Heterogeneous Peer Effects and Rank Concerns: Theory and Evidence

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Introduction

- The aim of the paper is to develop a model of peer effects and scholastic achievement and to understand how the variance of student performance matters for outcomes.
- The key idea in the model developed is that students care about their own score and how they rank in their class.
- The theoretical model solves for the equilibrium effort in the classroom.
Introduction

The results in the paper are important because

1. We do not know enough about peer effects and how they work
2. The paper makes an explicit attempt look at the data through the prism of a well articulated theory
3. The specific results here speaks directly to the question of whether children should be streamed by ability.
The outline of the model

- Test scores depend on own effort and peer ability (not performance).
- Preferences depend on test score outcomes, effort expended in obtaining them and importantly on class rank.
- The utility function takes the special form $U = V(y, q)(\phi + F(y))$ where $F(y)$ is the cdf of scores in the classroom and $q$ is cost of effort.
- Since rank will depend on effort, which in turn is a monotonic function of effort cost, we can rewrite these as $U = V(y(e), q(e, c))(\phi + 1 - G(c(e)))$
- This is then maximized to solve for the equilibrium strategy, taking into account the endogenous nature of rank.
- At this point it is unclear how restrictive the specification is.
The implications of this model are rich and interesting. Specifically, increasing the variance of the peers will have different effects at different parts of the distribution and will depend on the density of individuals ranked close by. If the density is high, this induces more effort since it is easier to overtake people nearby. When the variance increases (with $\phi > 0$), low ability improve performance, ambiguous at the top and worse in the middle. With $\phi = 0$ all do worse except sometimes the high ability. So the value of more diverse or more selected classes is an empirical question and depends on the specific ability group. Specific policy implications are unclear.
At a more general level it would be nice to know what the educational production function looks like.

Is unbridled competition a good idea? Or should we be promoting cooperation: competitive effects versus better circulation of information but also free-riding.

From a positive perspective, what do schools think: do they really promote competition, do they publish rank? Do they promote cooperation?
Taking the model to the data

- The challenge here is to find exogenous shifters of the variance of ability within the classroom.
- In addition it is desirable to be nonparametric about the preference structure.
- The model is assumed to take the separable structure:
  \[ y = m_l(c_i) + \epsilon_{il} = e_l(c_i, G_l(c_i)) + u_l(c_i, \text{classroom characteristics}) + v_{il} \]
- This contrasts with the model equation:
  \[ y = a(\mu)e(\mu, c_i, G_l) + u(\mu) \]
- Looking at this I would say the model corresponds to one with unobserved individual and
Taking the model to the data

- It is unclear how this decomposition individual and classroom effects relates to the model.
- In particular the first function normally interacts with average classroom ability.
- The next key restriction is that $c_i$ is an index of observables.
- This will allow matching individuals by cost of effort.
- The object will be to isolate the impact of changing $G(c_i)$.
Taking the model to the data

- The strategy will be diff in diffs.
- Going back to the fundamentals, a Diff-in-diffs strategy requires the counterfactual to be a monotonic function of the unobservable say $v$, i.e. $y = H(v, t)$.
- The distribution of the unobservable $v$ has to be invariant over time.
- Here it is more complicated because of the continuous nature of the treatment- but the idea is the same.
- The theoretical model is not separable in the way presented here. Hard to see how we can fir it in this framework.
- Both classroom and individual characteristics are likely to contain unobserved components.
- For example effort interacts with a function of average classroom ability.
Taking the model to the data

- This brings us to another related issue: test scores do not have a natural scale and diff-in-diffs estimates are not invariant to monotonic transformation.
- So the starting point of linking the model to the data should not assume additive separability.
- The two points relate because this means we need an empirical approach that does not depend on a specific scale for the test scores.
- Hence it would be good if we could have an empirical approach that did not depend on additive separability between observables and unobservables.
- The key would be to show conditions under which the counterfactual can be written as a function of one unobservable.
Taking the model to the data

- Empirically, the important idea in the paper is that the 2010 earthquake would have increased exogenously the variance of cost of education (cost is used interchangeably with ability).
- The argument is developed for the population of schools where there were no evacuations and which receive no evacuees.
Taking the model to the data

Here is the basic argument:

1. Pupils come into a specific school from nearby areas with very different earthquake outcomes. Hence the earthquake increased variance conditional on average local intensity.

2. We can use pre-earthquake data to control for permanent differences between areas of different earthquake intensity.
Taking the model to the data

- Of course the average peer ability can also change.
- Since we want to get at the effect of a mean preserving change in the spread this has to be taken into account.
- This is done by matching people on the cost of education.
- This is a function of observables and of earthquake intensity at the place of residence.
Taking the model to the data

- The key threat to identification is that educational processes change differentially across different earthquake intensities.
- Some evidence is presented to corroborate - for example completing the curriculum as an outcome variable.
- Effectively the empirical approach tries to eliminate all other reasons for the areas to be different leaving the variance as the only remaining factor.
- It is important to realize that the variance of performance is never used directly.
- We need to accept that all other factors have been eliminated and hence the only remaining effect is the effect of the variance.
Taking the model to the data

- The results suggest that the increase in variance harmed only the middle in "Spanish"; it harmed all but the lower ability (highest cost) in Maths.
- This is implicitly driven by preferences ($\phi > 0$ or $\phi = 0$) and on the baseline distribution.
- For an improvement to be induced the increase in the variance must have increased the density to make competition more effective.
Concluding remarks

- This is an ambitious and interesting paper that combines economic theory reasoning with empirical results induced by exogenous variation.
- Careful collection of data and analysis combined with the idea of using the earthquake makes for a rich empirical framework.
- The link between the theory and the empirical model and identification strategy needs to be strengthened.