Embarassingly Parallel GMM over Split Data Sets

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The Idea

- Develop a methodology to estimate (linear) GMM when datasets are split into subsamples that cannot be merged together.
- In a nutshell: compute each component of the numerator & the denominator of the estimator $Z'Y/Z'X$, then aggregate them "at home"
- Two cases, two examples:
  - **Case 1**: subsamples contain Z, X, and Y
    Example 1: disentangling credit supply vs demand using various Credit Registries
  - **Case 2**: X and Y are in separated datasets (and Z can be matched to both)
    Example 2: effect of education on firm productivity (X employee education, Y productivity, Z -say- compulsory educ.reform)

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- Very manageable
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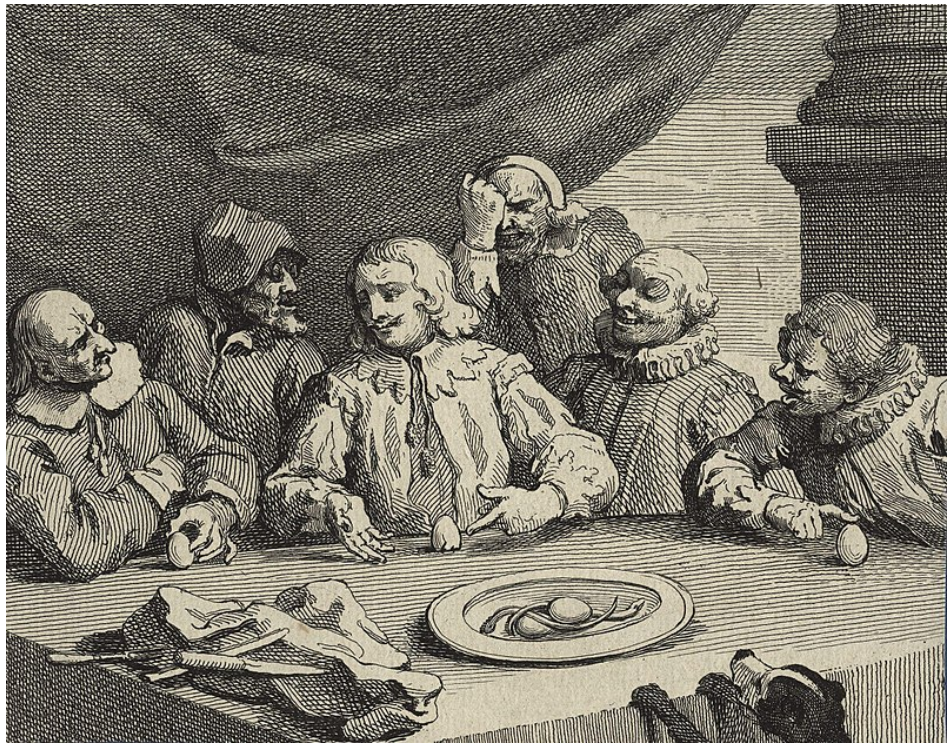
Looks like a Columbus' Egg!



Critical Points

- The pro's and con's of cross-country? The case of production function estimation.

$$y_{ic} = f(X_{ic}, \beta_c) + \omega_{ic} \tag{1}$$

OR

$$y_{ic} = f(X_{ic}, \beta) + \tilde{\omega}_{ic} \tag{2}$$

if true DGP is (2), then $\beta_c = \beta$,
if true DGP is (1), then $\tilde{\omega}_{ic}$ is biased (shall we make cross-country comparisons with biased TFP estimates?)

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- What about inference? Say, for policy evaluation.
  Bootstrapping, wild bootstrapping, cluster-robust inference...
- In Case 2: ZY and ZX samples must have strictly the same observations,
  otherwise you may need a "missing at random" assumption.

Conclusions

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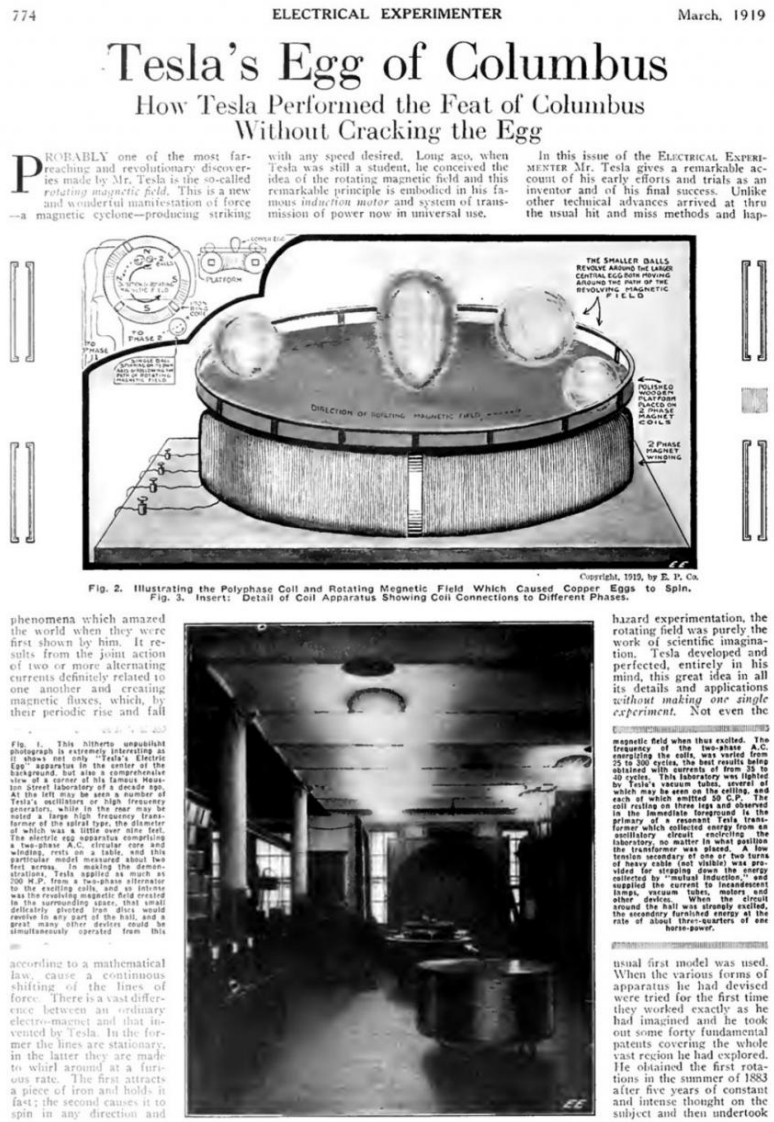
- **from Columbus' Egg to Tesla's Egg**
  First-best for integrated economies (like EU!): allow for reliable, harmonized micro-level data at firm level.
  H2020 MicroProd ?



774 ELECTRICAL EXPERIMENTER March, 1919

Tesla's Egg of Columbus

How Tesla Performed the Feat of Columbus Without Cracking the Egg

PROBABLY one of the most far-reaching and revolutionary discoveries made by Mr. Tesla is the so-called *rotating magnetic field*. This is a new and wonderful manifestation of force—a magnetic cyclone—producing striking with any speed desired. Long ago, when Tesla was still a student, he conceived the idea of the rotating magnetic field and this remarkable principle is embodied in his famous *induction motor* and system of transmission of power now in universal use.

In this issue of the ELECTRICAL EXPERIMENTER Mr. Tesla gives a remarkable account of his early efforts and trials as an inventor and of his final success. Unlike other technical advances arrived at thru the usual hit and miss methods and hap-

Fig. 2. Illustrating the Polyphase Coil and Rotating Magnetic Field Which Caused Copper Eggs to Spin. Fig. 3. Insert: Detail of Coil Apparatus Showing Coil Connections to Different Phases.

phenomena which amazed the world when they were first shown by him. It results from the joint action of two or more alternating currents definitely related to one another and creating magnetic fluxes, which, by their periodic rise and fall

Fig. 1. This hitherto unpublished photograph is extremely interesting as it shows not only "Tesla's Electric Egg" apparatus in the center of the background, but also a comprehensive view of a corner of his famous Houston Street laboratory of a decade ago. At the left may be seen a number of Tesla's oscillators or high frequency generators, while in the rear may be noted a large high frequency transformer of the spiral type, the diameter of which was a little over nine feet. The electric egg apparatus comprising a two-phase A.C. circular core and winding, rests on a table, and this particular model measured about two feet across. In making the demonstrations, Tesla applied as much as 700 H.P. from a two-phase alternator to the exciting coils, and as intense was the revolving magnetic field created in the surrounding space, that small delicately pivoted iron discs would revolve in any part of the hall, and a great many other devices could be simultaneously operated from this

according to a mathematical law, cause a continuous shifting of the lines of force. There is a vast difference between an ordinary electro-magnet and that invented by Tesla. In the former the lines are stationary, in the latter they are made to whirl around at a furious rate. The first attracts a piece of iron and holds it fast; the second causes it to spin in any direction and

hazard experimentation, the rotating field was purely the work of scientific imagination. Tesla developed and perfected, entirely in his mind, this great idea in all its details and applications *without making one single experiment*. Not even the

magnetic field when thus excited. The frequency of the two-phase A.C. energizing the coils, was varied from 25 to 300 cycles, the best results being obtained with currents of from 35 to 40 cycles. This laboratory was lighted by Tesla's vacuum tubes, several of which may be seen on the ceiling, and each of which emitted 50 C.P. The coil resting on three legs and observed in the immediate foreground is the primary of a resonant Tesla transformer which collected energy from an oscillatory circuit encircling the laboratory, no matter in what position the transformer was placed. A low tension secondary of one or two turns of heavy cable (not visible) was provided for stepping down the energy collected by "mutual induction," and supplied the current to incandescent lamps, vacuum tubes, motors and other devices. When the circuit around the hall was strongly excited, the secondary furnished energy at the rate of about three-quarters of one horse-power.

usual first model was used. When the various forms of apparatus he had devised were tried for the first time they worked exactly as he had imagined and he took out some forty fundamental patents covering the whole vast region he had explored. He obtained the first rotations in the summer of 1883 after five years of constant and intense thought on the subject and then undertook

Thank You