xsmle Estimation of various spatial panel models
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Introduction

- An empirical investigation using the Stata command xsmle
- xsmle is a module designed for the estimation of spatial panel models
- presented in the Stata Users Group by Belotti, Hughes and Mortari in 2013 in Postdam, Germany
- implements the quasi-maximum likelihood estimation of a wide range of spatial panel specifications
- the research question, and the empirical methodology and then emphasize the practical limitations, in relation to the theoretical imperatives

Our Research Question

- Transborder Ethnic Kin and Regional Property :
  Evidence from Nighttime Light Intensity in Africa
  a joint paper with Christophe Muller, Greqam.

- What are the externalities in terms of local development from friendly ethnic groups across international borders on the African continent?

- What are the consequences of the fact that the identity of an ethnic group becomes politically salient on the economic development of their co-ethnic or ethnic friends in a neighboring country?

- Ethnicity matters in redistributive politics. Political leaders tend to favor their co-ethnics. Burgess et al. (2015) AER
- The attribution of patronage follows the balance of power between ethnicities. Francois et al. (2015) Econometrica
- There is a possibility that a change in political activity of one ethnic group shifts the balance of power elsewhere.
- Many historic African ethnicities were split by modern state border in the aftermath of the European colonization.

$$
\begin{aligned}
Y_{nt} &= \rho W_n Y_{nt} + \mathsf{EGIP}_{n,t-1}\ \gamma_1 + \mathsf{TEK}_{n,t-1}\ \gamma_2 \\
&\quad + \mathsf{X}_{n,t-1}\ \delta + \mathbf{c}_{n0} + \alpha_{t0}\iota_n + U_{nt} \\
U_{nt} &= \lambda W_n U_{nt} + V_{nt}
\end{aligned}
$$

for $t = 1, \ldots, T$.

The expression of the Spatial AutoCorrelation model (SAC)

$$Y_{nt} = \rho W_n Y_{nt} + \text{EGIP}_{n,t-1}\, \gamma_1 + \text{TEK}_{n,t-1}\, \gamma_2$$
$$+ X_{n,t-1}\, \delta + \mathbf{c}_{n0} + \alpha_{t0}\iota_n + U_{nt}$$
$$U_{nt} = \lambda W_n U_{nt} + V_{nt}$$

- With the restriction $\lambda = 0$, this becomes the Spatial AutoRegressive model
- Other models embraced by the Xsmle command are the Spatial Error Model (SEM), the Spatial Durbin Model (SDM), Generalized Spatial Random-Effects Model.
- W_n : Spatial Weights Matrix records how the geographic units relate to each other.
- $W_n Y_{nt}$: spatially lagged dependent variable
- ρ is the spatial autocorrelation coefficient

$$
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U_{nt} &= \lambda W_n U_{nt} + V_{nt}
\end{aligned}
$$

- EGIP is participation in the central government by the ethnic group
- TEK is the number of politically active ethnic friends in neighboring countries
- There are unit specific fixed-effects and year specific fixed-effects.
- U_{nt} is the spatially autocorrelated error term.
- λ is the spatial error autocorrelation coefficient.
- V_{nt} is an i.i.d error term.
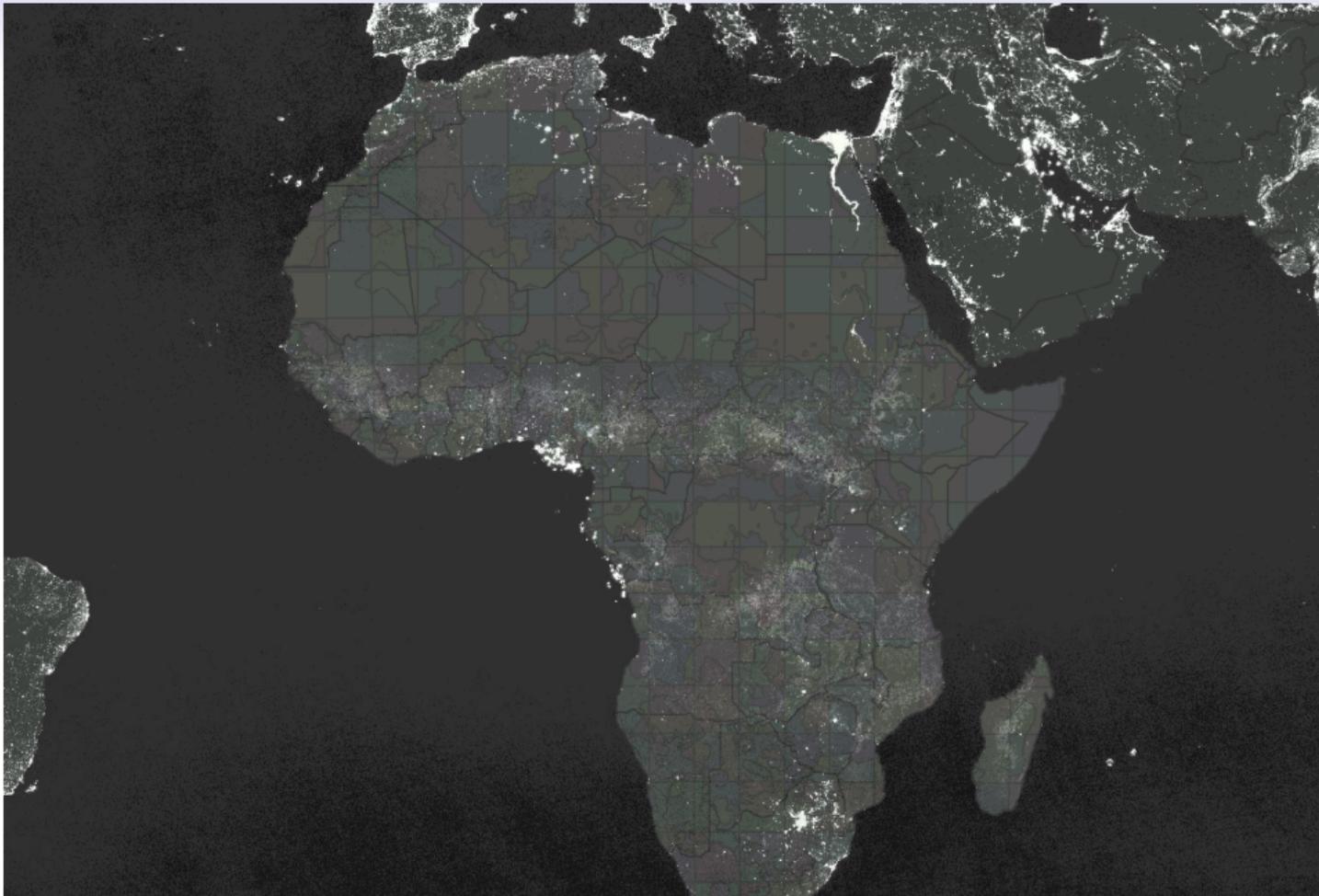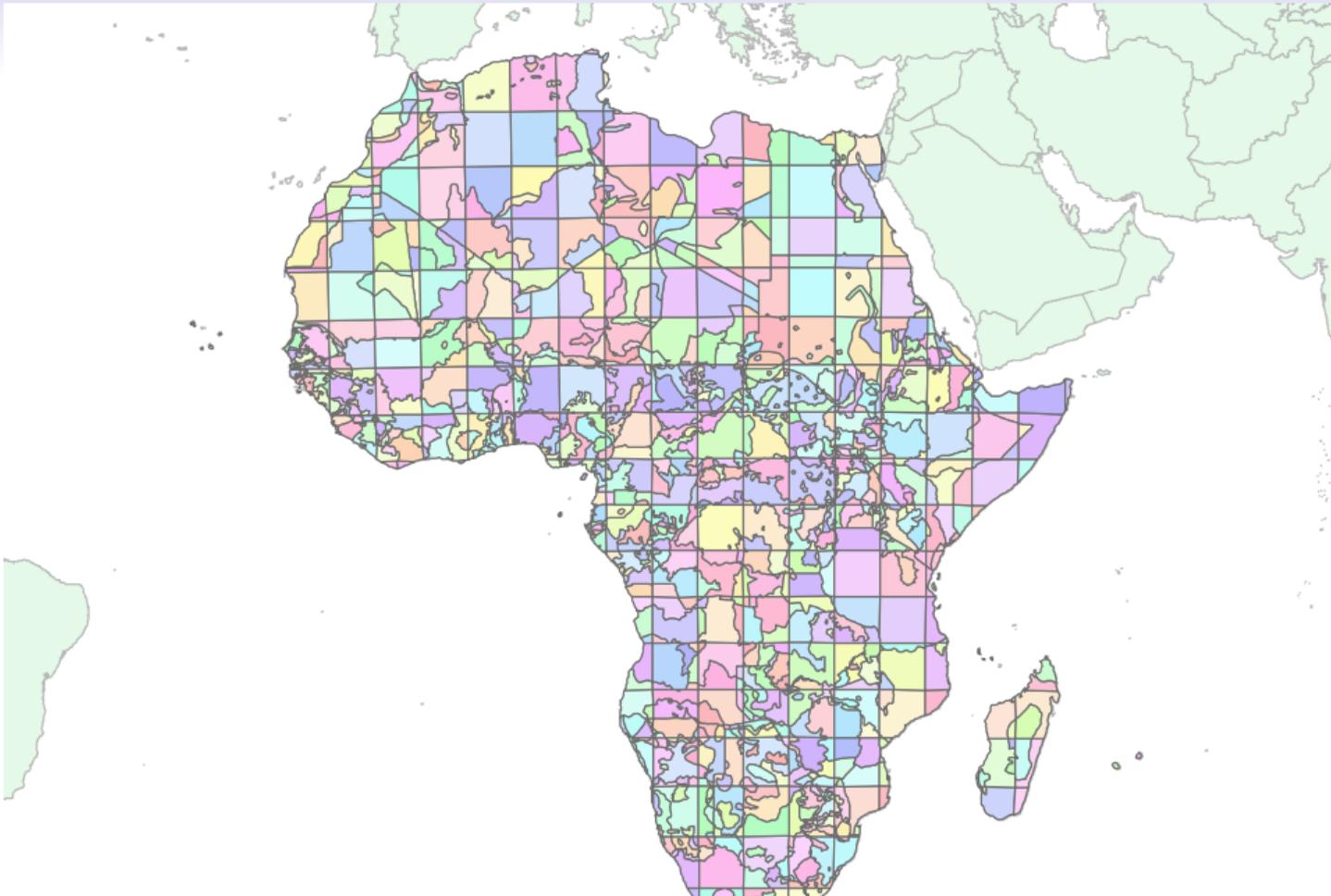
Economic activity tends to be geographically clustered.

This model allows to distinguish politico-ethnic effects from other economic externalities

(trade, employment, security, investment, education, health)

- The syntax of the xsmle command is rather standard
- xsmle depvar indepvars, options
- Website of Federico Belotti, www.econometrics.it
  A brief xsmle tutorial
  ```
  net install xsmle, from(http://www.econometrics.it) force all
  use product.dta, clear
  spmat use W using usaww.spmat // compute the log of the variables

  xsmle lngsp lnpcap lnpc lnemp unemp, wmat(W) model(sar)
  ```

```
SAR with random-effects                          Number of obs    =      816

Group variable: state                            Number of groups =       48
Time variable: year                              Panel length     =       17

R-sq:     within  = 0.9435
          between = 0.9800
          overall = 0.9790

Log-likelihood =  1426.5768
```

lngsp	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Main						
lnpcap	.0129454	.0275776	0.47	0.639	-.0411057	.0669966
lnpc	.2255536	.025119	8.98	0.000	.1763212	.274786
lnemp	.6708108	.0288595	23.24	0.000	.6142472	.7273744
unemp	-.0057972	.0009386	-6.18	0.000	-.0076368	-.0039575
_cons	1.658149	.1663725	9.97	0.000	1.332065	1.984233
Spatial						
rho	.1616144	.0290562	5.56	0.000	.1046652	.2185636
Variance						
lgt_theta	-2.893863	.2047895	-14.13	0.000	-3.295243	-2.492483
sigma2_e	.0012464	.000069	18.07	0.000	.0011112	.0013816

```
r; t=0.88 14:59:43
```

Light intensity at night : comes from the National Oceanic and Atmospheric Administration. A raster for all inhabited parts of the world for each year from 1992 onwards. The data on the ethnic groups location and political participation. This comes from the Geo-Ethnic Power Relations database (Vogt et al. 2015 JCR) The Data Issues The xsmle in principle requires a perfectly balanced panel. (The xsmle command is integrated with mi to handle unbalanced panels.) There is no information in the EPR for some countries. Albeit, the logic of the estimator requires a uniform region preferably. A setting well respected by the African continent. The unit of observation is a parameter of the empirical design. It must be constant over the whole sample period. Some PREG regions switch on and off, merge or split. Some PREG regions intersect. Some PREG regions are very large.

The interpretation of the coefficient is not straightforward.
Equation (4) in the text.

The choice of Wn affects the convergence of the iterative process. The dynamic version of the model with Yt-1 does not converge in general. Very long estimation time, mainly for the Lesage and Pace 2009 simulation process to estimate the standard errors of the total, direct and indirect effects.