Regional Quota in Multi-level and Multi-regional Contests: An empirical study of Imperial Exam in China, 1690-1904

Yifei Huang

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Very Brief Introduction of Institutions and Data

- The Imperial Examination: centralized exam to select officials and to grant gentry status
- Three levels of exams: county-level, provincial level, and national level
- Admission Quota: county quota and provincial quota
- My main dataset: county-wise numbers for county quota, provincial graduates, and national level graduates for about 80 counties, 1690-1723, 1726-1760, and 1870-1904 (Liang and Zhang, 2013)
- Two Patterns in the data: (1) rigidity in cross-county difference in quota (maximum value / minimum value < 2); (2) cross-county difference in provincial and national outcomes are huge (best / worse > 10); (3) Conditional on passing the provincial exam, a student from better-performed county has much higher chance of passing the national exam.

Some Patterns in the Data

- Rigidity in cross-county difference in quota (maximum / minimum < 2);
- Cross-county differences in provincial and national outcomes are huge (best / worse > 10);
- Conditional on passing the provincial exam, a student from better-performed county has much higher chance of passing the national exam.

My Questions

- How to explain cross-county difference in exam outcomes?
- Whether relative abundant quota in those relatively poorly performed counties (in provincial and national levels) actually harm them in terms of incentivizing private educational investment?

A Hypothesis of Quota Curse Effect

- A fact: the preparation for exams took more than 20 years, and average age for passing county-level exam is 24, for provincial exam is 30, and for national exam is 35. (Zhang, 1955)
- An important assumption to drive results: **Dynamic complementarity of educational investment**. Specifically, investment before passing county exam not only helps improve performance in county-level exam, but also helps more efficient investment in the future.
- (Rough) Intuition: Counties with more stringent quota would have more competitive county-level exams, which would push students to make more investment at young ages. A particularly element is that the option value of passing county-level exams is proportional to students' ability, since higher ability students are more promising in passing future advanced exams.

A Simple Model– One levels and one region case (Lau, 2012)

- Individual Decision Making

$$u(\theta_i, e_i, \bar{S}) = \begin{cases} \alpha[s(\theta_i, e_i) - \epsilon_i] + W - c(e_i) & \text{if } s(\theta_i, e_i) - \epsilon_i \geqslant \bar{S} \\ \alpha[s(\theta_i, e_i) - \epsilon_i] - c(e_i) & \text{otherwise} \end{cases}$$

$$\begin{aligned} \mathbb{E}(u(\theta_i, e_i, \bar{S})) &= \alpha s(\theta_i, e_i) - c(e_i) + \mathbb{P}[s(\theta_i, e_i) - \epsilon_i \geqslant \bar{S}]W \\ &= \alpha s(\theta_i, e_i) - c(e_i) + H(s(\theta_i, e_i) - \bar{S}) \end{aligned}$$

FOC:

$$\frac{\partial s(\theta_i, e_i)}{\partial e_i}[\alpha + h(s(\theta_i, e_i) - \bar{S})W] = c'(e_i)$$

Intuition: Assuming $h(\cdot)$ is single-peaked at 0, then the FOC implies the closer a student's expected score is from cutoff score, the more motivation is provided by the discrete prize for passing.