

Profitability of Fertilizer Use in Malawi (preliminary)

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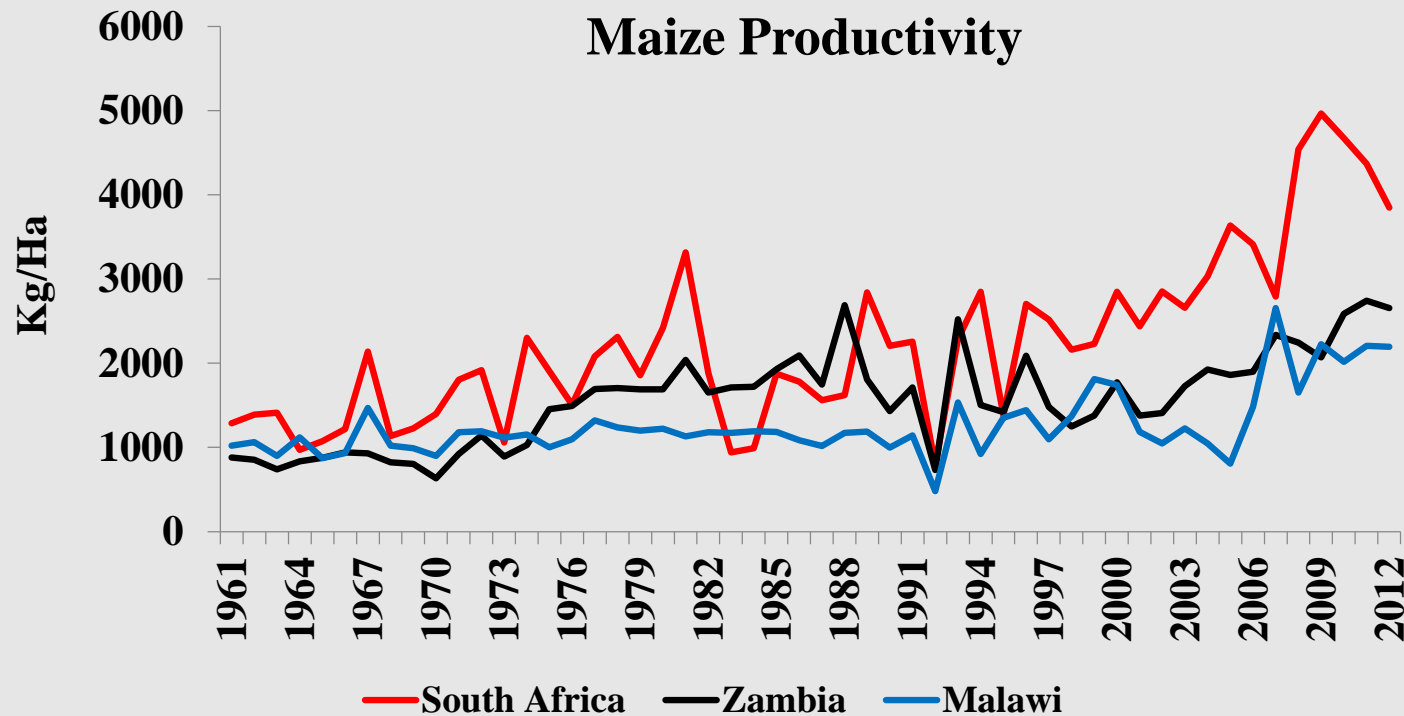
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Talip Kilic (The World Bank)

Motivation

- Agricultural productivity in Malawi is low and erratic (MoAFS, 2011; Kilic et al., 2013)

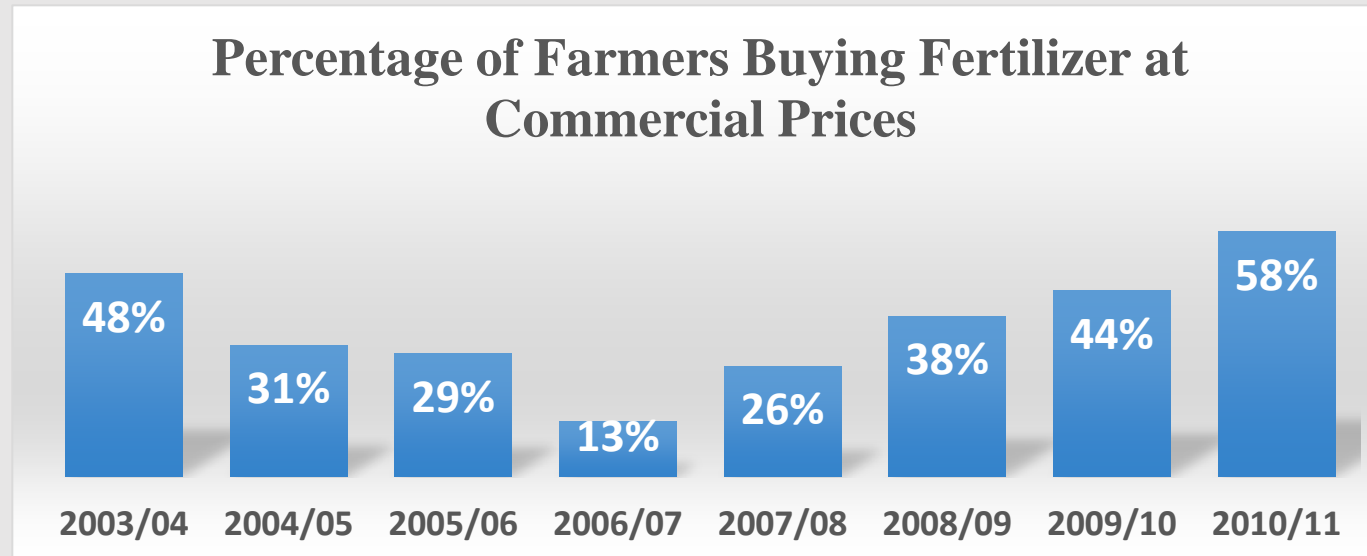


Yield Gap = 38% to 53%
for cereals
(MoAFS, 2011)

Motivation

□ Low productivity among smallholders primarily due to:

1. Limited utilization of modern farm inputs, particularly inorganic fertilizer and improved seeds (MoAFS, 2011; Daudi, 2007).



Limited use of inorganic fertilizer and improved seed could be because they are unprofitable or marginally profitable for many farmers

Research Questions & Relevance

Questions

- Where is fertilizer (un)profitable?
- What are the factors that affect the profitability of fertilizer use?

Relevance:

1. Help the government to form policies to boost the adoption of fertilizer and hence improve agricultural productivity
2. Help in the geographical targeting of the Farm Input Subsidy Program (FISP)

Contribution

- Build upon Xu et. al (2009) and Sheehan et al. (2012)
 - Xu et al: Are recommended fert. application rates in Zambia profitable?
 - Sheehan et al: Relative and absolute profitability of fert. application in Kenya
- Estimate financial and economic profitability
- Consider both commercial and subsidized prices of fertilizer

Methodology

- **Financial Profitability**

$$Y_{phc} = f(N_{phc}, C_{phc}, S_{phc}, L_{phc}, Soil_{phc}, D, D * N_{phc})$$

$$MVCR = \frac{MP * P_{maize}}{P_{fert.}}$$

MP = Marginal product of fertilizer

P_{maize} = farm gate price of maize

$P_{fert.}$ = farm gate price of fertilizer

Y_{phc} = output (in kilograms)

N_{phc} = the amount of inorganic fertilizer applied

C_{phc} = the amount of chemicals (e.g. pesticides)

S_{phc} = kilograms of seed

L_{phc} = the hours of labor

$Soil_{phc}$ = a vector of soil characteristics

D = District dummies

Profitable if MVCR > 1

Data

- Data collected by NSO of Malawi with World Bank support

- IHS3 – 2010/2011 ag. year

- 12, 271 HHs

1. HH information

2. HH agric. activities

3. HH participation in farm input subsidy programs

4. Community information

Results: Descriptive Statistics

Variables	Mean	Maximum	Minimum
Yield (Kg/Ha)	1408.493	4980.733	0.806
Fertilizer (Kg/Ha)	163.880	988.420	0
Seed (Kg/Ha)	51.224	3372.651	0
NPK (23:20:0, + 4S) Price (MKW/Kg)	103.184	122.333	80
Maize Price (MKW/Kg)	23.823	31.869	18.018
	Dummy Variables		
	Yes (%)	No (%)	
Organic	12.547	87.453	
Hired_labor	24.261	75.739	
Irrigation	0.278	99.722	
Female	23.205	76.795	
Inorganic	75.383	24.617	

Results: OLS (preliminary)

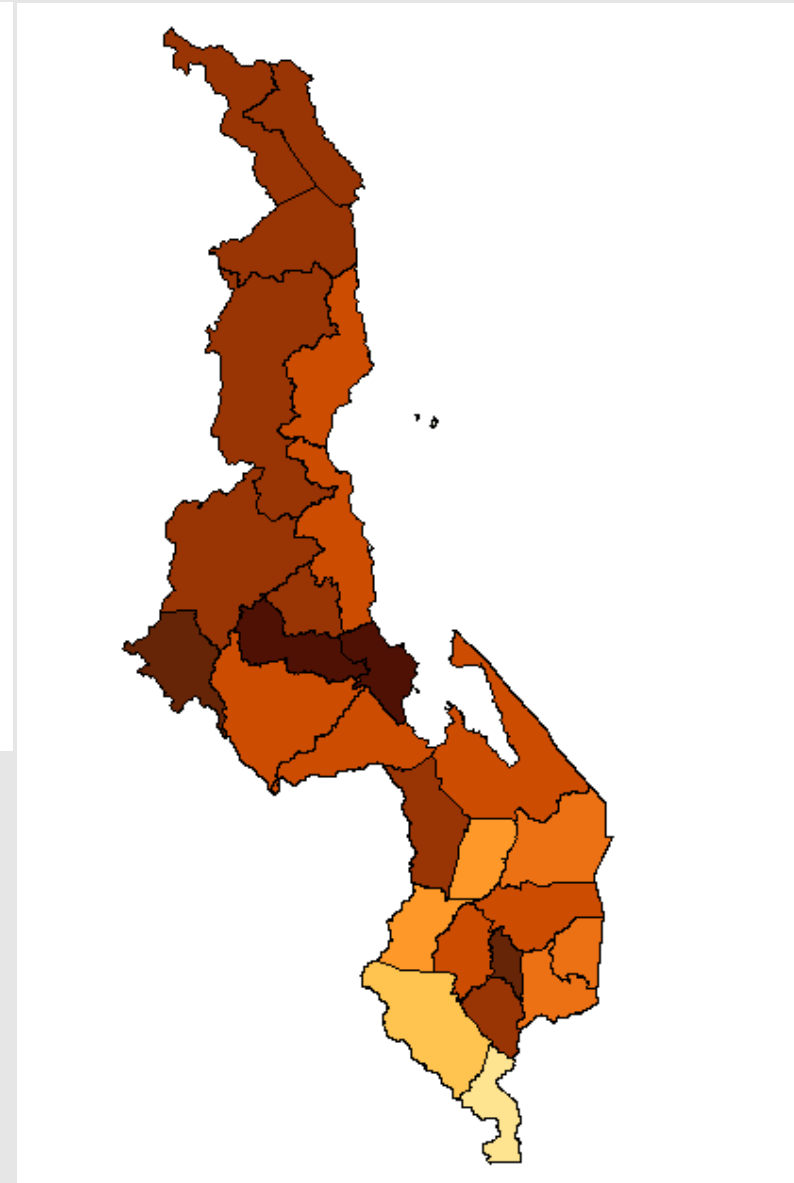
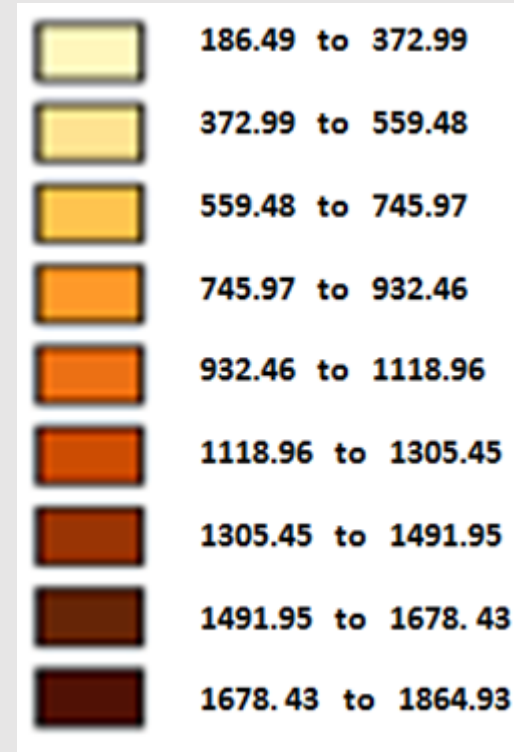
Independent Variable: Maize Equivalent Yield	
Independent Variables	
Fertilizer (Kg/ha)	3.328*** (0.000)
Seed (Kg/ha)	0.244* (0.087)
Labor (days/ha)	0.743*** (0.000)
Hired_Labor (= 1 if hired labor used)	143.2*** (0.001)
Legume (= 1 if intercropped with legume)	199.1*** (0.000)
Chemicals (= 1 if chemicals were applied)	551.5*** (0.004)
hybrid (= 1 if hybrid maize seed)	100.8*** (0.008)
Soil_quality_good (= 1 if good soil quality)	452.1*** (0.000)
Soil_quality_fair (= 1 if fair soil quality)	330.5*** (0.000)
Both_basal_and_topdress	87.47* (0.059)
District fixed effect	Yes
District x Fertilizer	Yes
N	2,677
R-squared	0.719

Results: (preliminary)

Distribution of yield (Kg/ha)

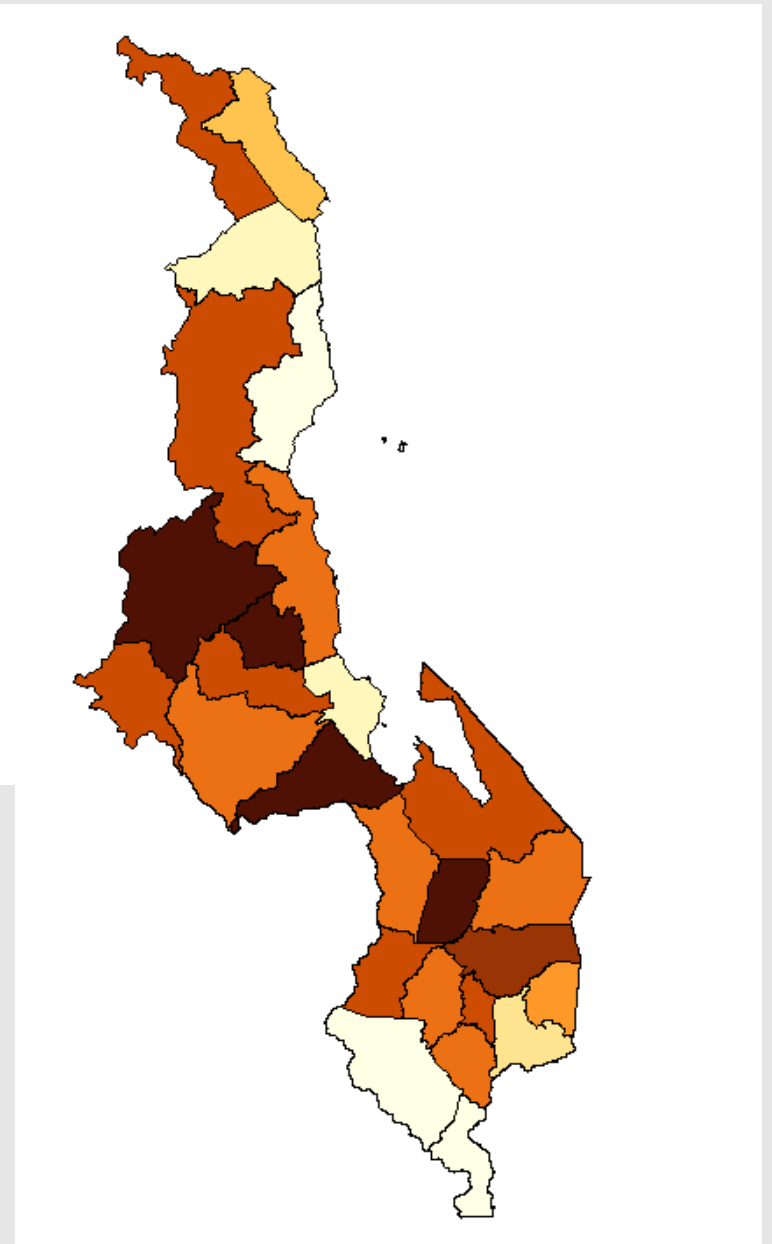
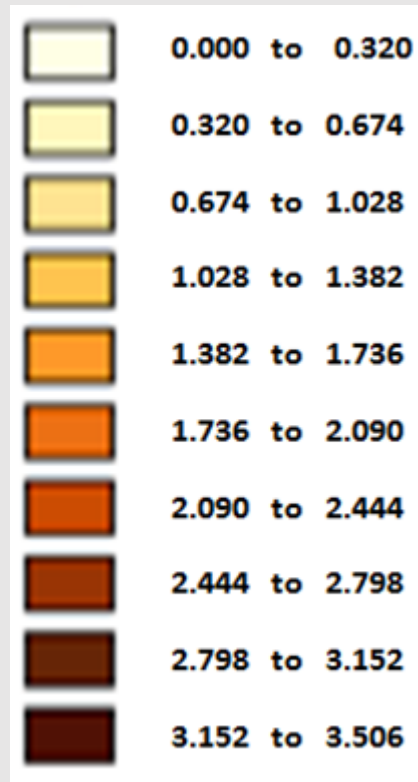
Highest in Mchinji, Dowa, Salama

Lowest in Nsanje, Chikwawa, Mwanza



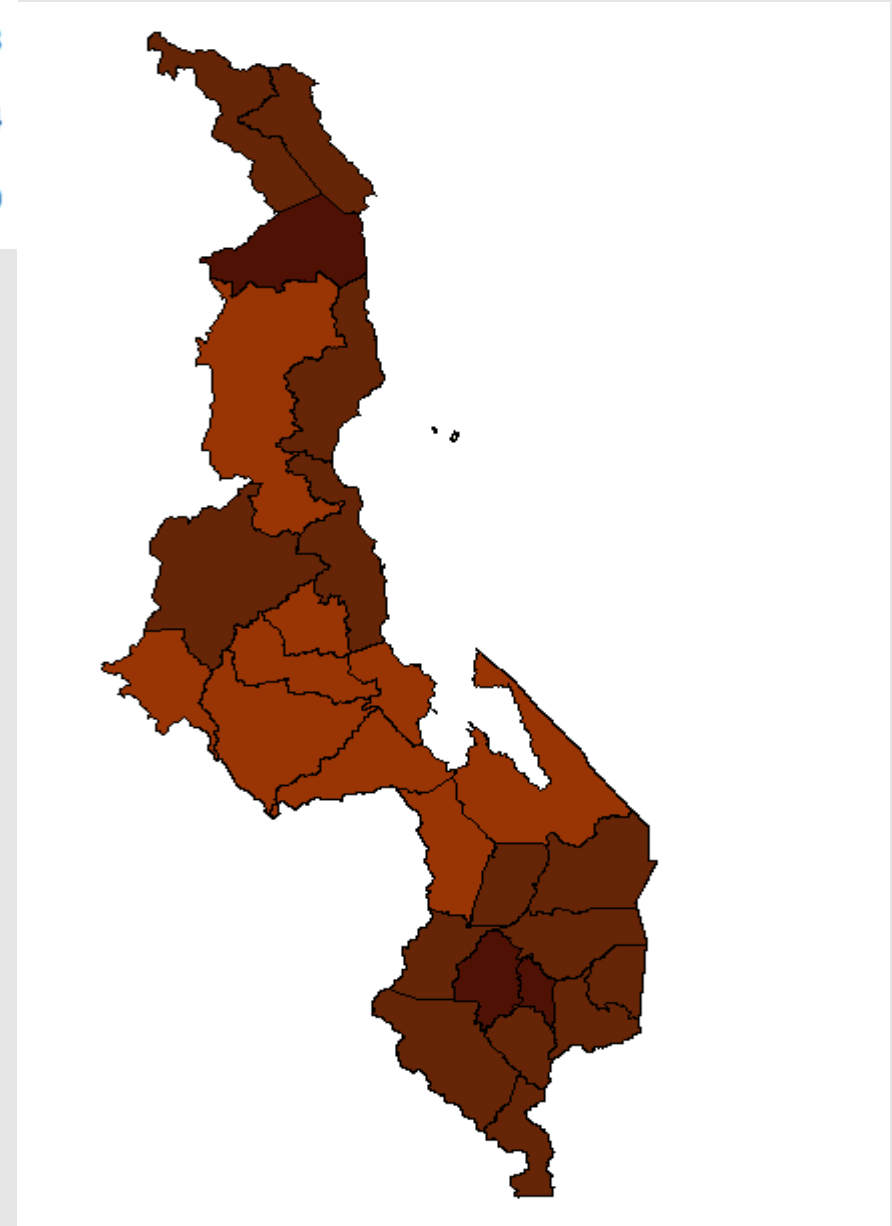
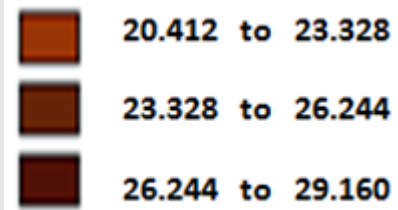
Results: (preliminary)

- Marginal Product of fertilizer
- Highest in Kasungu, Ntchisi, Dedza
Balaka
- Lowest in Nsanje, Chikwawa, Nkhatabay



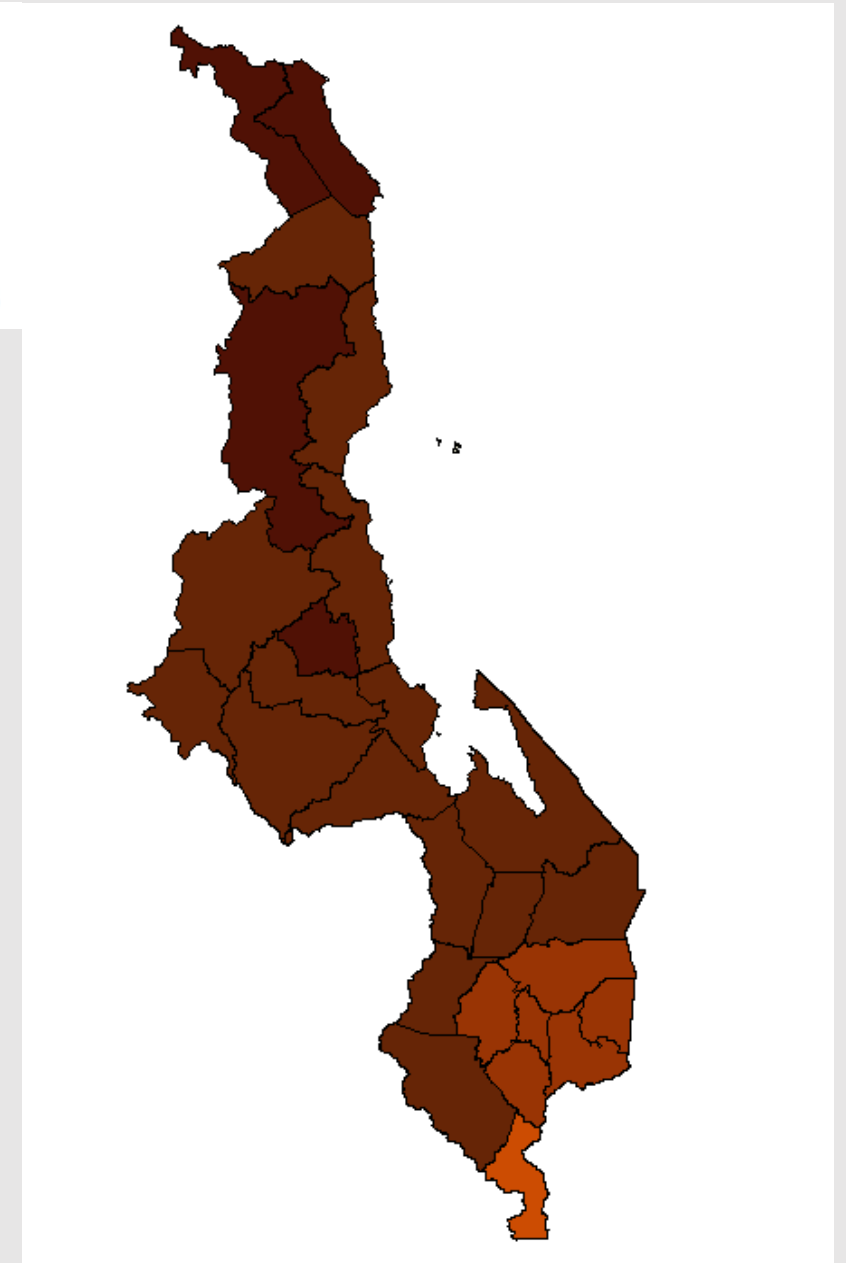
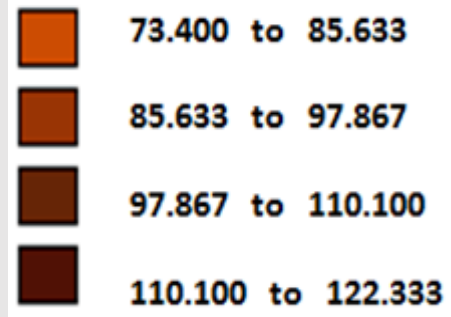
Results: (preliminary)

Maize Price (farm gate price, MKW/Kg)



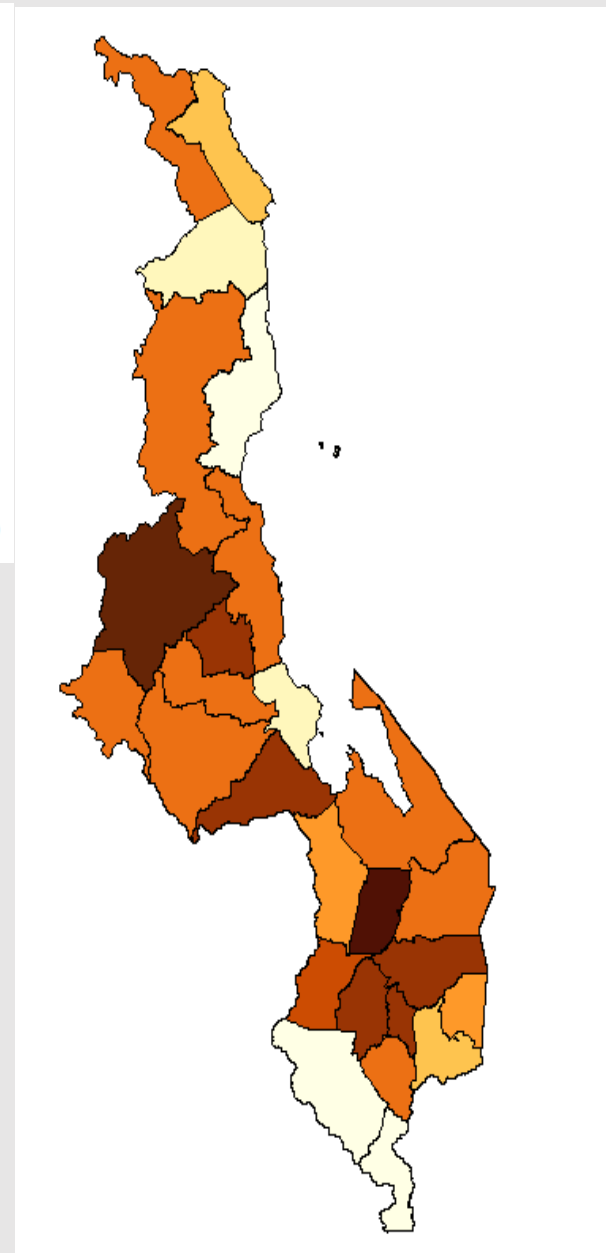
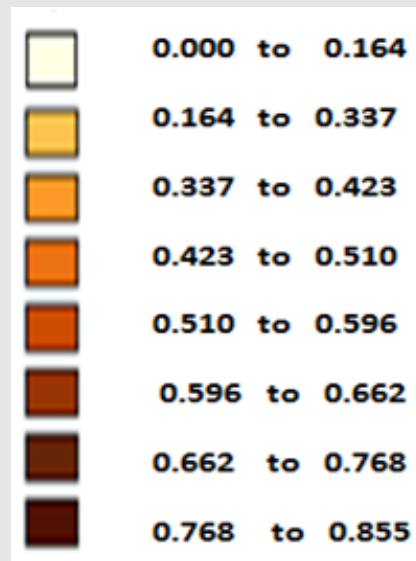
Results: (preliminary)

Fertilizer (NPK 23:21:0 + 4S) price (MKW/Kg)

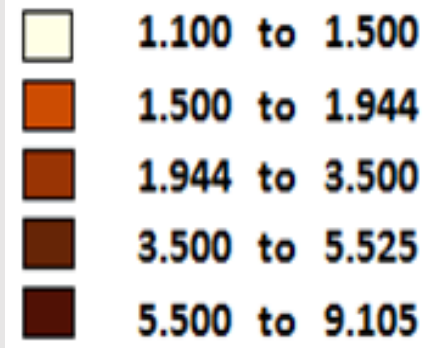


Results: (preliminary)

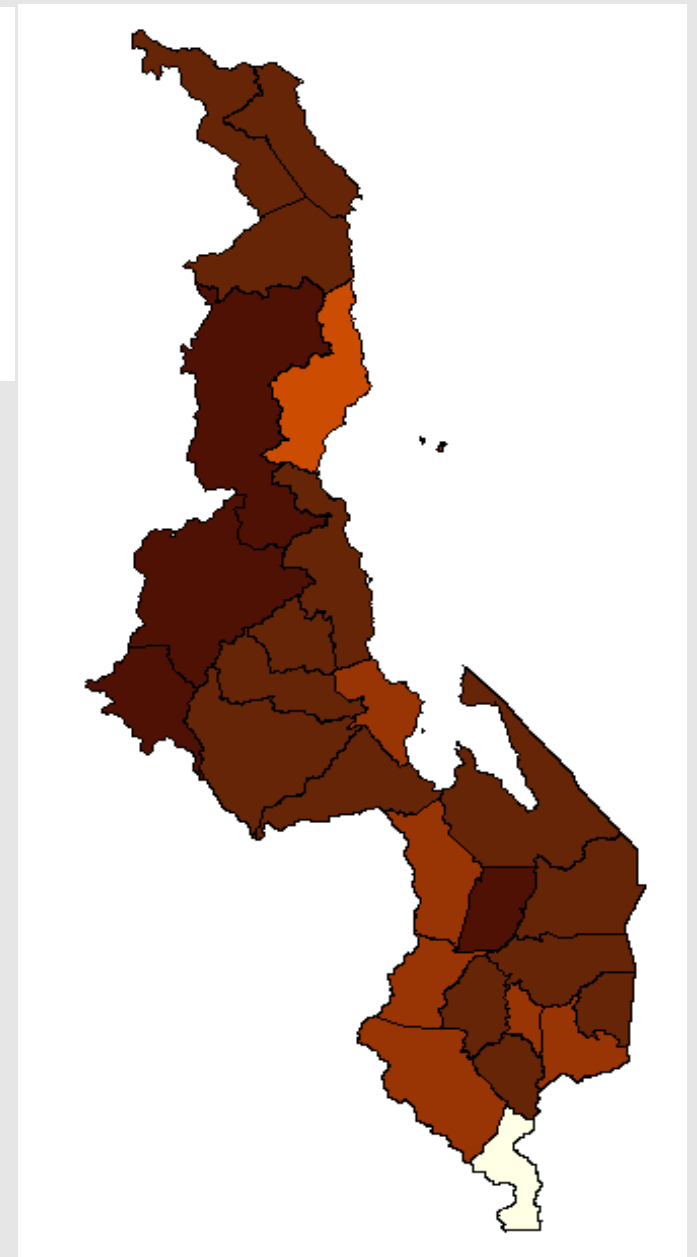
- Profitability (commercial fert. Price)
- Not profitable in any district
- Highest in Kasungu, Ntchisi, Dedza
Balaka
- Lowest in Nsanje, Chikwawa, Nkhatabay



Results: (preliminary)



- Profitability (subsidized fert. Price – MKW 10/Kg)
- Profitable in every district



Next Steps

1. Add IHPS (Panel): Household and plot-level fixed effects
2. Disaggregated (plot and household) profitability measures
3. Endogeneity of subsidized fertilizer
4. Estimate economic profitability
5. Spatial Hierarchical Model (determinants of profitability)

Plot level variables

Household level variables

Community level variables

Conclusion

- Fertilizer use is not profitable on average at commercial fertilizer prices; but profitable on average at 88% subsidy
- At commercial prices, fertilizer profitability is highest in
Balaka: 0.914; Mchinji: 0.719; Mzimba: 0.679; Kasungu: 0.631
- Profitability is driven by fertilizer response rate, because prices do not exhibit large spatial variation

Thank you

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