An Economist's Roadmap: from the World to formal Theory, and back to (Experimental) Data

by Alexis Belianin
ICEF and Laboratory of Experimental Economics
icef-research@hse.ru

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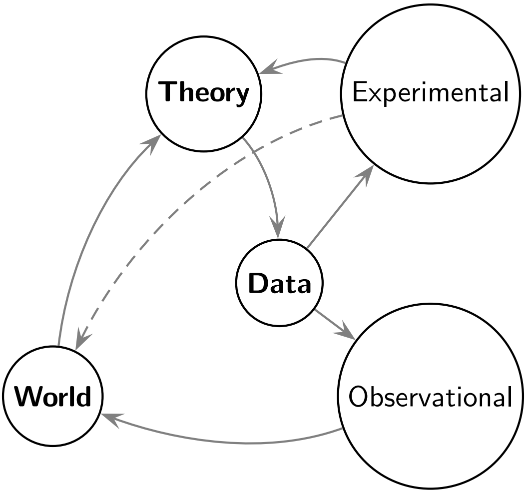
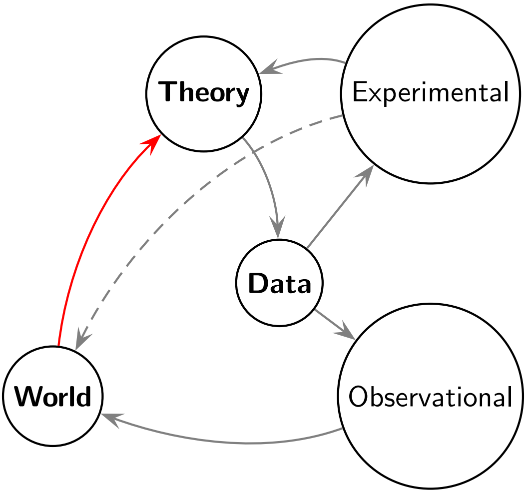


World to Theory



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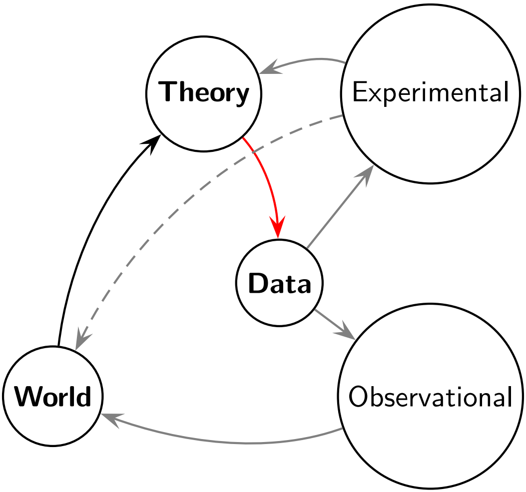
- And yet — they take place: GKO–OFZ in Russia, LTCM in US, Housing pricing bubble, financial pyramids...
- Behavioural explanations (Shiller, 2008, 2010): herd behaviour or information cascades (Bikhshandani e.a, 1982; Banerjee, 1982), or limits of arbitrage (Shleifer, 1986).
- Smith, Suchanek and Williams (1983) have shown that bubbles can systematically arise in classroom experiments.

Theory to Data



Theory–Data: Fertility decisions

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- ALL developed countries
- Policy question: how to increase it? Solutions for different countries tend to be temporary, incl. maternity capital in Russia.
- Furthermore, reduced-form estimates show insignificance of income for fertility decisions.

Random utility framework

Let $u(X_{it}, m_{it})$ be the utility of the i^{th} individual in period t, where m_{it} is the number of existing children, X_{it} is the vector of other (observable) covariates. Let $\delta_t = 1$ if decision to give birth is made in period t, and 0 otherwise.

Assume that per period utility is also affected by additive unobservable shock ξ_{it} with known distribution. Then (Volpin, 1984)

$$\delta_t = \begin{cases} 1 & \text{if } u_Y(X_{it}, m_{it}+1) + \xi_{it} \geq & u_N(X_{it}, m_{it}) + \xi_{it} \\ 0 & \text{if } u_Y(X_{it}, m_{it}+1) + \xi_{it} < & u_N(X_{it}, m_{it}) + \xi_{it} \end{cases} \tag{1}$$

Dynamic opimization problem

Expected value of present and future utility flows is given

$$V(X_{it}, m_{it}) = \max_{\{\delta_t\}_{t=0}^{T}} \sum_{t=0}^{T} \beta^t \int u(X_{it}, m_{it}, \delta_t, \xi_{it}) dF(\varepsilon_{it}) \quad (2)$$

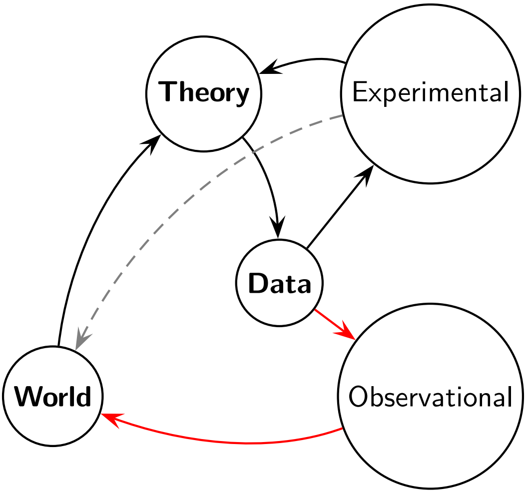
$$\text{given} \quad X_{i,t+1} = g(X_{it}, m_{it}, \delta_t, \xi_{it}, \varepsilon_{it}), \beta < 1, T \leq \infty$$

Present and future utilities are connected by the *Bellman equation*:

$$V(X_{it}, m_{it}) = \max_{\delta_t} u(X_{it}, m_{it}, \delta_t, \xi_{it}) + \beta \mathrm{E} V(X_{it+1}, m_{it+1}). \quad (3)$$

Parameters of this model are estimated by maximum likelihood using Nested Fixed Point Algorithm (Rust, 1992) on Russian data (RLMS).
Results reveal importance of income for childbearing decisions.

Data to World I



Data (Observational)–World: Do Guns Cause Crime?

- YES, OF COURSE: Guns are weapons to injure and kill. In the US, about 70% of homicides involve guns, and there are over 100,000 nonfatal vounded people per annum.

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  2. voting for the Republicans in the 1988 Presidential election
  3. numbers of military veterans

Data (Observational)–World: Do Guns Cause Crime II

- Controlling for county-level heterogeneity via fixed effect 2-stage GMM estimator, estimate

$$h_i = \beta_0 + \beta_1 Z_i + \beta X_i + \epsilon_i \tag{4}$$

where Z_i are instruments for g_i, X_i is a vector of other covariates, and β_1 is the estimated "average treatment effect".

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- Depending on specification, the authors find significant negative effect of guns on crime, implying 10 to 15% decrease of murders per 100,000 inhabitants if gun ownership is increased by 1%.

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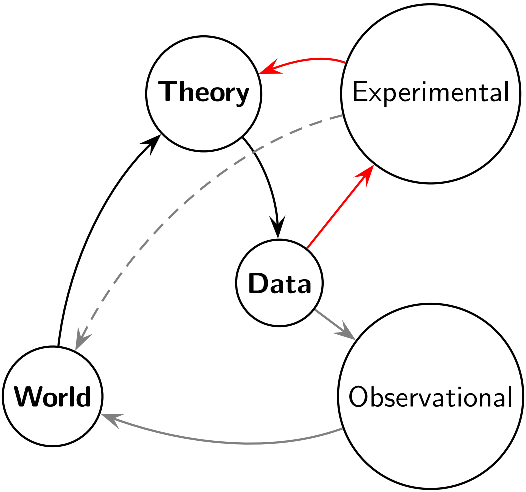
- Obvious policy relevance.

Data to World II



Data (Experimental)–Theory: Choice under Uncertainty

- Given the set of possible states of the world $\Omega = \{\omega\}$ and their consequences X, acts (as objects of choice) are functions $f : \Omega \to X$ and the set of acts is $F = X^{\Omega}$.
- von Neumann–Morgenstern Expected Utility Theory and Savage Subjective Expected Utility Theory are both based on *sure-thing principle* (aka *independence axiom*): if the consequences of two acts f and g differ only on the subset of states of the world $A \subset \Omega$, then preferences over them are independent of their consequences on A^C.
  e.g. $f =$'I would invest in a new project if United Russia gets over 2/3 votes in the election', $g =$'I would not invest in a new project if United Russia gets under 2/3 votes in the election', $A =$'United Russia gets over 2/3', $A^C =$'United Russia gets under 2/3'. Then, if $f \succeq_A g$ and $f \succeq_{A^C} g$, I prefer f to g no matter whether A or A^C will take place

Data (Experimental)–Theory: Savage/Subjective Expected Utility

IF sure-thing principle and other *Savage axioms* take place, then my preferences over acts can be described by the Subjective Expected Utility functional:

$$f \succeq g \Leftrightarrow \int_{\Omega} u(f(\omega))d\mu(\omega) \geq \int_{\Omega} u(g(\omega))d\mu(\omega) \qquad (5)$$

where μ is the subjective probability measure.

Data (Experimental)–Theory: The Ellsberg Paradox

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  Case 2 Bet C: if either a Red or a White ball is drawn, you receive \$100, if not, 0. Bet D: if either a Black or a White ball is drawn, you receive \$100, if not, 0.

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- People most often bet A in case 1 and bet D in case 2, but this violates the sure-thing principle: addition of the same event 'White ball' changes preferences!.

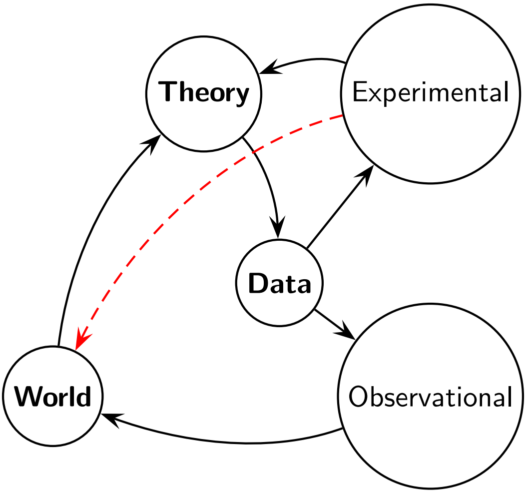
Data (Experimental)–Theory: Choquet Expected Utility Theory

Instead of subjective probability measure μ, use nonadditive measure ν which does not necessarily satisfy $\nu(A \cup A^C) = \nu(A) + \nu(A^C)$, i.e. while $\nu(A \cup A^C) = 1$, it is possible that $\nu(A) + \nu(A^C) \neq 1$.
Schmeidler (1986) proves the Choquet Expected Utility representation analogous to SEU:

$$f \succeq g \Leftrightarrow \int_\Omega f \circ u(\omega) d\nu \geq \int_\Omega g \circ u(\omega) d\nu \qquad (6)$$

where integrals are defined in the sense of Choquet, i.e. $\int_\Omega f d\nu = \sum_{i=1}^m (x_j - x_{j-1}) \nu(\cup_{i=1}^m A_i)$
This approach is increasingly popular in finance (to measure investor pessimism etc.).

Data to World III



Data (Experimental)–World: Potential outcomes framework (D.Rubin)

- We want to estimate the effect of treatment D (sanitation, democracy, education...) on performance indicator Y (health, government efficiency, exam performance...), i.e. to see if performance of the treated units Y_1 is systematically larger than performance of the non-treated units Y_2.

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- But each individual unit can be either treated $(D = 1)$ or not $(D = 0)$, but we cannot observe the same unit in both states!
- Solution: *randomization*, or random assignment of many units to control and treatment groups. The mean difference-in-differences treatment effect is then

$$\tau = (\bar{y}_1^t - \bar{y}_0^t) - (\bar{y}_1^u - \bar{y}_0^u) \qquad (7)$$

where $\bar{y}_1^t$ is mean performance of treated units after treatment, $\bar{y}_0^t$ is their performance before treatment, $\bar{y}_1^u$ and $\bar{y}_0^u$ is mean performance of untreated units before and after treatment, resp.

Data (Experimental)–World: Field Experiments

- In *classroom* experiments, which bring subjects to the classroom and observe their behaviour in controlled environment
- In *natural* experiments, researchers observe behaviour of subjects affected by some *natural* treatment (reform, war...)
- In *field* experiments, researchers use randomized assignment of units to treatment and control group in their real life and and bring in some changes (sanitation, democracy, education...) to measure its effect in real life..
- Key names: A.Banerjee (MIT), E.Duflo (MIT), M.Humphreys (Columbia), P.Dupas (Stanford)...
- Close to social work rather than research.
- Usually VERY time-consuming (about 5 years) and VERY expensive (millions US$), but sometimes feasible in Russia (!)

Conclusion

- Economics can be interesting
- Economics can be useful
- Economics is worth your time and efforts :)

Questions and suggestions are most welcomed!