



The Role of (In-)efficiency as an Explanation of International Income Differences

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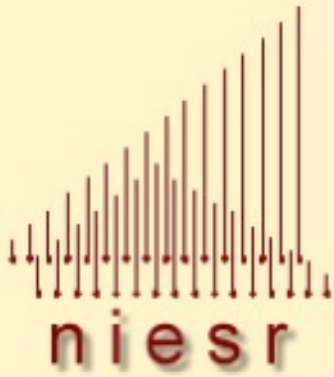
Introduction

- Why are some countries richer than others?
- Physical and human capital accumulation?
- Productivity
- Merely shifts the question to:



Why are some countries more productive than others?

- **Four explanations:**
 1. Resistance to new technology
 2. Appropriate technology
 3. Physical distance or geography
 4. Absorptive capacity



Absorptive capacity

- **Three elements (Morgan, 2002):**
 1. Accessibility to overseas technology
 2. Learning ability
 3. Incentives or barriers to implementing new technology

Current Literature

- **Two-stage approach**
 1. Generate estimates of productivity
 - Residual from growth accounting
 - Residual from econometric estimation of production function
 2. Regressing productivity on a set of explanatory variables



Explanatory Variables

1. Geographic Variables
2. Historical, political and Cultural
3. Policy dependent
 - Human capital
 - Trade variables
 - Macroeconomic stability

Stochastic Frontier Analysis

- Consider the following deterministic frontier:

$$y_i = x_i \beta - u_i, \quad i = 1, 2, \dots, N.$$

- The (output-orientated) Farrell measure of technical efficiency is:

$$TE_i = \frac{y_i}{\exp(x_i \beta)} = \frac{\exp(x_i \beta - u_i)}{\exp(x_i \beta)} = \exp(-u_i)$$

Stochastic Frontier Analysis

II: A Simple 2-part error specification

- SFA decomposes the error term into two parts:
 - Random error term (ε_i)
 - Inefficiency component (η_i)

$$y_i = x_i \beta + \eta_i + \varepsilon_i$$



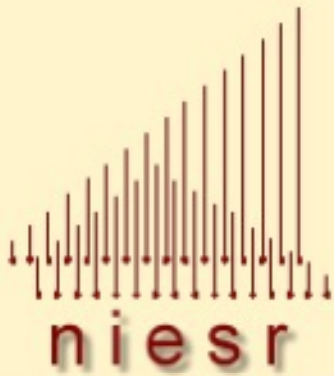
Stochastic Frontier Analysis

III: Estimating the model by ML

- The likelihood function is expressed in terms of two variance parameters:

$$\sigma_s^2 = (\sigma_\eta^2 + \sigma_\varepsilon^2)$$

$$\gamma = (\sigma_\eta^2 / \sigma_s^2)$$



The Determinants of (In-)efficiency

- Could perform a second-stage regression
- However, in first stage, η_i is assumed to be independently and *identically* distributed.
- Battese and Coelli (1995) Model
- Inefficiency effects

$$\eta_{it} = \delta E_{it}$$

Results 1

	<i>Coef.</i>	<i>s.e.</i>	<i>t-stat</i>
<i>CONSTANT</i>	0.049	0.171	0.289
<i>LATITUDE</i>	-0.014	0.003	4.883
<i>TROPICAL</i>	0.282	0.081	3.483
<i>LANDLOCK</i>	0.565	0.083	6.772
<i>URBAN</i>	-0.002	0.000	4.904
<i>HUMAN</i>	-0.226	0.030	7.665
<i>SWOPEN</i>	-0.017	0.047	0.361
σ^2	0.31	0.04	7.61
γ	0.89	0.02	56.69
Countries	82	Obs.	2168



Results 2

	<i>Coef.</i>	<i>s.e.</i>	<i>t-stat</i>
<i>CONSTANT</i>	-0.036	0.191	0.188
<i>LATITUDE</i>	-0.008	0.002	4.172
<i>TROPICAL</i>	0.473	0.098	4.825
<i>LANDLOCK</i>	0.578	0.098	5.905
<i>URBAN</i>	-0.004	0.000	7.370
<i>HUMAN</i>	-0.138	0.026	5.371
<i>SWOPEN</i>	-0.069	0.061	1.127
<i>ICRGE</i>	-0.063	0.021	3.002
σ^2	0.280	0.042	6.613
γ	0.954	0.007	137.333
<i>Countries</i>	77	<i>Obs.</i>	2043



Results 3

	<i>Coef.</i>	<i>s.e.</i>	<i>t-stat</i>
<i>CONSTANT</i>	-1.312	0.433	3.030
<i>LATITUDE</i>	-0.017	0.004	4.514
<i>TROPICAL</i>	1.159	0.230	5.032
<i>LANDLOCK</i>	0.401	0.040	10.021
<i>URBAN</i>	-0.001	0.000	2.901
<i>HUMAN</i>	-0.054	0.010	5.597
<i>SWOPEN</i>	-0.112	0.069	1.623
<i>ICRGE</i>	-0.043	0.012	3.499
<i>ETHNIC</i>	0.007	0.002	4.103
σ^2	0.208	0.015	13.700
γ	0.902	0.011	85.045
<i>Countries</i>	75	<i>Obs</i>	1999



Results 4

	<i>Coef.</i>	<i>s.e.</i>	<i>t-stat</i>
<i>CONSTANT</i>	-0.984	0.324	3.038
<i>LATITUDE</i>	-0.013	0.003	4.502
<i>TROPICAL</i>	0.948	0.172	5.527
<i>LANDLOCK</i>	0.405	0.042	9.542
<i>URBAN</i>	-0.002	0.000	4.202
<i>HUMAN</i>	-0.054	0.010	5.191
<i>SWOPEN</i>	0.132	0.103	1.277
<i>ICRGE</i>	-0.040	0.010	3.879
<i>ETHNIC</i>	0.006	0.001	4.399
<i>SWOPEN*H</i>	-0.048	0.019	2.537
σ^2	0.201	0.018	11.442
γ	0.906	0.008	119.926
<i>Countries</i>	75	<i>Obs.</i>	1999



Conclusions

Evidence that the following factors affect (in-)efficiency

- **Geographical:**
 - Latitude, Tropical, Landlocked
- **Historical, political and cultural:**
 - Urban, and Ethnic mix
- **Policy-dependent**
 - Human capital, quality of institutions
 - Trade interacts with human capital



Looking forward

- **What is the correct way to specify the production technology?**
- **New explanatory variables**
 - Telecommunications
 - Political stability
- **Interactions between factors**
 - Political stability and education
 - Telecommunications structure and education