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Weather shocks and local labor markets

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Introduction

Climate change is predicted to increase weather variability in twenty-first century. An important challenge for sustainable development in rural areas is the perceived increase in output volatility due to climate change. The variation in the area affected by precipitation shocks has increased in recent years in the study area (see Figure 1). This paper studies how shocks in precipitation, as one measure of weather variability, affect rural workers in the labor market and how these effects are related to infrastructure such as availability of roads. We study the role of road infrastructure in labor market responses of rural households to weather shocks. Our main hypothesis is that, better infrastructure is important factor that helps households in their response to shocks. A well established road system connects local markets for goods and labor to other places. It can help households to increase production more easily in a good year, and also allow them to travel for work or leisure or migrate to other places with less costs. A strand of literature have shown that economic activity in general is affected by weather. This effect on productivity and economic growth may not be similar in industrial and developing countries. Dell et al. (2008), for example, show that higher temperatures substantially reduce economic growth in poor countries but have little effect in rich countries. This difference in the impact of weather can be due to difference in infrastructure among other things, and may also exists within single countries. Burgess and Donaldson (2010) show that railroad access in colonial era India mitigates the impact of short-run adverse weather shocks on famines by enabling openness to trade. our paper adds to this literature by investigating how infrastructure, in the form of roads, affects the response to weather.

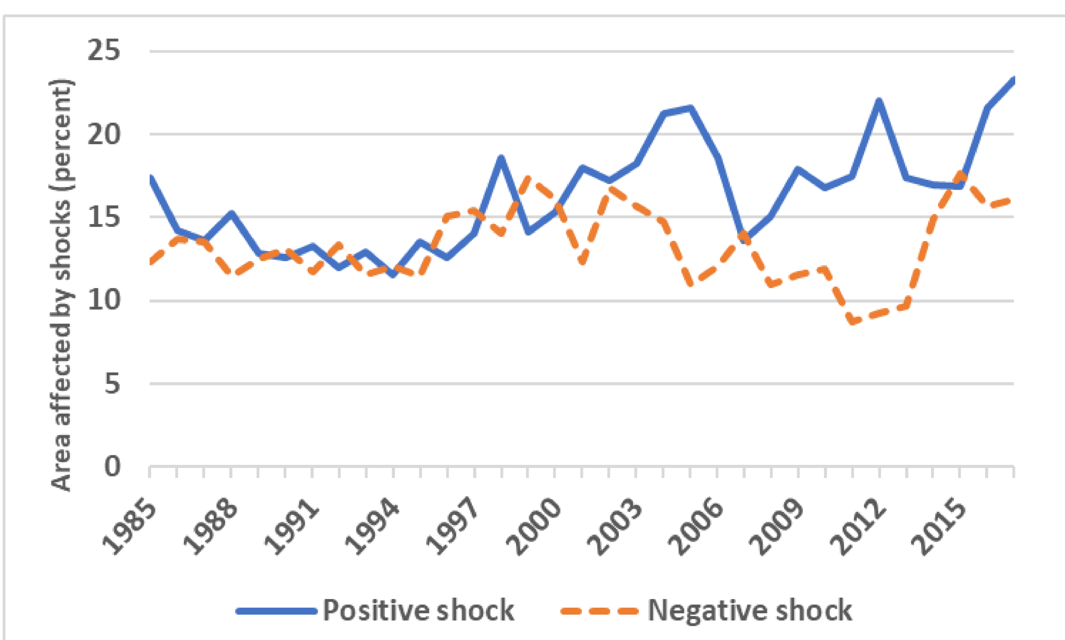

Fig. 1: Percent of Iran's area affected by shocks Notes: 10-year moving average. Source: Willmott and Matsuura (2001).

Data and Empirical Strategy

In this paper, we study the impact of precipitation shocks on the intensive and extensive margins of employment. We use individual-level panel data and match them with high resolution gridded precipitation data (at .5° or approximately 52 km intervals) at rural-agglomeration level. Our rich panel data consists of 655,202 observations in 1218 rural-agglomerations over the 2009-12 period. We also match the rural roads quality measure to these data at agglomeration level. Precipitation data is used to define positive and negative precipitation shocks separately. We define positive (negative) shocks as precipitation levels one standard deviation more (less) than the average precipitation in the 1995-2014 period in each agglomeration.

At the intensive margin of employment, we use a fixed effects model to estimate the following equation:

$$hpw_{ijt} = \alpha_1 * Pos.Shock_{jt} + \alpha_2 * Neg.Shock_{jt} + \beta x_{it} + \gamma_t + \theta_i + \epsilon_{ijt}, \qquad (1)$$

where hpw_{ijt} is the hours of work per week for person i, in rural-agglomeration j, in year t. $Pos.Shock_{jt}$ and $Neg.Shock_{jt}$ are positive and negative shock indicators. Estimation results presented in Table 2, and 4.

In order to find the effects of precipitation shocks the extensive margin, we estimate the following probit model:

$$y_{ijt} = \phi(\alpha_1 * Pos.Shock_{jt} + \alpha_2 * Neg.Shock_{jt} + \beta x_{it} + \gamma_t + \theta_i + e_{ijt}), \qquad (2)$$

where y_{ijkt} is an indicator for individual i, in rural-agglomeration j, in year t being employed (or in the labor force). The estimation results for this equation are presented in Table 3.

We look at the responses based on the quality of rural roads in each agglomeration. We create a measure of road quality based on the share of villages in each rural-agglomeration that have access to a dependable, paved, road based on the 2011 Census. As described in Table 1 rural-agglomerations vary based on their distance to cities, having temporary or permanent residents, access to electricity and including a school. Quality of roads is also very different 10% of agglomerations have no village with a dependable road, while and 5% of them have dependable roads for all villages in them. The average share of villages with a dependable road is 60 percent. We call an agglomeration "High road quality" if the share of villages in that agglomeration with a dependable road is more than median.

Table 1: Summary statistics of agglomerations

	Observations	Mean	Std	Min	Max
Distance to nearest city (km)	1,201	12,330.04	10,137.41	0.00	83,634.11
Share of villages with: (percent)					
Access to quality road	2,400	59.48	32.22	0	100
Permanent resident	2,400	74.78	23.37	02.70	100
Piped water	2,400	81.18	20.93	0	100
Electricity	2,400	92.28	13.56	0	100
School	2,400	68.37	24.23	0	100

Results

Table 2: Impact of precipitation shocks on hours of work

	All workers		Agriculture	
	(1)	(2)	(3)	(4)
Quality of rural roads:	Low	High	Low	High
Positive Precipitation Shock	-0.50	1.43**	0.30	2.19**
	(0.64)	(0.57)	(0.91)	(1.02)
Negative Precipitation Shock	-0.10	-0.24	1.15	-0.25
	(0.60)	(0.50)	(1.09)	(0.89)
Adjusted R^2	0.537	0.518	0.053	0.066
Observations	104214	114308	48143	51681

Table 3: Road quality and impact of precipitation shocks on extensive margin of employment

	Employment						Labor force					
Quality of rural roads:	Low			High			Low			High		
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Positive Precipitation Shock	0.00	-0.01	0.01	-0.01	-0.01	-0.02	0.01	-0.00	0.01	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Negative Precipitation Shock	-0.01	-0.01	-0.01	-0.01	0.01	-0.03**	-0.00	0.00	-0.00	-0.02*	0.00	-0.03**
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Adjusted R^2	0.421	0.386	0.241	0.427	0.359	0.240	0.414	0.370	0.223	0.426	0.360	0.219
Observations	103121	47393	55728	110048	51685	58363	103121	47393	55728	110048	51685	58363

Summary of findings

1. Positive precipitation shocks increase hours of work.
2. Increase in hours is for agriculture and industry sectors
3. The increase in hours of work is only observed in agglomerations with high road quality, implying road infrastructure is important for rural areas to gain from positive productivity shocks.
4. Negative precipitation shocks decrease employment and labor force participation of women, in agglomerations with high road quality.
5. Both positive and negative shocks have their impacts in locations with better road quality.

References

References

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Table 4: Impact of precipitation shocks on hours of work of non agricultural workers

	Service		Industry	
	(1)	(2)	(3)	(4)
Quality of rural roads:	Low	High	Low	High
Positive Precipitation Shock	-0.22	1.20	1.98	3.03**
	(1.11)	(0.88)	(1.50)	(1.43)
Negative Precipitation Shock	-0.54	-0.84	-1.32	1.56
	(0.94)	(0.72)	(1.19)	(0.99)
Adjusted R^2	0.073	0.068	0.122	0.076
Observations	28751	33245	9863	10831