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Testing Exclusion Restriction at Infinity in the Semiparametric Selection Model

3rd Conference on Policy Evaluation, 27.10.2006

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The selection problem

- Manski (1994):

  $$P\left(y^*\middle|x\right) =$$

  $$P\left(y^*\middle|x, I=1\right)P\left(I=1\middle|x\right) + P\left(y^*\middle|x, I=0\right)P\left(I=0\middle|x\right)$$

- We observe $P\left(y^*\middle|x, I=1\right)$ and $P\left(I=1\middle|x\right)$.

  Therefore

$$P\left(y^*\middle|x\right) \in \left[P\left(y^*\middle|x, I=1\right)P\left(I=1\middle|x\right) + \gamma P\left(I=0\middle|x\right), \gamma \in \Gamma\right]$$

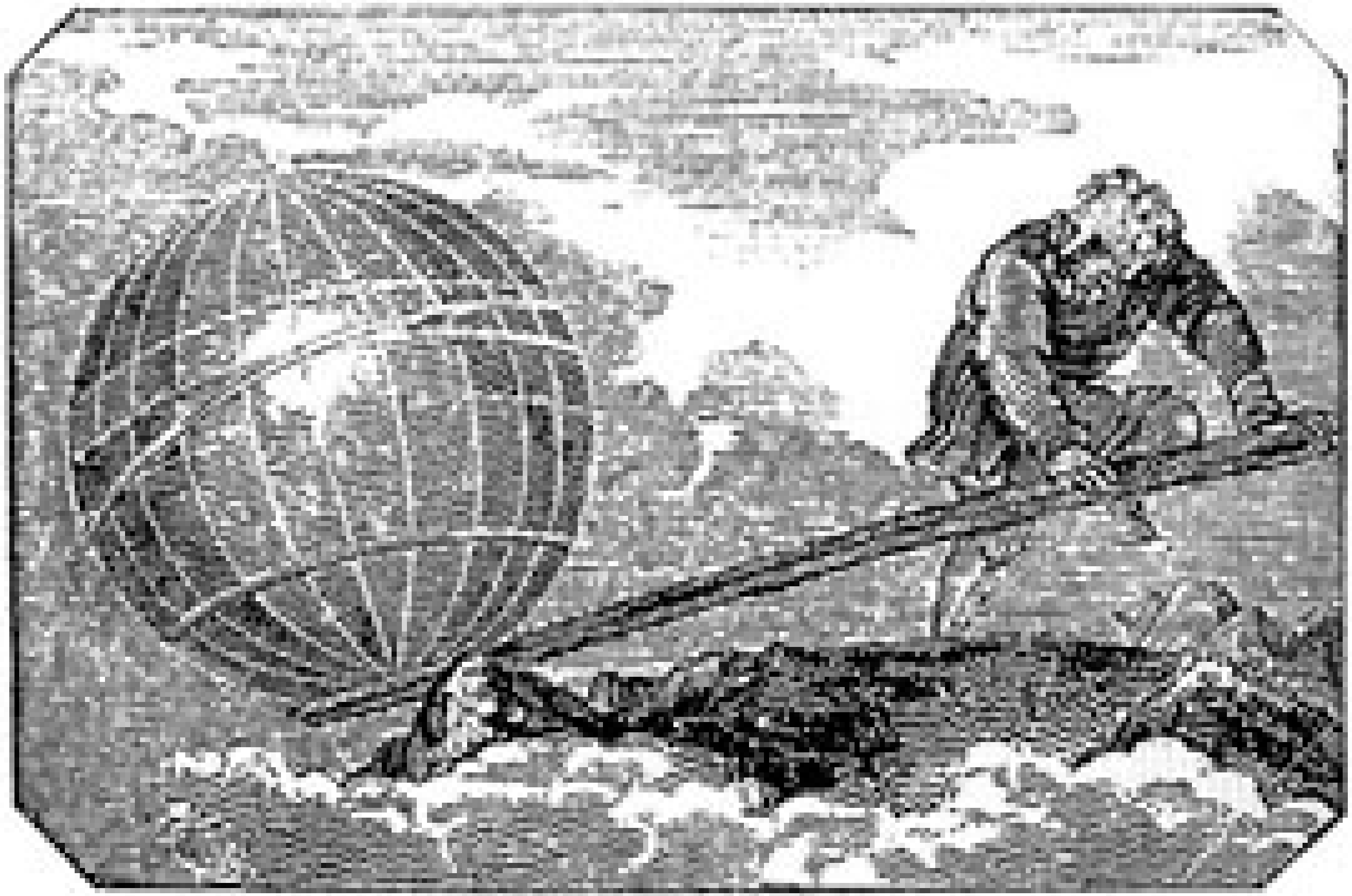
$P\left(I=1\middle|x\right) = 1 \Rightarrow P\left(y^*\middle|x\right)$ is point identified.

The selection problem

- If we have a parametric model that is identified using only observations with $P\left(I=1|x\right)=1$ then we identify $P\left(y^{*}|x\right)$ for all observations
- If we add more structure: single index assumption for $P\left(I=1|x\right)$, independence of the error terms from the regressors, linear functional form, then we identify all parameters assuming only unbounded support of the single index
- Contributions: identification of the slope parameters test of the exclusion restriction, alternative estimator

"Give me a lever long enough and a place to stand, and I will move the earth."

Archimedes Circa 240 BC



« Give me … a place to stand »

- A place to stand: observations with $P\left(I=1|x\right)=1$
- Do they exist?
  - Theoretically: we need an error term with bounded support or a regressor with infinite support
  - In applications: often difficult to find! Covariates have typically a bounded support
- The problem is even worse if we want to evaluate a program: we need observations with $P\left(I=1|x\right)=1$ and others with $P\left(I=1|x\right)=0$

« Give me … a place to stand »

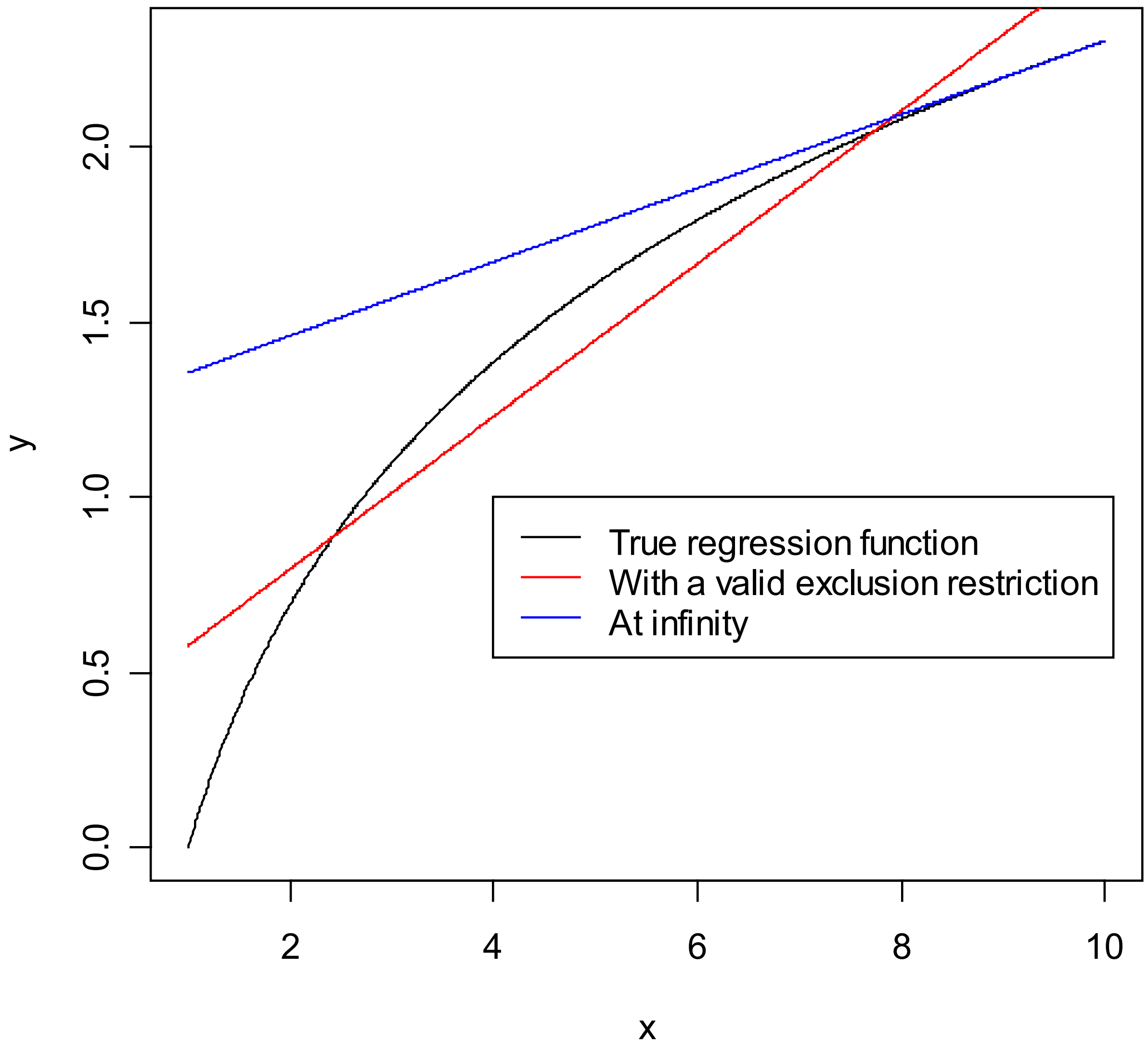
- Another problem of the estimation at infinity: non-robustness, sensibility to outliers
- An alternative that does not require the presence of observations with $P\left(I=1|x\right)=1$ and the choice of a threshold would be to bound $P\left(y^{*}|x\right)$ instead of trying to point identify it. Tests against violations of the exclusion restriction can be built.

  Blundell, Gosling, Ichimura and Meghir (2006): for the quantiles. A parametric model can be added as restriction. For the mean: bounded support for y

« Give me a lever long enough »

- A lever long enough: the parametric model
- This identification strategy is a pure parametric strategy based on extrapolation. If the test reject the model: should we reject the exclusion restriction? or the parametric model?
- A generalization of the proposed approach to an arbitrary parametric model (without the single index assumption and the independence assumption) is possible as long as the moment conditions are identified using only observations with $P\left(I=1|x\right)=1$

« Give me a lever long enough »



Conclusion and 2 short questions

- This paper exhausts the implications of classical selection models. This is an important contribution
- From my point of view, the fact that we can identify all parameters without exclusion restrictions show how strong (unrealistic?) these assumptions are.

- 2 short questions:

- Is there an efficiency gain if we test simultaneously for the value and the derivative? (theoretically)
- I don’t understand the results for the LIV. Is the extrapolation possible?