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**Agricultural Productivity, Openness, and Urbanization: A Smooth Coefficient Regression Analysis**

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# Agricultural Productivity, Openness, and Urbanization: A Smooth Coefficient Regression Analysis

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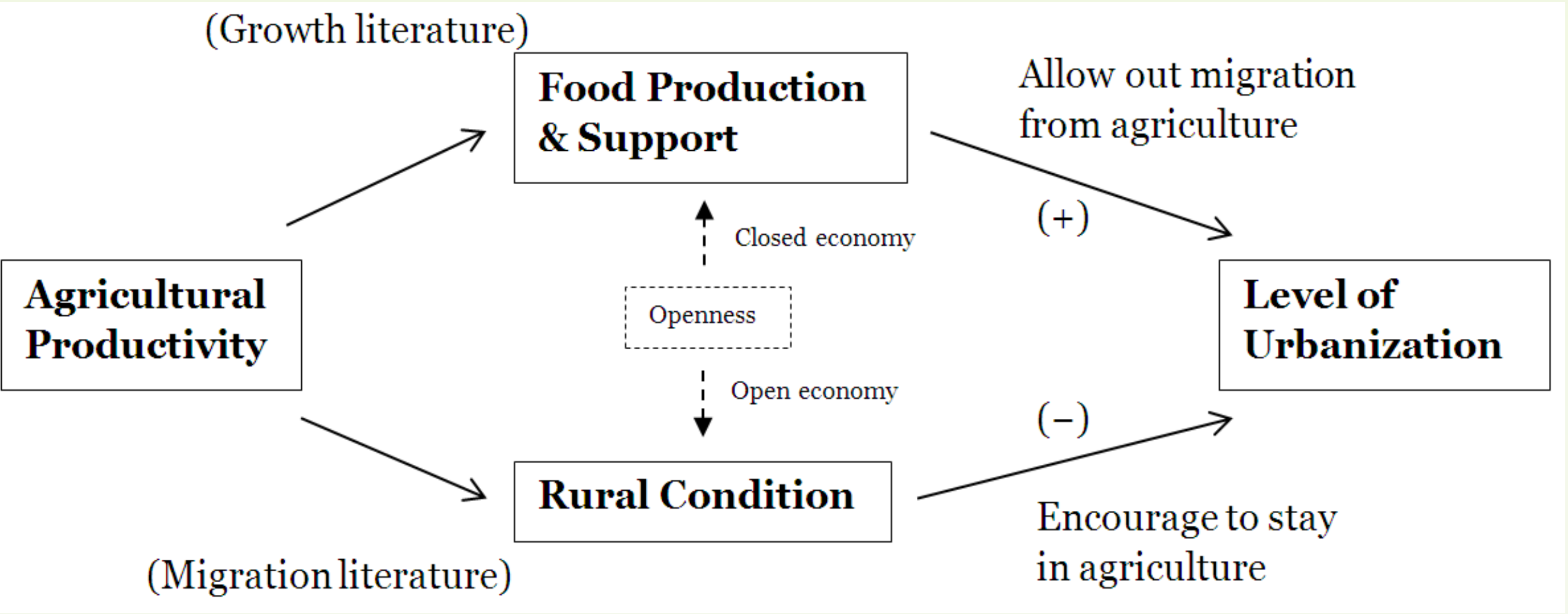
## Motivation

### Conflicting roles of agricultural productivity in the urbanization process:

- Positive role: Increase efficiency of farm production; release labor out of agriculture. (Economic growth literature)
- Negative role: Rise agricultural wage; discourage rural-urban migration. (Migration literature)

### A theoretically reconciling: Matsuyama (1992)

It depends on economic openness. In closed economies, where food relies completely on self-production, high agricultural productivity is a bless for urbanization. In open economies, where food can be freely imported from (exported to) outside market, good agriculture is a curse.



### Goal of this study:

Empirically test the changing role of agricultural productivity in urbanization with different degrees of economic openness.

## Data

### Countries of the world, 1980-2012

- Exclude: developed countries; small, island countries; countries without a significant agriculture sector.
- 105 countries; 2849 observations.
- Sources: FAO; The World Bank.

### Define variables

- Urbanization: Urban population as % of total

$$Urb = \frac{\text{Urban Population}}{\text{Total Population}}$$

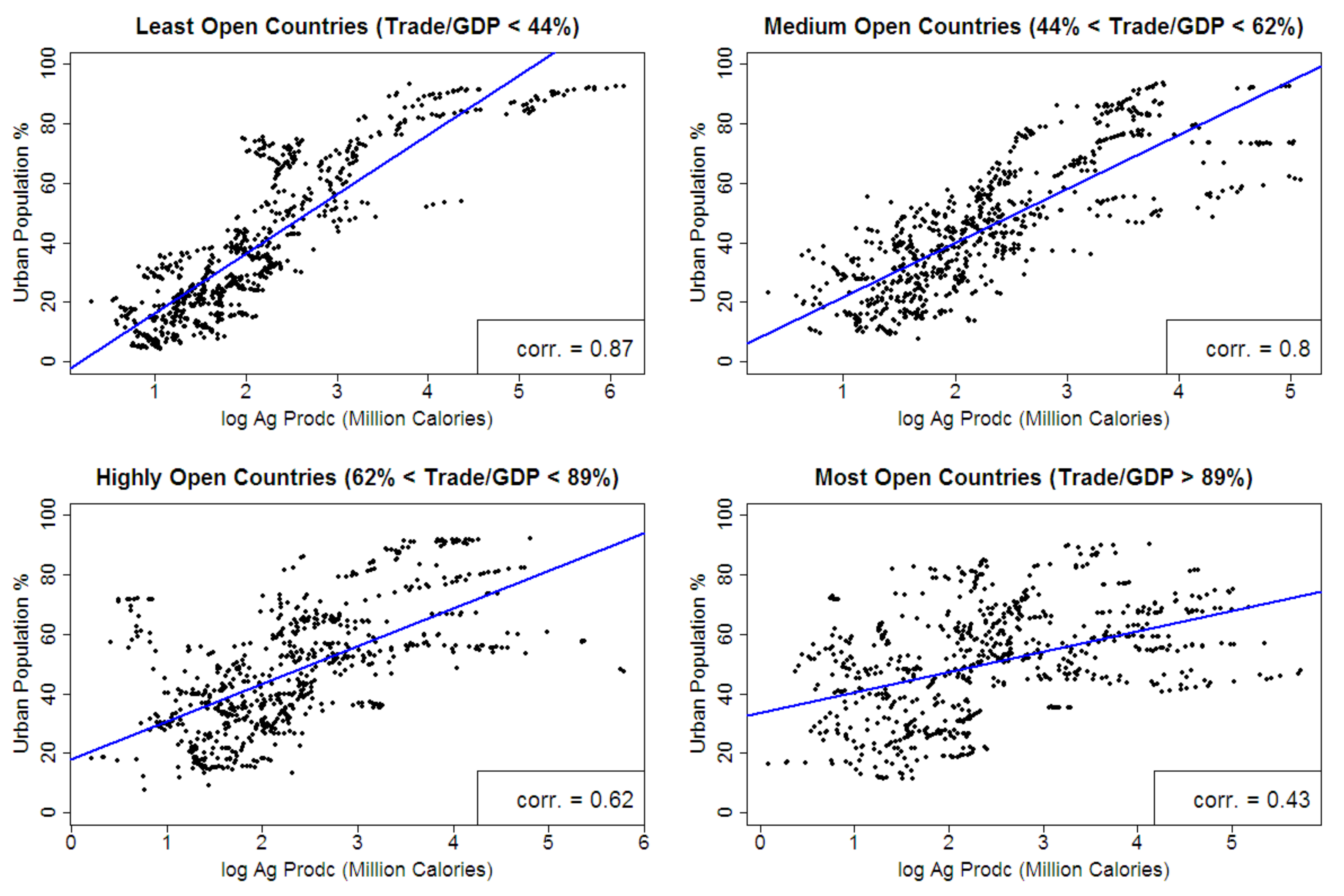
- Agricultural productivity: Calories per labor in cereal production

$$AgPrd = \frac{\text{Total Calories of Cereals Output}}{\text{Labor under Cereals Production}}$$

- Economic openness: International trade as % of GDP

$$openness = \frac{\text{Import} + \text{Export}}{\text{GDP}}$$

### Urbanization ~ agricultural productivity: by degree of openness



Note: 1. Each point in the graphs represents a country in a specific year; countries of various years are pooled together here; 2849 points total of the four graphs.  
2. The four groups of countries are divided by the 1/4, 1/2, 3/4 quantiles of the trade-GDP ratio: 44%, 62%, and 89%.

## Regression Specification

### Smooth coefficient regression:

Regress urbanization on agricultural productivity, with the coefficient allowed to vary by economic openness:

$$Urb = \beta(openness) * \ln(AgPrd) + \varepsilon$$

where  $\beta$  is modeled as a function of  $openness$ .

### Hypothesized pattern:

- $\beta$  is positive and large when  $openness = 0$
- $\beta$  decreases as  $openness$  increases

Try three functional form specifications of  $\beta(\bullet)$ :

(1) Linear:

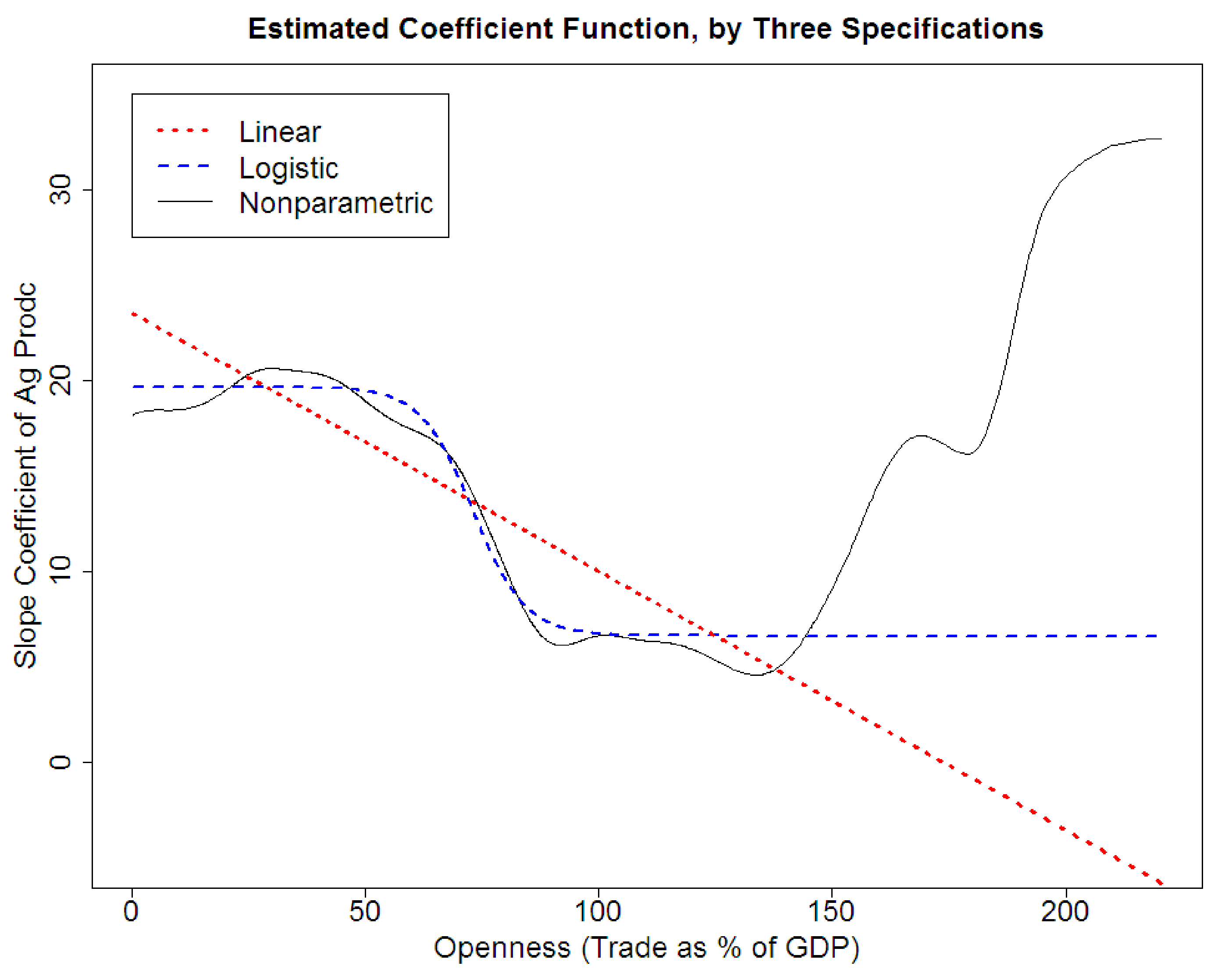
$$\beta = b_0 + b_1 * openness$$

(2) Logistic:

$$\beta = b_0 + b_1 * \frac{1}{1 + \exp[\frac{-\gamma(openness - c)}{sd(openness)}]}$$

(3) Nonparametric

## Results and Conclusions



Notes: 1. Interpretation of  $\beta$ : For a 100% increase in  $AgPrd$ , the level of urbanization is expected to increase by  $\beta$  percentage points.  
2. For most range of openness, the three specifications result to similar declining patterns of the  $\beta$ -function. However, in the range of extremely high openness values (>150%) the three estimates differ dramatically. Especially, the nonparametric estimate reports a trend of rising  $\beta$  by  $openness$ , which may be due to the small sample size and outliers in that openness range.

### Conclusions:

The association between agricultural productivity and urbanization varies with countries' degree of economic openness.

- For economically closed countries, agricultural productivity plays important role in urbanization.
- As the countries become more open, the role of agricultural productivity declines.
- The declining pattern is robust to different functional form specifications.