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The last mile(s) in modern input distribution

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1. Introduction

- Most promising way of increasing agricultural productivity is through the adoption of modern inputs.
- However, several constraints to adoption. Most importantly related to profitability issues and lack of familiarity of farmers with new technologies.
- This paper looks at remoteness as a constraint to the adoption of modern inputs.



2. Background Ethiopia

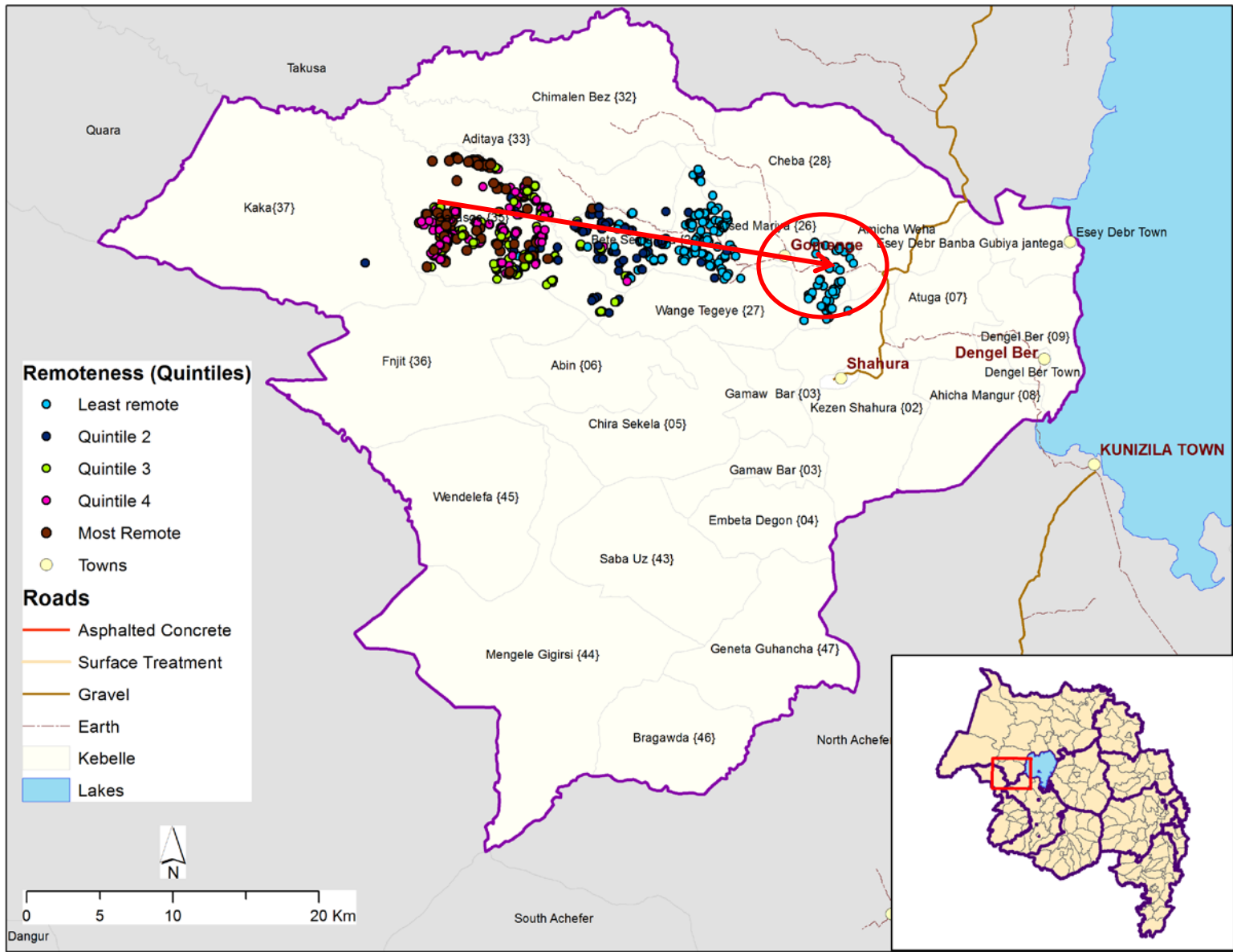
- Modern input use has until now contributed relatively little to the growth of agricultural productivity.
- As conventional sources of growth are running out (land), increasing use of modern inputs in Ethiopia is increasingly important.
- Rapid growth of fertilizer use over the last 15 years, but use of fertilizer is still low and below recommended levels.
- Fertilizer distribution is exclusively done by cooperatives; share of private sector very limited.



3. Data

- Sample area was selected purposefully in the remote area of Amhara region.
- Households' circumstances differ because of different transport costs but not because of land characteristics.
- 851 households interviewed over a 35 km distance (from less remote to most remote).
- Detailed questions asked on transaction and transportation costs, on use of extension agents and on the use of modern inputs





3. Data

No significant effect of remoteness on adjusted yields and household characteristics

	Unit	No. of obs.	Mean	Effect transport costs*	
				Coeff.	t-value
Adjusted cereal yields (yields adjusted for weather shocks and input use)					
Maize	quintals/ha	590	19.88	0.002	0.08
Millet	quintals/ha	521	13.86	0.022	1.46
Sorghum	quintals/ha	607	14.56	0.025	1.12
Teff	quintals/ha	325	6.81	-0.011	-1.12
Household characteristics					
Household size	number	851	5.77	0.006	1.49
Gender of the head of household	male=1	850	0.91	0.004	1.23
Number of years of schooling	number	847	1.64	-0.002	-0.41
Age of the head of household	years	850	40.94	-0.002	-0.07

4. Modern input use and perceived constraints

	Chemical fertilizer	Improved maize seeds
Did the household use...	80.2	26.0
Major reason for not using modern input		
I lacked the money at the time of need	39.7	47.6
No need	17.0	0.0
No need because of share cropped out	14.2	5.4
Modern inputs are too expensive	12.8	8.9
I do not have enough land	5.0	2.7
I was unable to find them	5.7	10.4
There is too much hassle	2.1	2.9
I do not know how to apply them	2.1	2.3
Other	1.4	2.7
I don't grow maize	0.0	17.2
Total	100.0	100.0

5. Transaction costs (before acquisition)

	Chemical fertilizer	improved seeds
Number of trips made before each transaction...		
... before the farmer was able to pick up modern input		
0 trips	52.54	65.87
1 trip	15.75	12.98
2 trips	16.05	12.5
3 trips	9.17	4.8
> 3 trips	6.49	3.84
Total	100.0	100.0

Farmers often have to do extra trips before they are able to pick up modern inputs



5. Transaction costs (before acquisition)

	Chemical fertilizer	improved seeds
Reasons for the unsuccessful trip:		
Form issues	39.4	46.9
Form did not have signature of an official	8.4	11.2
Not enough people on the form	31.0	35.7
Management cooperative	52.4	37.1
Cooperative office not open	15.5	11.2
There was no supply of modern inputs	9.2	10.5
Too long queue	23.7	14.0
Money collector was not there	4.0	1.4
Looking for/met with committee member	4.2	5.6
Other	4.1	10.5
Total	100.0	100.0

5. Transaction costs (acquisition)

		Chemical fertilizer	Improved seeds
Average time spent on acquisition trip:			
Travel there	hours	3.2	2.3
Time at location	hours	5.5	5.0
Travel back	hours	3.6	2.0

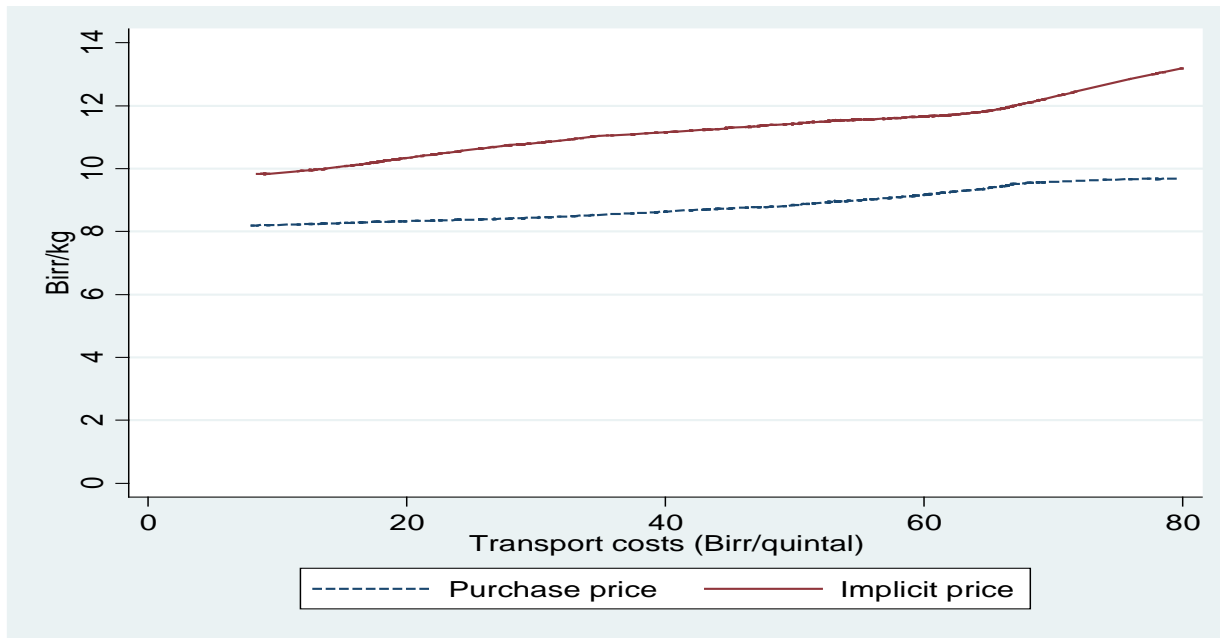
A farmer in these remote areas spends on average more than 13 hours on a fertilizer acquisition trip



6. Profitability of fertilizer use

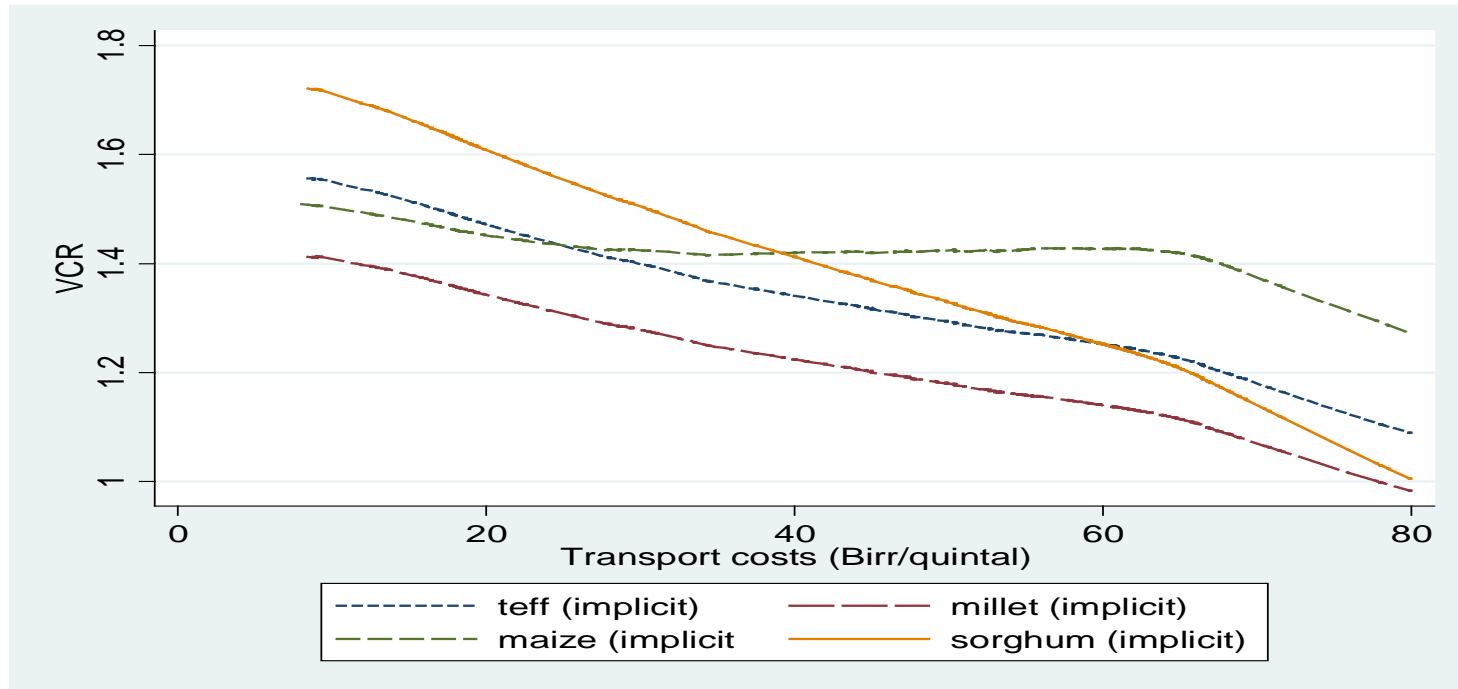
- Profitability of fertilizer use explained by two factors:
 - 1) the technical response of output to fertilizer use;
 - 2) the relationship between output prices and fertilizer prices.
- The value cost ratio (VCR), combining both of these measures is the ultimate yardstick that is often used to evaluate profitability of fertilizer.
- A rule of thumb is that the VCR should be greater than 2 to provide enough incentives for farmers to use fertilizer.

Fertilizer prices by remoteness



Farmers that live at about 10 kms from the distribution center face per unit transportation and transaction costs as high as the cost to bring fertilizer from international port to the input distribution center

Profitability of fertilizer use: VCR by remoteness

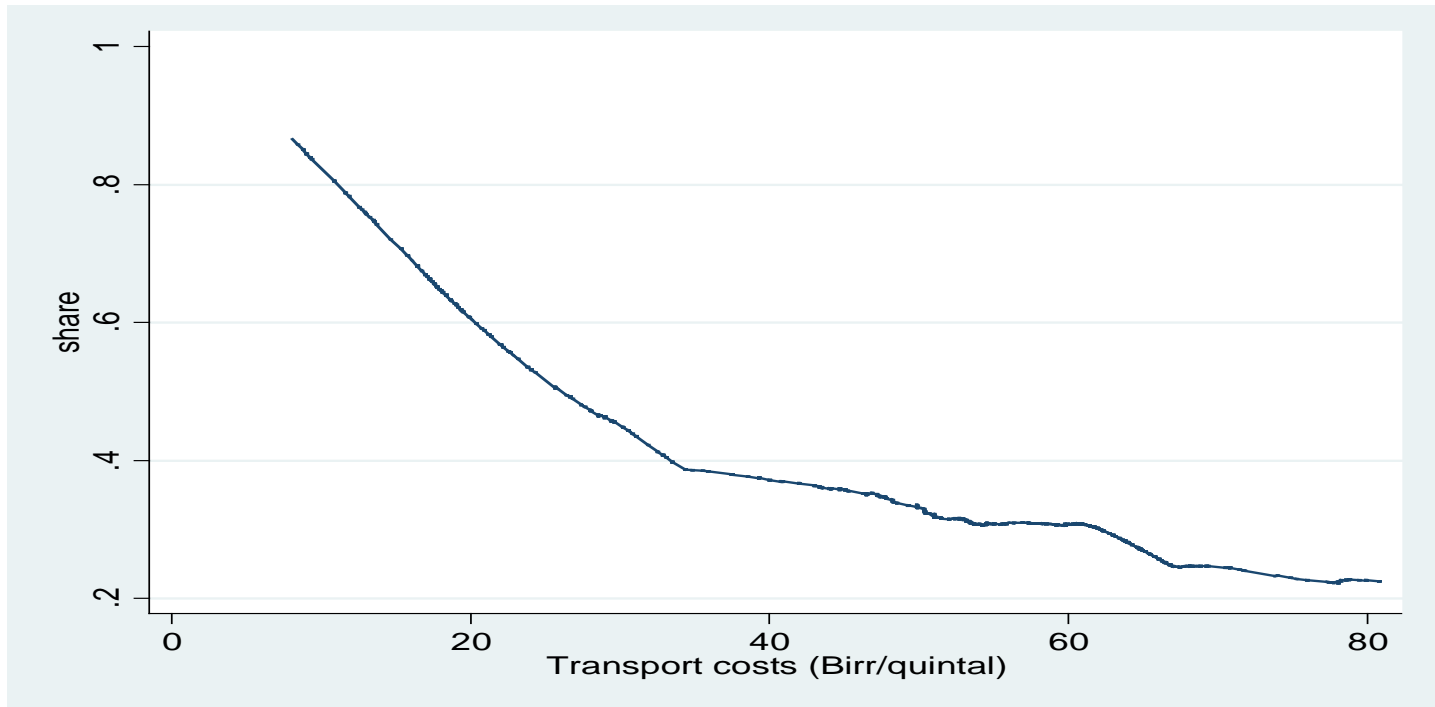


Incentives for fertilizer use decline quickly over space
(because output/input price ratios drop to half)

7. Last mile, agricultural extension, and agricultural knowledge

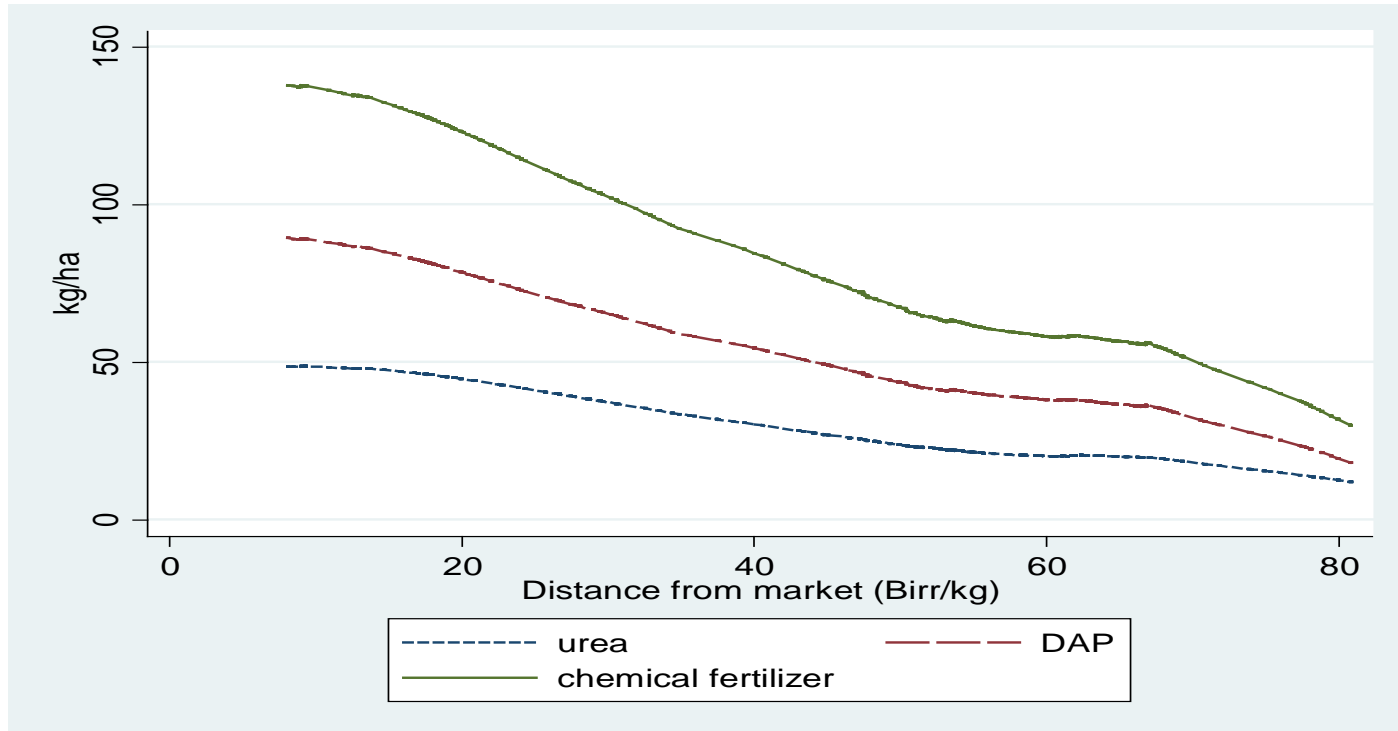
	Unit	Mean	Effect transport costs	
			Coeff.	t- or z-value
Visited in the last five year an agricultural extension agent	yes=1	0.37	-0.016	-6.68
Number of times talked to extension agent in the last year	number	1.51	-0.383	-8.17
Number of times participated in community meetings to discuss agr. Issues in last year	number	2.05	-0.079	-7.86
Visited in last year demonstration plot, demonstration home or research station	yes=1	0.10	-0.021	-6.59
Visited in last year government office of agriculture	yes=1	0.16	-0.017	-6.06

Knowledge of recommended fertilizer use for the planted crop (share plots) by remoteness



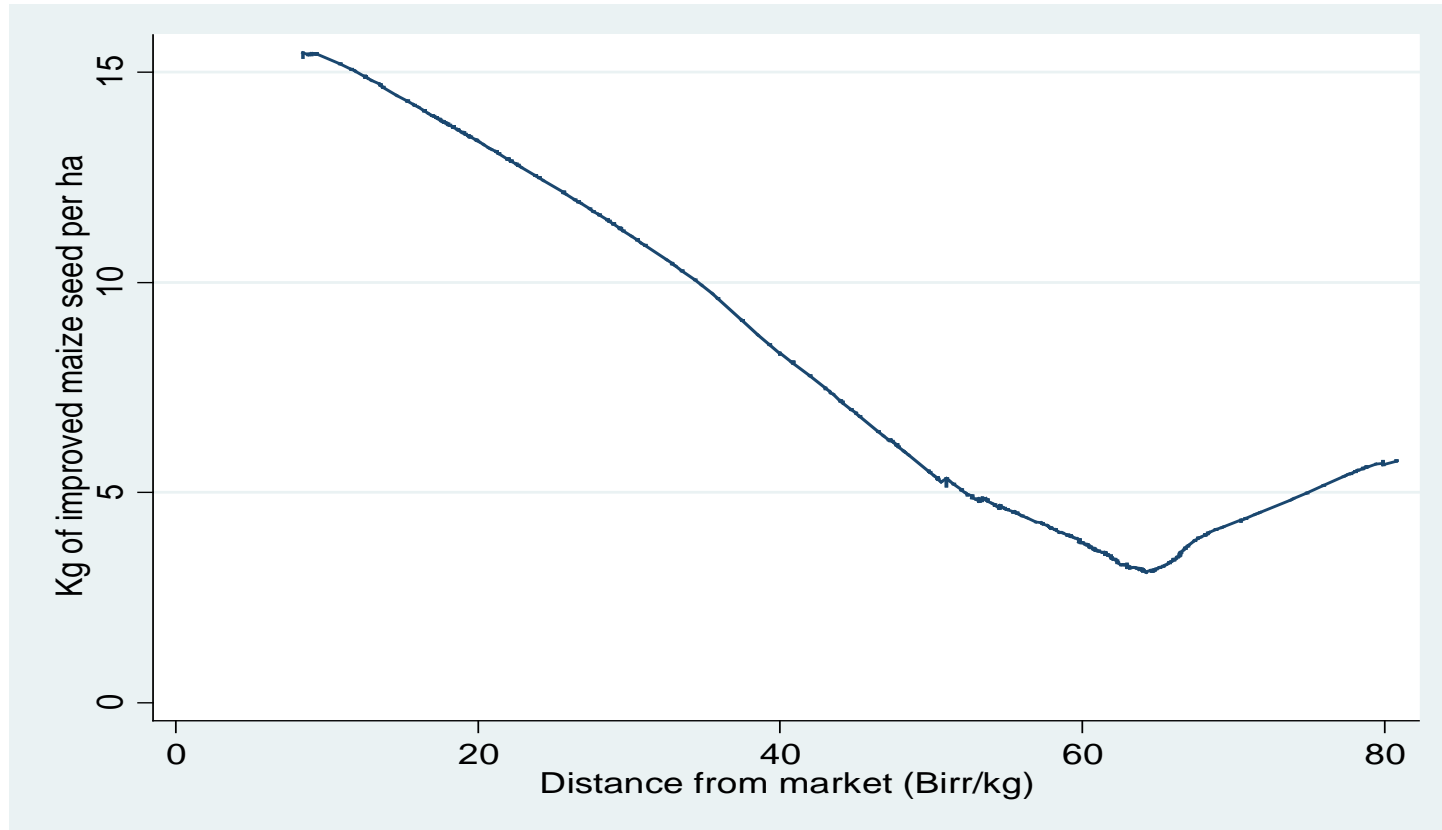
8. Adoption of modern inputs

Chemical fertilizer use (kg/ha) by remoteness



Chemical fertilizer use drops to one-third in the most remote areas

Adoption of improved maize seeds (kg/ha) by remoteness



Use of improved maize seeds drops to one-third in most remote areas

8. Adoption of modern inputs

Results double hurdle model:

- Use the unconditional Average Partial Effect (APE) to analyze impact of explanatory variables
- APE of $\log(\text{distance})$ on chemical fertilizer use is evaluated at -44 (highly significant), i.e. a doubling of the distance to the cooperative office and market (or about 20 kms) reduces the fertilizer use by 44 kg per ha (*ceteris paribus*).
- A doubling of the distance reduces the improved maize seed use by 6 kg per hectare.

8. External validity constraints

- To what extent are the findings from this remote area in Amhara region valid temporarily (over time) and spatially (for Ethiopia as a whole)?
- *Over time.* Similar results were observed key variables in the year 2011, indicating the year of the survey was not a particular year.
- *Over space.* 20% of farmers in AGP woredas live at more than 2 hours from input distribution centers; remoteness and profitability issues are important in Ethiopia.



9. Conclusions

Major findings from our study:

- Important transaction and transportation costs limit the profitability of modern input use
- Access to extension agents and knowledge of recommended fertilizer use strongly linked with remoteness
- Distances to input and output markets are a major determinant of modern input adoption

Findings matter as credit access and network effects might be important but are not the only factors that drive modern input adoption



10. Policy implications to improve adoption

1. *Road infrastructure investment:* Further improvement in infrastructure needed to reduce transportation cost
2. *Reduce transaction costs:*
 - a. Further management capacity building for cooperatives required
 - b. De-licensing as to allow for a more competitive environment in the last mile
3. *Reduce supply constraints of improved seeds:* Better improved seed supply chains are required (as most farmers complain about lack of access)

