FACULTY OF
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RURAL DEVELOPMENT ECONOMICS

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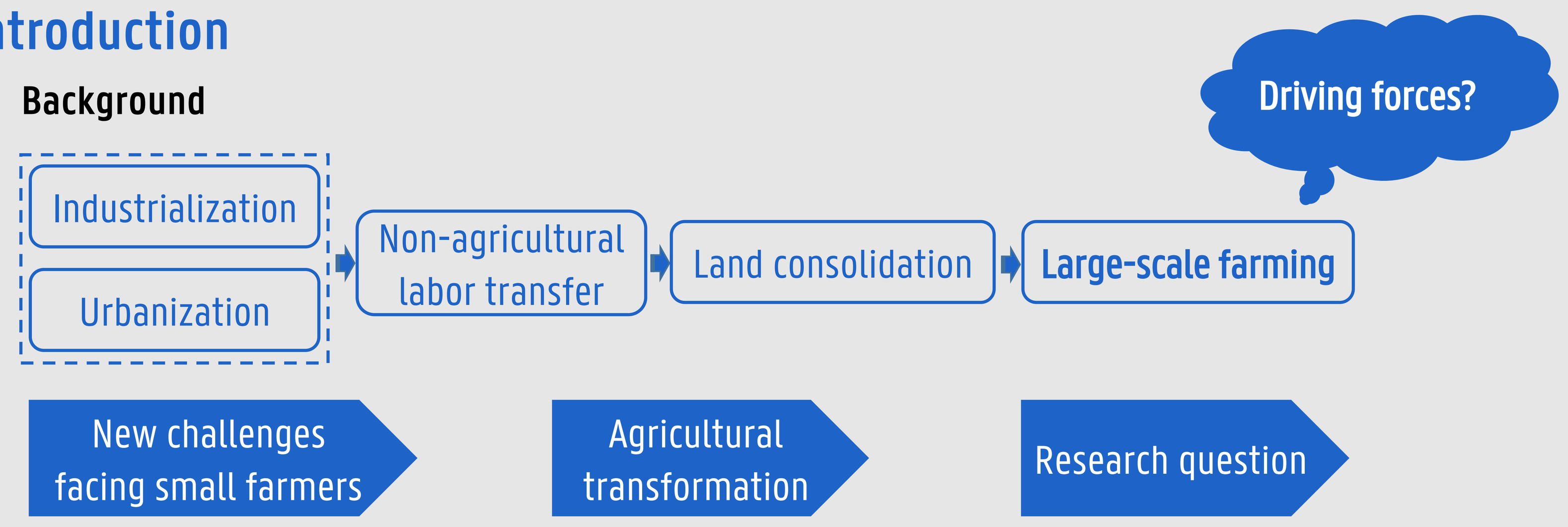
EXPANDING FARMS: A SPATIAL PANEL DATA ANALYSIS TO EXPLORE THE DEVELOPMENT OF LARGE-SCALE FARMING IN CHINA

Introduction

- **Background**



- **Objectives**
  - Examining the determinants that influence the development of large-scale farming while taking into account spatial interrelationship;
  - Proposing policy suggestions on how to promote the sound development of large-scale farming.

Methodology

- **Data collection**

Statistical data covers 44 county-level cities and counties of Jiangsu Province in China from 2002 to 2016.

- **Model specification**

(1) Spatial Autoregressive Model (SAR)

$$y = \rho(I_T \otimes W_N)y + X'\beta + \varepsilon$$

(2) Spatial Error Model (SEM)

$$y = X'\beta + \mu$$

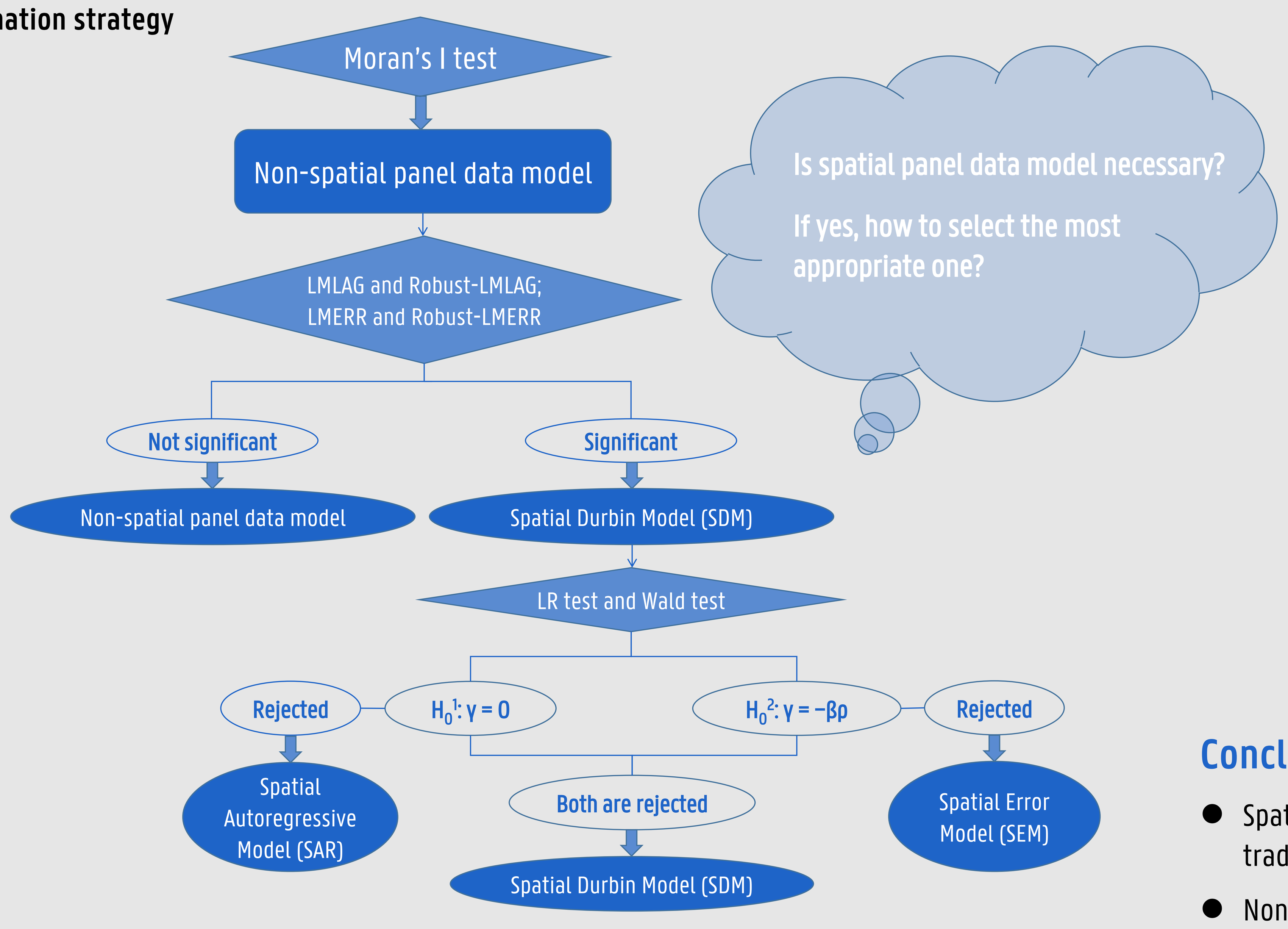
$$\mu = \lambda(I_T \otimes W_N)\mu + \varepsilon$$

(3) Spatial Durbin Model (SDM)

$$y = \rho(I_T \otimes W_N)y + X'\beta + \gamma(I_T \otimes W_N)X + \varepsilon$$

y is dependent variable; X is the matrix of independent variables with its corresponding matrix of coefficients β; ε is the error term; W_N is a (N × N) spatial weighting matrix indicates the interaction between any two counties; ρ is the spatial autoregressive coefficient;
μ reflects the spatially autocorrelated error term; λ represents the spatial autocorrelation coefficient of the error term;
γ is the spatial autocorrelation coefficient of independent variables.

- **Estimation strategy**



Results

- **Spatial weight matrix - Inverse distance weight matrix: Threshold distance**

Table 1 Randomization results of Moran's I-statistic

Critical distance cut-off (km)	Moran's I (Standardized Z-value)		
	$lnSCALE_{i2002}$	$lnSCALE_{i2008}$	$lnSCALE_{i2016}$
min	0.315***(2.365)	0.246**(1.983)	0.417***(3.065)
60	0.335***(3.163)	0.343***(3.289)	0.414***(3.903)
70	0.310***(3.294)	0.218***(2.512)	0.304***(3.237)
80	0.297***(3.573)	0.172**(2.185)	0.263***(3.179)
90	0.288***(3.809)	0.142**(2.050)	0.259***(3.424)
100	0.314***(5.136)	0.048(1.066)	0.214***(3.461)

Note: SCALE=Land area cultivated under large-scale farming/Total cultivated land in the county; *** p<0.01, ** p<0.05, * p<0.1

- **Moran's I-statistic of the dependent variable**
  - Moran's I values are positive at 1% significance level during the whole period;
  - Implying that the promotion of large-scale farming in Jiangsu Province has a significant positive correlation in spatial distribution.

- **Estimates of non-spatial panel data model**

- LR test: The model with two-way fixed effects is justified as the best fitting for the non-spatial panel data specification.
- LM tests and their robust counterparts: Most of the null hypothesis of no spatially lagged dependent variable and no spatially autocorrelated error term are strongly rejected at 1% significance level in all the specifications.

➡ There exists spatial dependence among the data;
Spatial panel model is necessary for further analysis.

- **Estimates of spatial panel data model**

- LR test and Wald test: SDM model is more appropriate than SAR model and SEM model.
- Hausman test: Fixed effects assumption provides a better fit to the given data.

➡ SDM model with spatial and time-period fixed effects is chosen as the best specification.
Model results: The estimated coefficient on the spatially lagged term ρ of the dependent variable is significantly positive at 1% level, suggesting that the development of large-scale farming in neighboring counties exerts a positive effect on local large-scale farm expansion.

- However, the interpretation of spatial spillovers should not stop at the point estimates above; a better interpretation lies in the estimation of indirect effects presented below.

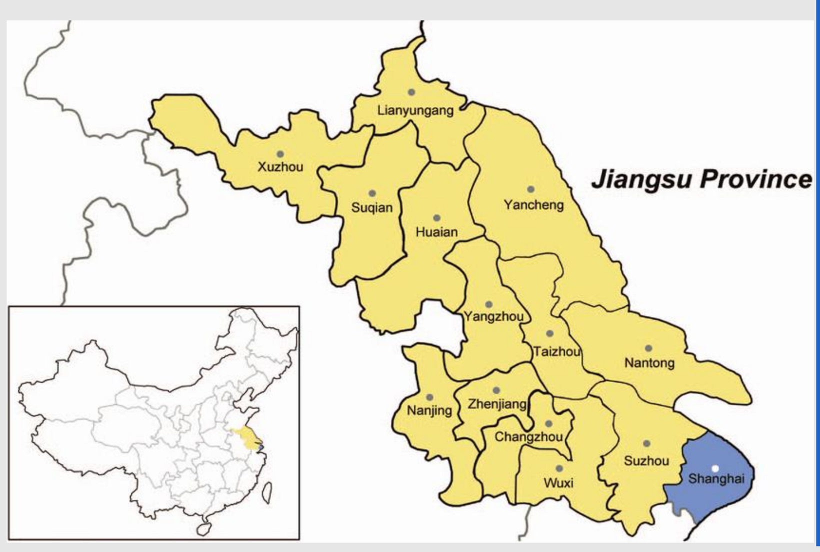
Table 2 Cumulative impacts from SDM model with spatial and time-period fixed effects

Variables	Direct effect	Indirect effect	Total effect
Total land area	-1.7865***	-0.2576	-2.0442***
	(-6.1371)	(-0.5801)	(-3.8818)
Land area per household	-3.1014*	0.1446	-2.9568
	(-1.6981)	(0.0318)	(-0.5723)
Land area per household^2	1.2424**	-0.2434	0.9990
	(2.1648)	(-0.1772)	(0.6432)
GDP per capita	0.2829	0.1372	0.4201
	(1.5919)	(0.4299)	(1.1172)
Share of tertiary industry	-0.7216	2.1367	1.4152
	(-0.7531)	(1.5718)	(0.8812)
Non-agricultural employment	1.5383**	5.2153***	6.7536***
	(2.4690)	(5.5958)	(6.7038)
Agricultural mechanization	0.1619	1.3760**	1.5379***
	(0.4678)	(2.4706)	(2.7540)
Land certification	0.6179***	-0.0975	0.5204*
	(4.2266)	(-0.4384)	(1.9136)

Note: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Conclusions

- Spatial spillovers do exist in the development of large-scale farming between counties in Jiangsu Province; traditional non-spatial panel data model will lead to biased results due to model misspecification;
- Non-agricultural employment, agricultural mechanization as well as land certificate issuance have been found to have positive effects on the promotion of large-scale farming;
- Policy-makers should target their policy for large-scale farm expansion in an overall view, considering not only the development situation of local regions but also possible influence on surrounding regions.



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