

## 1 What is Formalized Economics ?

*Definition 1 (positive view)* Whatever the people in this room are doing in their professional life.

This defines a field, in the technical term of Bourdieu. Every field has its own rules regarding entry, (intellectual) capital-building (university positions and specialized journals), market power.

*Definition 2 (normative view)*  $FE = MM + ?$

Where MM is Mathematical Models and ? will be defined later

## 2 No concern on the LHS of the equation

The mathematics are doing just fine, thank you:

- equilibrium theory (Arrow-Debreu, rational expectations): fixed point theorems,
- growth and investment: optimal control, infinite horizon
- finance: stochastic processes
- consumer theory and collective demand: nonlinear systems of PDEs, exterior differential calculus (Slutsky conditions and their generalizations to efficient groups)
- principal-agent problem, hedonic markets, matching problems: optimal transportation
- and lots of open problems:
  - moral hazard,
  - qualitative theory for adverse selection
  - numerics for multidimensional contract theory

To sum up, it has been my experience that if you take the theory seriously, you end up with extremely interesting mathematical problems. Some open up avenues for existing theory, others raise entirely new problems (calculus of variations with convexity constraints)

Note : I personally lay great hope in hedonic models, ie quality goods

### 3 Partial concerns about the arrow

*First meaning of the arrow:* is anyone listening out there ?

It certainly is a fact that mathematical tools or models are no longer as popular as they used to be within the broader economics community (except for finance). At best, people will try to make their point with as simple a model as possible (adverse selection, two types). This has to do with the sociology of the field, and may well be reversed.

*Second meaning of the arrow:* check model on data.

- are there testable consequences of the theory (characterization) ? Slutsky or its analogues for collective demand. D
- if so, can we retrieve the characteristics of the model:
  - non-parametrically (identifiability), eg. the utility function from the demand function
  - parametrically (identification), eg the parameters of an assumed Cobb-Douglas utility from finitely many observations of demand

Raises interesting mathematical questions in itself:

- this is really looking into mappings between function spaces: surjectivity, injectivity, stability - inverse function theorem, genericity and Thom's transversality theory
- going from non-parametric to parametric is a grey area, which, if taken seriously, will lead to new mathematical problems, eg Hildenbrand's work on the law of demand

There are other questions (what is good / sufficient data ?) . All I'm saying is that much greater attention should be paid to the characterization/identification question.

### 4 What is the RHS of the equation ?

Certainly contains the following:

- consumer theory (intertemporal, and under uncertainty)
- strategic behaviour of individual within groups

Some landmarks:

- Arrow-Debreu model of perfect competition
- rational expectations
- asymmetry of information
- Black and Scholes, certainly the most successful model ever

Some holes:

- satisfactory model of behaviour under uncertainty
- satisfactory model of intertemporal arbitrage
- any model of price formation (dynamics vs. statics)

Does it apply at a lower level?

- multiple selves and individual psychology (Elster)
- belief in a just world and individual psychology (Tirole)

Does it apply at a higher level ?

- what are the microeconomic foundations of macroeconomics ? The question can be tackled from two ends:
  - from the micro end: how does one aggregate individual beliefs, preferences, and behaviour ? What we have here is negative results (Sonnenschein - Mantel - Debreu), and simplifying assumptions (representative consumer) which have no justification in theory and little support in practice (equity premium puzzle)
  - from the macro end: how much microeconomic theory to macroeconomists use ? Some do, perhaps most do (Lucas, Sargent, labour economics...) but it usually turns out that aggregate macroeconomic variables are poor tools for understanding

End result: Not a clear or complete picture, at least for me

- in finance, we have a theory of derivative pricing. What about fundamentals ? Stocks and bonds ? Raw materials ?
- how are interest rates formed ? Specifically, what is the relationship between the short rate and the long rate ?
- why has the US \$ been so high for so long ?

## 5 Are we asking the right questions ?

If we take the RHS seriously, in the sense that there is an economic world which is the object of formalized economics, we should try to investigate some outstanding questions concerning that world. Here is a list

- the functioning of the US economy
- the functioning of financial markets
- international trade (globalization)
- global warming
- sustainable development
- inequalities and redistribution

Which ones does FE study ? Which have the most researchers / papers / prestige ? The answer seems to concentrate on the top of the list

And yet, the tools of FE are versatile enough to accomodate the problems in the bottom half. These are basically problems concerning *public goods* and *welfare*. Unfortunately

- some of these tools are forgotten. When did you last read a paper on production theory ? It would seem from most of the literature that there is nothing but exchange markets.
- others are not used to potential. Economic theory is about efficiency (Pareto optimality) and redistribution. There is nothing in the mathematical theory to suggest that efficiency should be more worthy of study than redistribution (Hayek vs Sen).
- in the traditional utilitarian criterion:

$$\sum_i \lambda_i u_i(x_1, \dots, x_n)$$

the  $x_i$  are traditionally taken to be consumption. But there is nothing to prevent us from incorporating other variables people care about, for instance individual rights (Rawls), preferences about the structure of society (working conditions). Not doing so is a modelling choice which will have consequences.

- in growth theory, there should be no mathematical difficulty in incorporating non-renewable resources and public goods such as the environment

Why is it not done, or not done at the center of FE ?

- There are academic reasons for that (young researchers should study well understood subjects, so that their work can be read and appreciated; older researchers should not start their students on purely intellectual pursuits, with no job at the end, and anyway they need grants to support them)
- There may be conflicts of interest. There is huge literature on executive compensation (stock options, golden parachutes, etc), most of it concludes that they are necessary to motivate executives. If you work in a business school, depending on alumni, how popular are you going to be if you take the opposite view ?

## 6 Conclusion

There is no choice: no alternative to formalization

I would like to see more work on (a) econometrics (b) public goods (c) redistribution

A possible path to go: Laffont's work on political economy, connecting to Montesquieu and the French Enlightenment.