THE PROBLEM OF MATHEMATICS IN FIRST YEAR ECONOMICS TEACHING

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A Quick run-through of part of first year economics

Theory of the firm:

Revenue: Money earned by the firm from selling goods.

Costs: Monetary costs to the firm from selling goods

Both depend on the quantity of goods sold.

Profit= Total Revenue- Total Costs

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Marginalism:

It is assumed that the so-called “Marginalist” approach is important.

We can define “Marginal Revenue” as the additional revenue brought in for each additional unit of a good sold.

Hence “Marginal Cost” is the additional cost for each unit sold.

It is often emphasised that decision-making is usually made “at the margin” i.e. we don’t compare *total* quantities but rather *marginal* quantities.

This is often described as the “rational” or “economic” approach to decision-making.

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It is assumed that firms maximise profits.

It is usually asserted that this occurs when Marginal Revenue=Marginal Cost.

The “official” explanation: “If Marginal Revenue is greater than Marginal Cost then it follows that additional revenue can be generated by selling one more unit of the good and so the firm has an incentive to sell that good. This continues until Marginal Revenue equals Marginal Cost. If Marginal Revenue is less than Marginal Cost then one can reduce one’s costs by selling one fewer goods and so the firm has an incentive to sell fewer goods. This continues until Marginal Revenue equals Marginal Cost.”

Marginalism in Teaching

A few points:

i) This is very hard to teach!! It requires one to understand the idea of a marginal quantity and then apply this to the procedure laid out above.

ii) The decision- making procedure outlined above, far from being “rational” is actually highly unintuitive. It is hard to convince students that this is how firms actually conduct decision-making.

iii) Firms don’t actually make decisions like this and economists don’t assume that firms operate like this. Post first year teaching does away with this procedure as well.

(Note that this refers to the *decision procedure* not the assumption that firms maximise profits)

Why teach MR=MC in this way?

This goes back to the origin of marginalist thought and exemplifies a teaching problem that economists have had for over 100 years.

MR=MC is a *mathematical* argument and has no empirical content at all if one assumes that a firm maximises profits.

Students are actually not learning anything about economics at all but a roundabout way of teaching a mathematical argument.

Marginal Revenue is the *differential* of the Total Revenue function.

Marginal Cost is the differential of the Total Cost function.

Differentiation and Marginalism

Differentiation is a mathematical technique used to find the slope of a function.

The Differential of a function is roughly equivalent to the Marginal version of that function.

Using the definitions above, it is a mathematical fact that MR=MC when a firm is maximising profits. It is a straightforward application of ideas about differentiation. (roughly, a firm maximises when its profit function has a slope of zero)

However, this requires knowledge of differential calculus, which is post- elementary maths.

The Problem of Maths in Introductory Economics

Most students coming to do an economics- based degree at university do not have Higher/ A-level maths and so do not have knowledge of differential calculus.

Requiring students to have Higher/ A-level maths could put off many students who may be very good at economics.

Hence, it has to be taught. However, there is great reluctance to do this in introductory economics.

This problem is not new- it dates back to the end of the 19th Century when maximisation was first put forward by the “neoclassical” or “marginalist” school.

The Problem of Maths in Introductory Economics

Alfred Marshall- (1890) “Principles of Economics”.

World’s first “proper” economics textbook. Also full of innovations relating to economics.

Marshall was a good mathematician and systematised economics around the idea of optimisation.

However, he refused to use maths in the main text and used various types of circumlocutions to avoid mentioning it.

This was for similar reasons to those used today. Most of his audience were not mathematicians.

The Problem of Maths in Introductory Economics

The marginal concepts were primarily a pedagogical tool.

While the “marginal” label is used in advanced economic research, the decision procedures outlined above are never used.

This has continued to the present day in economics textbooks and teaching.

However, it gives a completely wrong- headed view of economics.

It is hard to understand and unintuitive.

The decision making procedure is never used in advanced economic analysis.

The Problem of Maths in Introductory Economics

We need a different way of dealing with maths in first year economics:

One possibility is to acknowledge that economics has moved on and to introduce modern techniques to introductory economics.

One example of this would be the use of game theory, which is in widespread use in economics.

This has the advantage of not using differential calculus which can be introduced at a later stage.

Game theory is also intuitive and can rapidly be used to produce interesting and intuitive results while organising students' thinking.

What does this tell us about scholarship?

Scholarship is a multi-faceted activity.

In discussing the problem of maths in introductory economics we have had to use a large set of skills:

i) Knowledge of different mathematical techniques- in order to recommend an alternative we need to know how these alternatives work.

ii) Knowledge of different ideas within economics. Game theory

iii) Knowledge of the History of Economic Ideas- Marshall etc.

iv) Experience in teaching these methods.

What does this tell us about scholarship?

It also has multiple roles to play:

i) Acquisition of new knowledge.

ii) Policy formation.

iii) Greater understanding of our teaching and where it comes from.

iv) Dissemination of knowledge about Economics teaching.

v) Prevention of mistakes (e.g. getting outsiders to teach first year economics)