TECHNICAL SESSION #5/b

Efficient Land Use: Tools and Practices

The drivers of land use dynamics

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المؤتمر العربي الثاني للأراضي

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DEVELOPMENT RESEARCH

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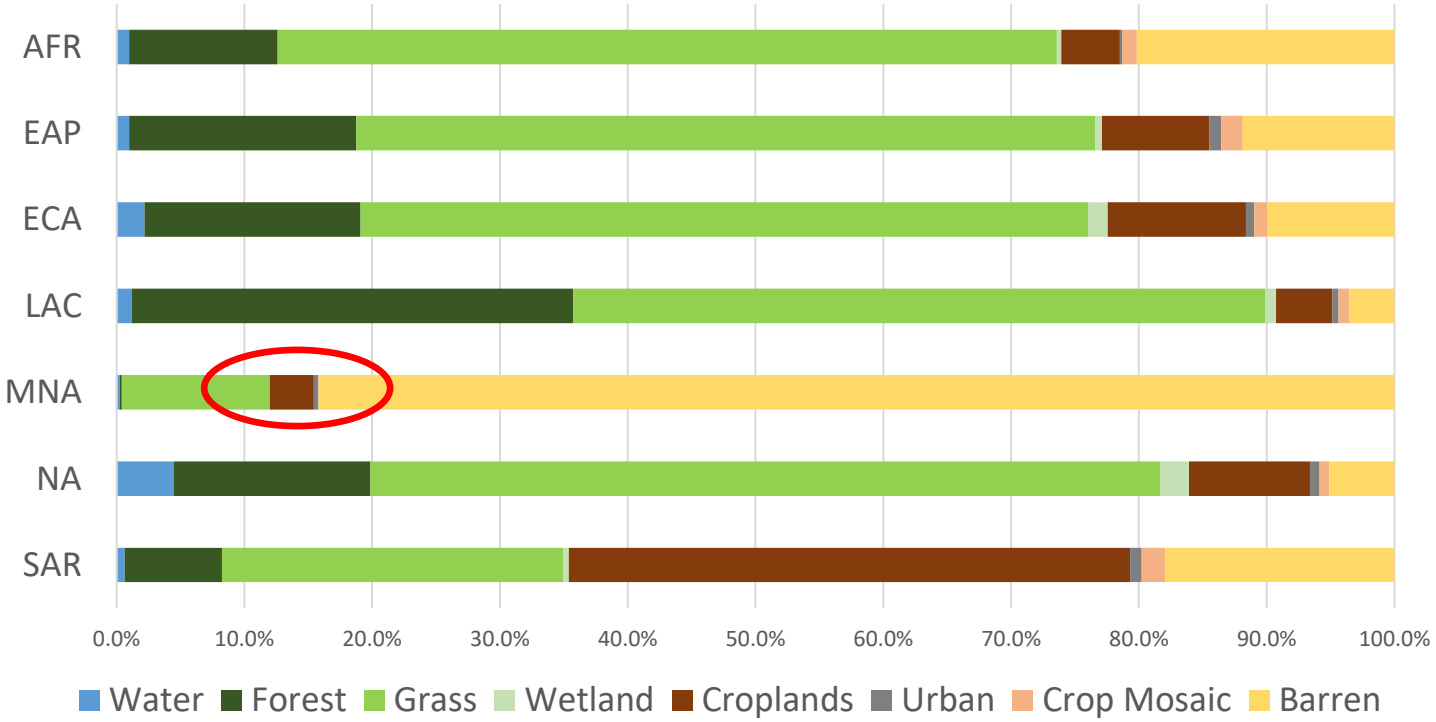
Cropland is scarce in the Middle East and North Africa (3.5 percent of the land)

Figure 1 - Regional decomposition of land cover (2018, in %)



Land in MENA is mostly desert

- Desert : 84.2 percent
- Cropland: 3.5 percent
- Urban: 0.3 percent
- Water: 0.3 percent
- Forest: 0.2 percent

Cropland in MENA is scarce

- **37 million ha (0.064 ha per inhabitant)**

Source: Author's calculation based on Friedl, M., Sulla-Menashe, D. (2019). MCD12Q1 MODIS/Terra+Aqua Land Cover Type Yearly L3 Global 500m SIN Grid V006. NASA EOSDIS Land Processes DAAC.

Cropland in MENA decreases (-0.17 percent per year)

Table 1 - Movements in and out of cropland (2003-2018)

	MENA	LAC	ECA	SSA	EAP	NAM	SA
% change in cropland	**-2.4%**	14.3%	-2.3%	-1.3%	-2.0%	0.4%	2.3%
% of 2003 cropland that was degraded	11%	13.8%	8.9%	20.3%	11.7%	6.5%	4.5%
% 2018 cropland that was reclaimed	9%	23.8%	6.9%	19.29%	10.57%	6.94%	6.9%
(from barren land)	**(0.23%)**	(0.01%)	(0.00%)	(0.00%)	(0.00%)	(0.00%)	(0.05%)

Source: Author's calculation based on Friedl, M., Sulla-Menashe, D. (2019). MCD12Q1 MODIS/Terra+Aqua Land Cover Type Yearly L3 Global 500m SIN Grid V006. NASA EOSDIS Land Processes DAAC. MENA stands for Middle East & North Africa. LAC stands for Latin America & Caribbean. ECA stands for Europe & Central Asia. SSA stands for Sub-Saharan Africa. EAP stands for East Asia & Pacific. NAM stands for North America. SA stands for South Asia.

At the same time, **the MENA population increases** (at an annual rate of +2 percent)

OBJECTIVES OF THE RESEARCH

We study the **drivers of cropland changes** globally and in MENA

Focus on 3 type of drivers

- What is the **role of climate** ?
- What is the **role of demography and human activities** ?
- What is the **role of institutions (including land institutions)** ?

Policy relevance

- Understanding the drivers of changes in cropland can inform **land management policies** in a land scarce context

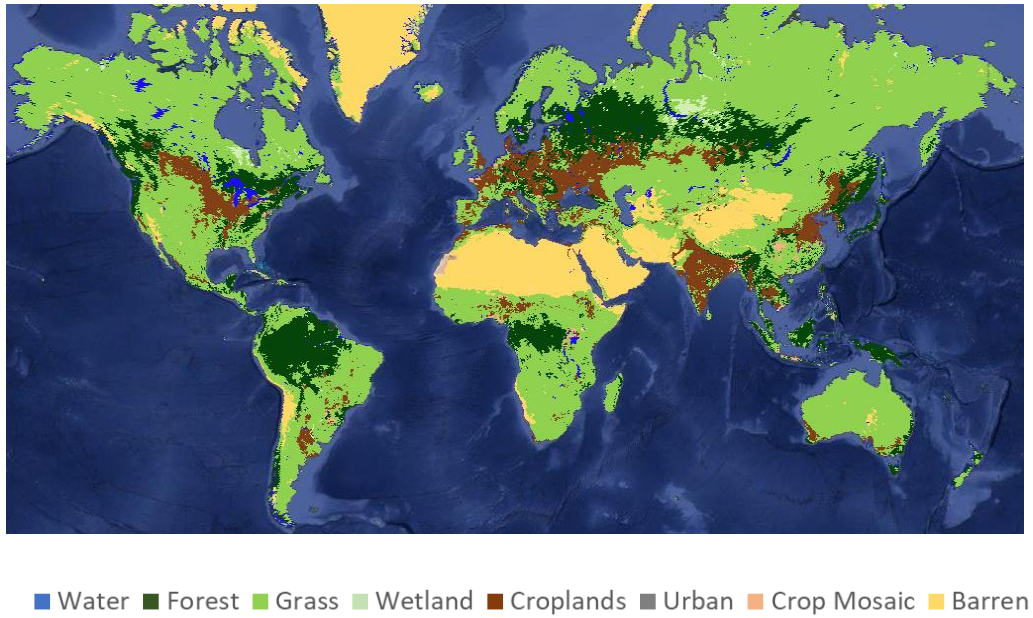
Approach

We use regression analysis to **correlate cropland loss** (i.e., the transition of cropland to other uses measured from satellite) **with potential local and national drivers**

Data

- **MODIS land cover satellite imagery** (2003-2018, 500m*500m, global)
- **Local biophysical variables** (temp., precip, droughts, distance to river & coast)
- **Local demographics / infrastructure**
- **National level data** (economics & institutions)

Figure 2 - Global land cover (MODIS, 2018)



1st STAGE RESULTS: REGRESSION OF CROPLAND LOSS ON LOCAL (PIXEL-LEVEL) VARIABLES

Cropland loss is correlated with **adverse climatic shocks**, **distance to river** (aridity and difficulty of irrigation), **proximity to coast** (salinization), **population growth** (encroachment of human settlements on cultivated land) and **travel time to local markets**

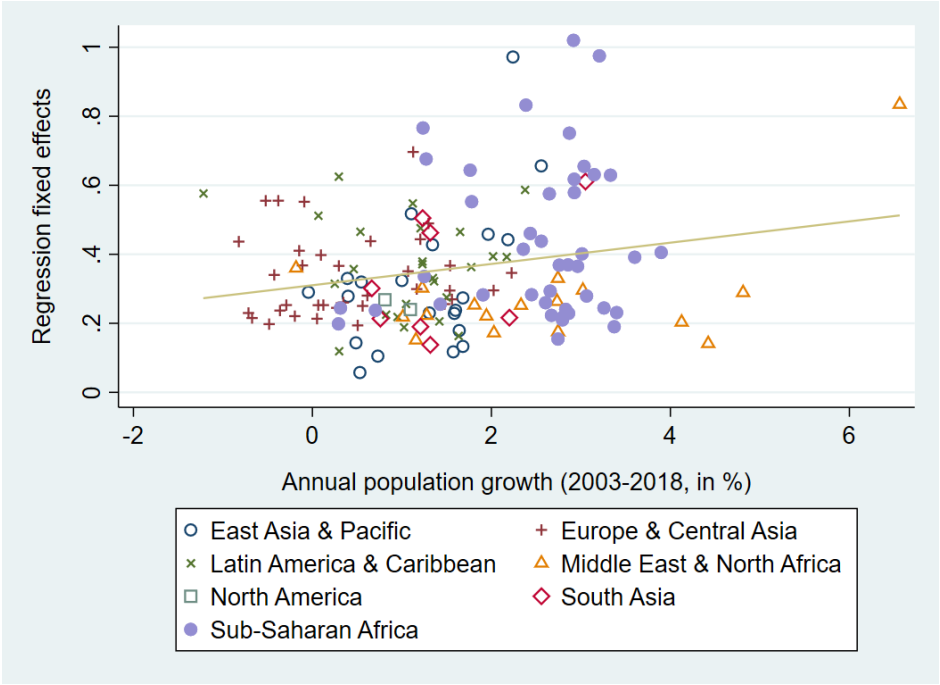
Dependent variable: Change in cropland status (linear probability model)		
	(1)	(2)
Travel time to nearest city	3.26E-04***	3.05E-04***
Population growth	4.30E-04***	4.28E-04***
Drought severity index	4.69E-04***	4.82E-04***
Distance to River	2.70E-08***	5.36E-08***
Distance to Coast	-4.32E-08***	-3.79E-08***
Country fixed effect	Y	Y
Köppen climate classification fixed effect		Y
Observation	37,916,150	37,916,150
R^2	0.15	0.16

2nd STAGE RESULTS: CONTRIBUTION OF NATIONAL LEVEL DRIVERS TO CROPLAND LOSS (1/5)

We recover overall **national contributions** (“fixed effects”) to cropland loss in our regression and **plot them against national level variables**:

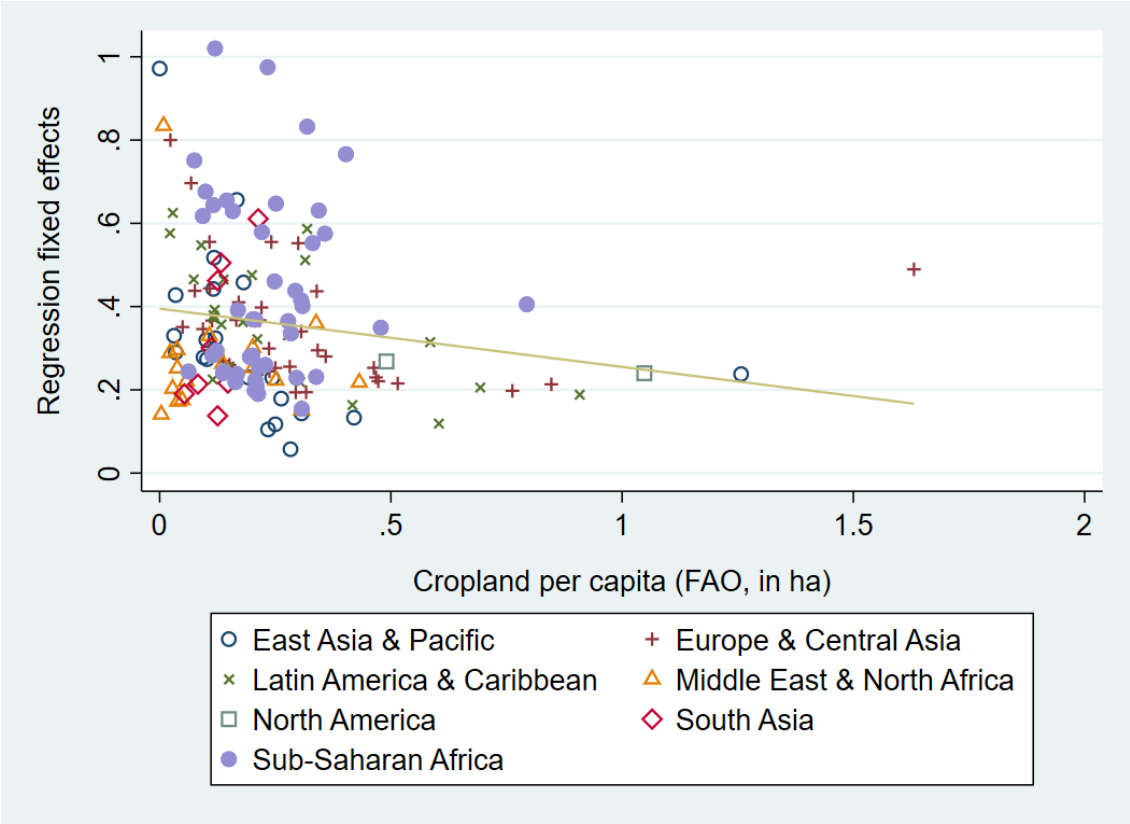
- On the below graphs, each observation is a country
- A positive slope means that the national level variable contributes to cropland loss

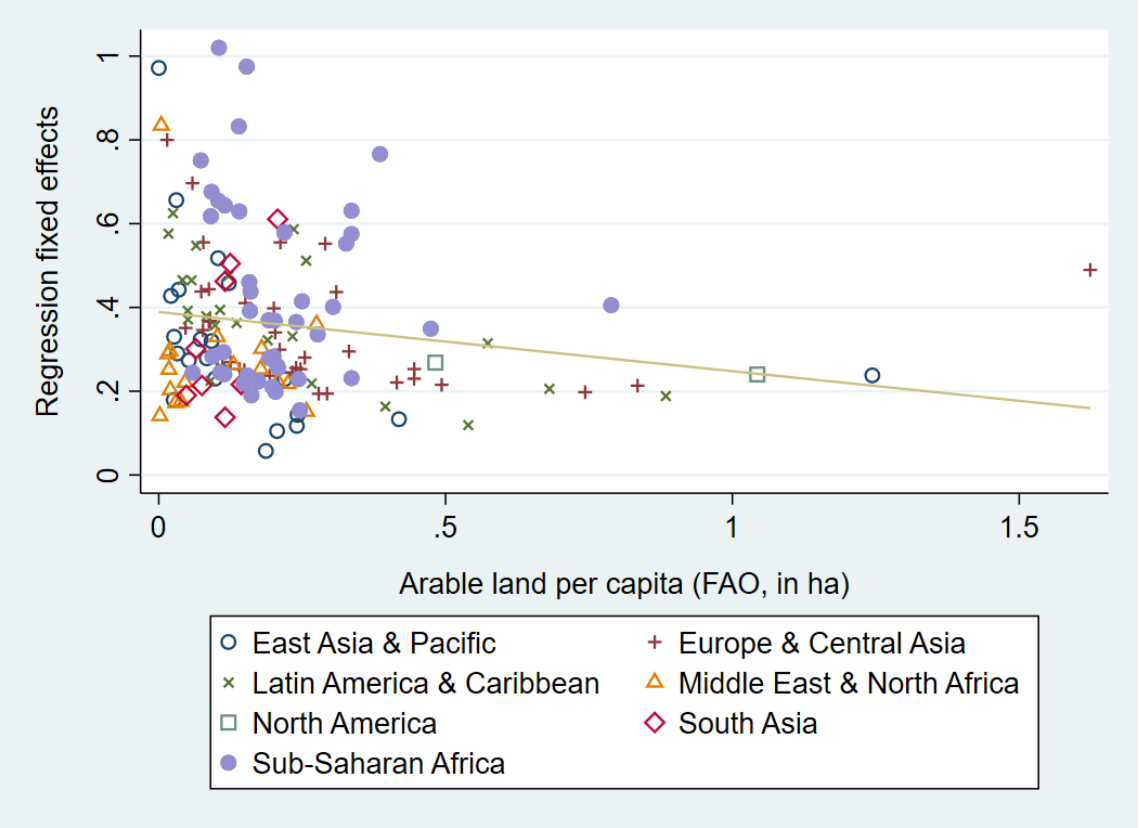
Population growth is positively correlated with **cropland loss**



2nd STAGE RESULTS: CONTRIBUTION OF NATIONAL LEVEL DRIVERS TO CROPLAND LOSS (2/5)

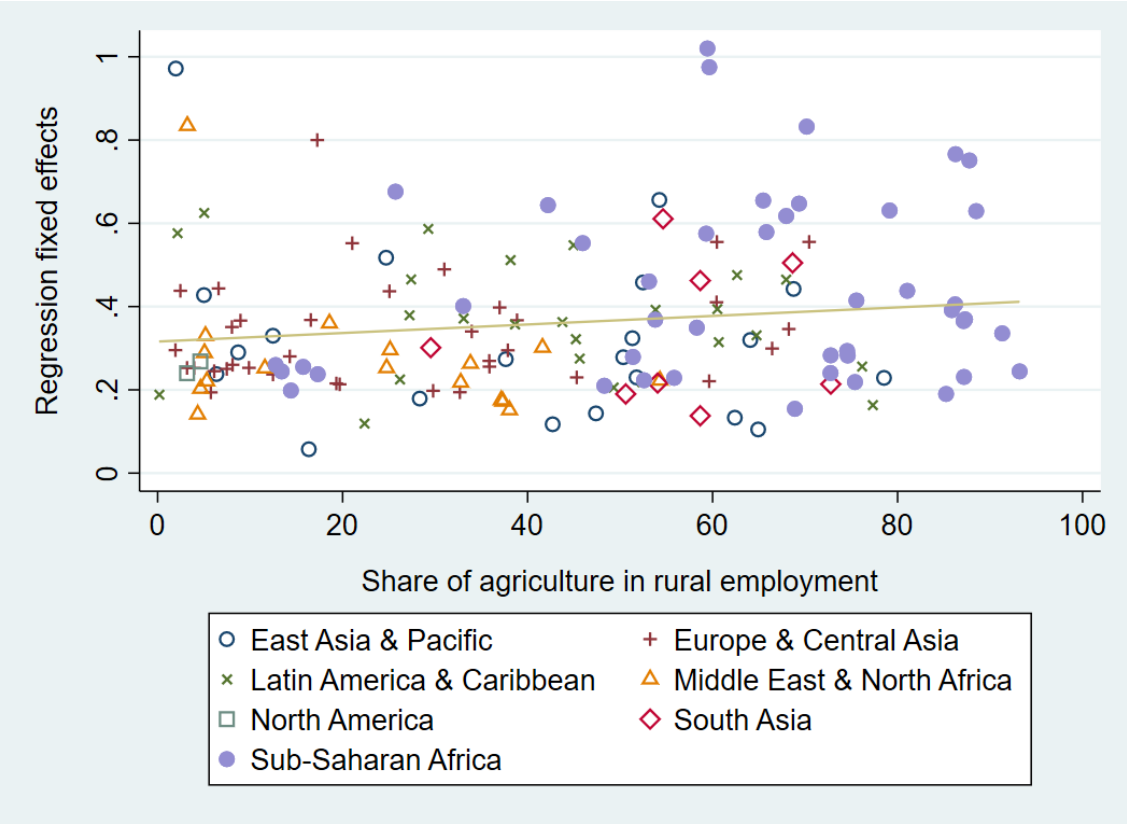
Land scarcity is positively correlated with **cropland loss**

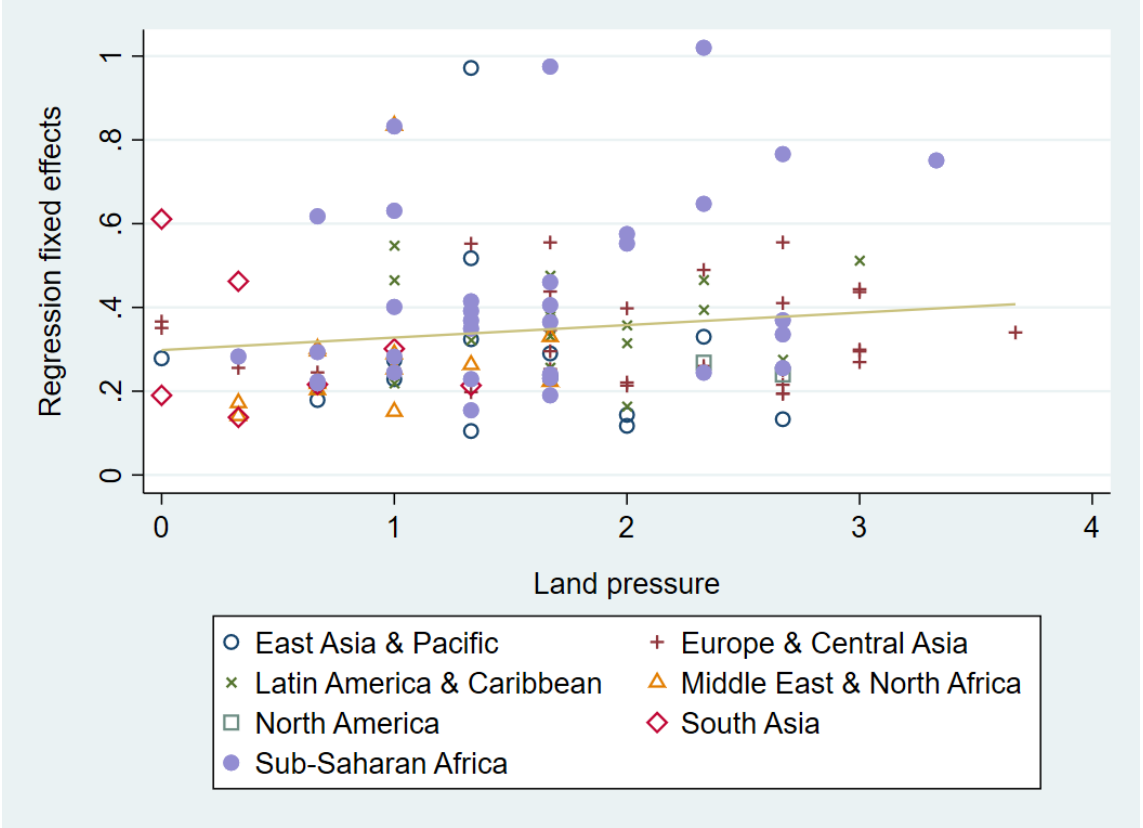




2nd STAGE RESULTS: CONTRIBUTION OF NATIONAL LEVEL DRIVERS TO CROPLAND LOSS (3/5)

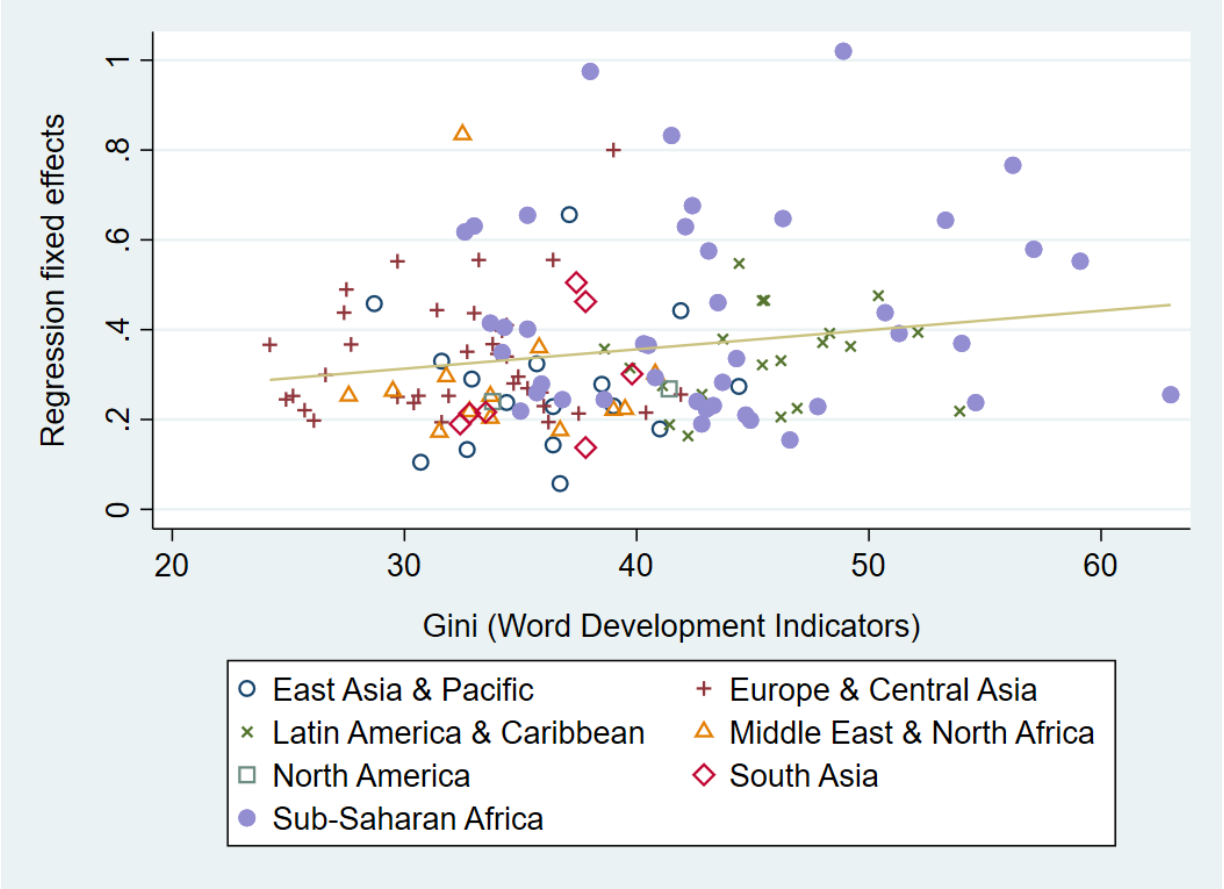
Intensity of use is positively correlated with **cropland loss**





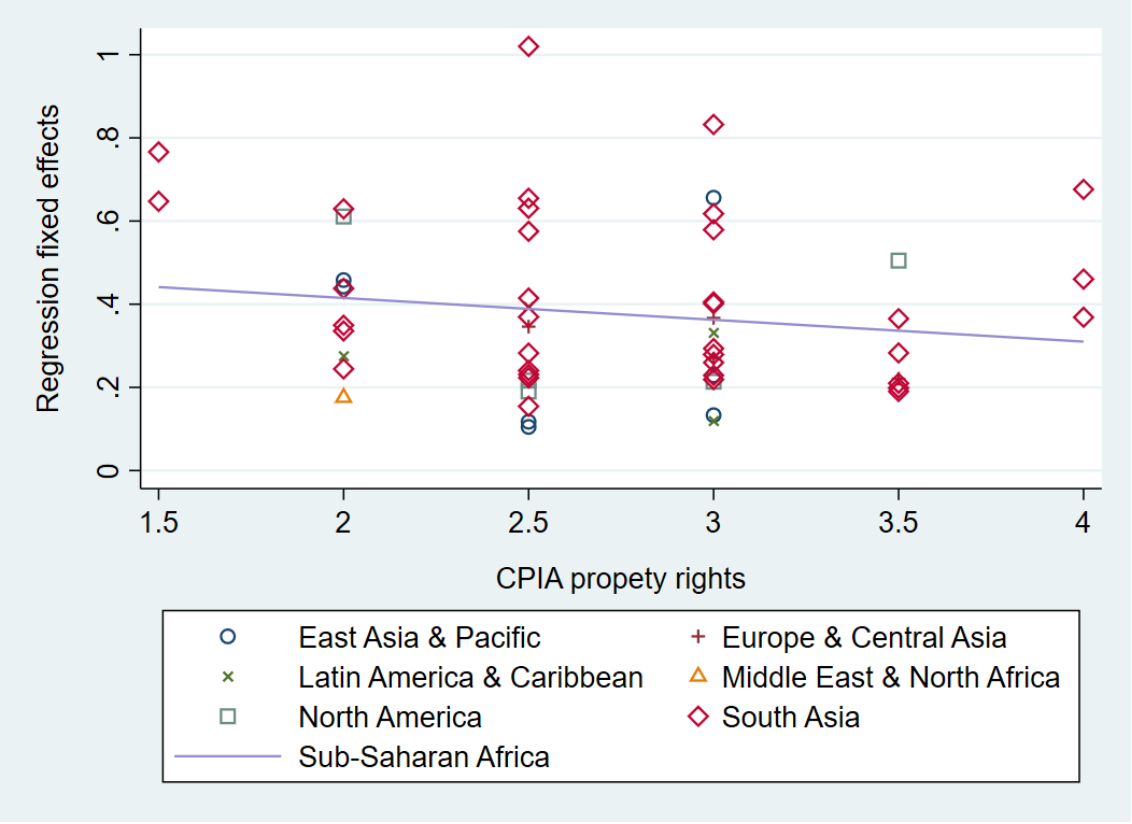
2nd STAGE RESULTS: CONTRIBUTION OF NATIONAL LEVEL DRIVERS TO CROPLAND LOSS (4/5)

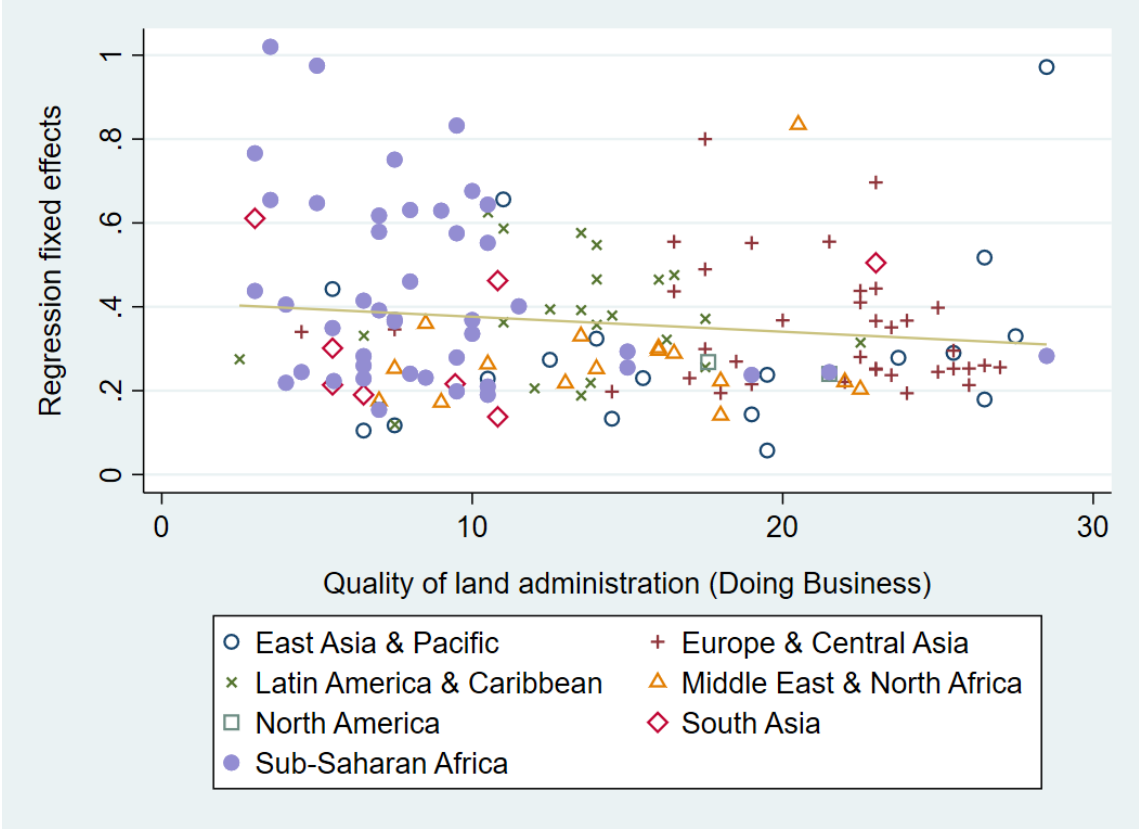
Income inequality is positively correlated with **cropland loss**



2nd STAGE RESULTS: CONTRIBUTION OF NATIONAL LEVEL DRIVERS TO CROPLAND LOSS (5/5)

Property rights are positively correlated with **cropland persistence**





Findings

- **Bio-physical**, **human** and **institutional factors** all affect **cropland loss**
- **This includes variables that characterize MENA countries: population growth, land scarcity** and, for some countries, weak enforcement of **property rights**
- We focus on ***gross* cropland loss** (but this can be mitigated by cropland gains from **desert land reclamation**, a practice that is particularly prevalent in MENA)

Next steps

- **Do some drivers have stronger effects in MENA** than elsewhere?
- What is the **role of policies** (agriculture and water subsidies)?

THANK YOU FOR THE ATTENTION!