2. Inefficient Supply Chain Management

In India, if farmers are to sell their produce, they have two options. First is to sell directly to the government at the MSP. The Central government procures 24 essential food items from the farmers through agencies such as National Agricultural Cooperative Marketing Federation of India Limited (NAFED) and Food Corporation of India (FCI). The second option is to take their produce to the nearby government-designated mandi (market) where in front of state officers they can auction produce to the brokers.

Typically, MSP is higher than the market price, and one would assume that farmers gain every time the government announces the MSP. However, farmers are seldom able to sell their produce at the MSP. First of all, every village does not have NAFED or FCI outlets. FCI currently procures a major portion of rice and wheat from a few selective states. 70 per cent of rice procurement comes from the Indian States of Punjab, Andhra Pradesh, Chhattisgarh, and Uttar Pradesh while 80 per cent of wheat procurement comes from Punjab, Haryana and Madhya Pradesh.

Farm size are small, and hence weak bargaining power of smaller farmers. In India, as much as 83 per cent of the farmers are smallholders, with less than 1 hectare of landholding. These smallholder farmers do not have access to cold storage facilities. The option for them is to sell their produce to the middlemen or traders. These middlemen form a cartel and at the time of auction offer a substantially lower price to the farmers.

Second, there is a need to undertake further reforms. Problems will continue to persist without further modification and harmonization of the APMC Act across states. It is interesting to note that the states that are vehemently opposing FDI in multi-brand retail are yet to execute any reforms in their APMC Act (see, Table 1). Reforming the APMC Act means farmers can sell their produce directly to the retailers and corporates, bypassing the middlemen.

Table 1: Stages of APMCS Reforms

Stages of APMC Reforms	Bihar	Punjab	Uttar Pradesh	West Bengal
Establishment of private market yards by a person other than market committee	0	1	0	0
Direct Purchase of agricultural produce from agriculturist by processor	0	1	1	0
To promote and permit e-trading	0	0	0	0
Establishment of private market yards by a person other than market committee	0	0	0	0
Contract farming provision	0	1	0	0
Single point levy of market fee	0	1	0	0
Single registration/ license for trade in more than one market	0	0	0	0
	0	4	1	0
Scores	0	0.571429	0.142857143	0

Source: Ministry of Agriculture and Farmers Welfare, Government of India (2016)

Reforming the APMC Act will require political will, something that various states government has to initiate. Some of the states such as Punjab, Tamil Nadu, Karnataka, and Himachal Pradesh, which has undertaken reforms in the APMC Act have already seen better price realization for their farmers. Reforming APMC Act is essential and equally important are government interventions, particularly when lack of rainfall lead to crop failures. In the next Section we look at how volatile rain patterns affect agricultural output.

3. Association between rainfall and the cyclical component of output

During the fiscal year 2013-2014, contribution of the agricultural and agriculture related allied activities was only 14 per cent of the Gross Domestic Product (GDP), despite providing the livelihood of around 70 per cent of the population. Volatile rainfall patterns lead to lower farm income and unequal income distribution. In India, rural-urban wage gap is at 45 per cent in comparison to around 10 per cent for China and Indonesia. India has around 260 million people living in poverty and 80 per cent of them live in the countryside. We hypothesized that for the states with inadequate irrigation facilities, farmers will experience a more fluctuating income. This implies farmers are less likely to commit suicides during good rainfall years. Intrinsic in this argument arise the necessity to test for the relationship between cyclical component of agriculture output and rainfall, which we do in our regression analysis. We use Beveridge-Nelson decomposition technique to decompose the state agricultural GDP into the trend and cyclical components. And, thereafter we look for association between cyclical component of GDP and rainfall data to examine how inadequate irrigation facilities may lead to volatile agricultural income.

3.1 Data

We have agricultural GDP data for four different states in India: Bihar, Punjab, Uttar Pradesh, and West Bengal. As we do not have matching rainfall data for other states in India, we limit our analysis to these four states only to study the effect of rainfall on agricultural output. The data consists of 49 annual observations from 1960-61 to 2009-10 measured in 2004-05 prices. The data used in this study are real agricultural state GDP data measured in millions of Indian Rupees. The data are obtained from Central Statistical Organisation (CSO), Government of India. Data on rainfall are sourced from Indian Institute for Tropical Meteorology, Government of India.

3.2 Results

Table 2: Cyclical and Permanent Components of Agricultural Output

Bihar

Identification: $$\Delta y_t = \underset{(0.0087)}{0.0077} - \underset{(0.129)}{0.632}\Delta y_{t-1} - \underset{(0.00003)}{0.0797}\varepsilon_{t-1} - \underset{(0.086)}{0.792}\varepsilon_{t-12} + \varepsilon_t$$

Solution:

$$y_t = y_0 + 0.0047 \cdot t + 0.0785\sum_{r=1}^{t}\varepsilon_r + 0.049 \cdot \varepsilon_t + 0.486 \cdot \left(\varepsilon_t + \varepsilon_{t-1} + \varepsilon_{t-2} + \cdots\cdots + \varepsilon_{t-11}\right)$$

Punjab

Identification: $$\Delta y_t = \underset{(0.0073)}{0.039} - \underset{(0.107)}{0.679}\Delta y_{t-5} - \underset{(0.057)}{0.869}\varepsilon_{t-5} + \varepsilon_t$$

Solution: $$y_t = y_0 + 0.023 \cdot t + 1.113\sum_{r=1}^{t}\varepsilon_r - 0.518 \cdot \left(\varepsilon_t + \varepsilon_{t-1} + \varepsilon_{t-2} + \varepsilon_{t-3}\right)$$

Uttar Pradesh

Identification: $$\Delta y_t = \underset{(0.0012)}{0.028} + \underset{(0.029)}{0.0448}\Delta y_{t\text{-}1} - \underset{(0.0391)}{0.0597}\Delta y_{t\text{-}1} - \underset{(0.025)}{0.96}\varepsilon_{t\text{-}1} + \varepsilon_t$$

Solution: $$y_t = y_0 + 0.027 \cdot t + 0.0393\sum_{r=1}^{t}\varepsilon_r + 0.946 \cdot \varepsilon_t$$

West Bengal

Identification: $$\Delta y_t = \underset{(0.0092)}{0.0388} - \underset{(0.0408)}{0.934}\varepsilon_{t-15} + \varepsilon_t$$

Solution $y_t = y_0 + 0.0388 \cdot t + 0.066 \sum_{r=1}^{t} \varepsilon_r + 0.934 \cdot (\varepsilon_t + \varepsilon_{t-1} + \varepsilon_{t-2} + \cdots\cdots + \varepsilon_{t-14})$

Standard errors are in parenthesis.

In the final step, we test for association between the cyclical component of agricultural GDP and rainfall. Agricultural output will increase in the event of normal rainfall, and will fall in the event of sub-optimal rainfall. This is particularly true if there is lack of physical infrastructure – making rainfall the sole driver for agricultural growth.

For estimation, we use Ordinary Least Square (OLS). The dependent variable is the cyclical component of state agricultural GDP, and the independent variable is rainfall. As heavy rainfall (flood) without proper irrigation facilities may harm crop production (some crops cannot withstand water stagnation) we take into consideration rainfall square as an additional explanatory variable. We estimate:

$$y_j^{tt} = \beta_0 + \beta_1 r_{j\text{-}1}^{t} + \beta_2 r_{j\text{-}1}^{2t} + e_j^t \quad (1)$$

where y_j represents the cyclical component of the agriculture GDP for the state j (j = Bihar, Punjab, Uttar Pradesh and West Bengal) at time period t. For the crops grown in these states, harvest time typically happens during February-March of every year. Therefore, we have taken the lag value for rainfall. That is, the effect of last fiscal year rainfall is expected to have an impact on the current year's harvest. All the variables are expressed in log form. The results are reported in Table 3.

Table 3: Effects of Rainfall on the Cyclical Component of Agriculture

Cyclical Component y_j^{tt}	Constant β_0	Independent Variables β_1 (Rainfall)	β_2 (Heavy Rainfall)
Bihar	6.689	0.216*	0.322***
Model diagnostics	(4.173)	(0.078)	(0.169)
Adj. $R^2 = 0.566$			
Punjab	8.556*	0.4112	0.788
Model diagnostics	(1.221)	(0.328)	(0.455)
Adj. $R^2 = 0.163$			
Uttar Pradesh	0.566	0.1002*	-0.0741**
Model diagnostics	(0.226)	(0.033)	(0.0382)
Adj. $R^2 = 0.623$			
West Bengal	3.822***	0.1855*	0.652
Model diagnostics	(1.722)	(0.097)	(0.462)
Adj. $R^2 = 0.486$			

Notes: * Indicates significance at 1per cent level; ** Indicates significance at 5per cent level; *** Indicates significance at 10per cent level. Standard errors are in parenthesis.

From the results, we find evidence about rainfall affecting the cyclical component of agricultural GDP. The results are particularly robust for the states of Bihar, Uttar Pradesh, and West Bengal (significant β_1 s). Interestingly, excessive rainfall has not affected agricultural output in Bihar (significant positive β_2). The case is opposite for Uttar Pradesh, where excessive rainfall has affected crop output (significant negative β_2). Bihar has a higher proportion of agricultural land (4.29 per cent) under coarse cereals in comparison to that of Uttar Pradesh (1.77 per cent).Coarse cereals such as sorghum, pearl millet and silver millet can withstand extreme weather conditions, and are unlikely to get affected by excessive rainfall and drought. Out of total agricultural land of Punjab, around 99 per cent is irrigated through canals or tube wells. This also partly explain why farmers from Punjab are able to grow a lot more non-cereal types crops such as fruits and Zucchini, and also are economically better-off in comparison to its peers. For the other states, Bihar, Uttar Pradesh and West Bengal (with relatively poor irrigation coverage)rainfall seems to be the predominant driver for growth in agricultural output. For example, considering net irrigation area as a percentage of net sown area, we find 85 per cent of the land is irrigated in Punjab, the corresponding figures for Bihar, Uttar Pradesh and West Bengal are 48 per cent, 72 per cent, and 43 per cent, respectively.

4. Conclusion

This paper's findings suggest a number of policy implications to improve the incomes of smallholder and subsistence farmers, and thereby reduce suicides. First is to rise above party-politics and ensure reforming the APMC Act. This will ensure farmers realize market price for their outputs.

Second is timely procurement through MSP. Lack of storage, adequate refrigeration and sanitation facilities degrade quality of perishable items, compounding the farmer loss. Growing horticulture crops always yield better returns in terms of income (almost four times more than the food grains), but also require better agricultural infrastructure such as cold storage facilities, better access to credits, etc., factors which are generally not forthcoming, especially for the small farmers.

Third is requirement of training, education, and urbanization. This will facilitate employment opportunities for the 70 per cent of Indians who are still dependent on the agriculture sector, by providing them smooth transition to other sectors such as manufacturing and services.

Fourth, instead of spending on input subsidies such as fertilizers, investment in rural infrastructure, such as electrification and building canals, will help to mitigate losses due to crop failures. Subsidies are not always targeted, with big farmers cornering benefit. Whereas, investment is rural infrastructure is likely to yield better outcome. Electrification will help setting up rural based small-scale industry, and canals will reduce dependence on the capricious weather. As our study indicates, fluctuation of agricultural GDP in three major states in India is due to supply-side shocks rather than demand-side factors. For the State of Punjab we did not find any statistically significant relation between the cyclical component of agricultural output and rainfall. The State government of Punjab has not only initiated reforms in the APMC Act but has also invested heavily in modern storage and transport facilities.

Finally, a better coordination between farmers and KrishiVigyan Kendra (agriculture research institutes set up by Government of India) for proper dissemination of research and rainfall related information. In fact, during January 2016, the Government of India launched FasalBimaYojana (Prime Minister Crop Insurance Scheme) with the government paying for bulk of the insurance cover against crops loss on account of natural calamity. Under this scheme, farmers will have to pay a uniform premium of 2 per cent for kharifcrops (sown during June-July), 1.5 per cent for rabi crops (sown during November-December), and 5 per cent for horticulture crops. The remaining share of the premium will be borne equally by the Centre and the respective State governments. So far as welfare of farmers are concerned targeted government interventions such as the crop insurance scheme is expected to yield better results.

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