

9 A pluralist approach to microeconomics

Steve Keen

A great strength of traditional economics is the absence of a well-developed, coherent alternative. The pressure to teach *something* often results in orthodox microeconomics ruling the roost. However, political economists should not be afraid to teach approaches which, in apparent contrast to the logically complete traditional economics of the firm, are inchoate and do not answer every question. A new approach is never born complete but evolves, and the process of teaching an alternative from an incomplete starting point can lead to its development over time.

However, an essential first is to demonstrate to students that the ostensibly well-developed and coherent traditional model is in fact an empty shell. That is difficult in a principles course, since the increase in business majors and the relegation of economics to a service role has dumbed down the content so much that critiquing it is problematic: it is hard to critique something that is itself so nebulous.

The potential for a critique arises at the intermediate level, where the mathematical treatment is first encountered. Many political economists eschew mathematics, often because it is seen as part of why traditional economics is so flawed. Ironically, however, it is precisely when traditional economics is presented mathematically that it is most vulnerable – especially at the level of intermediate microeconomics, where the foundations are still essentially Marshallian – because the mathematics itself is fallacious.

I begin my teaching of heterodox microeconomics by recapping traditional microeconomics, and then demonstrating that the following two key aspects of the theory are mathematically false.

- 1 Under the assumptions of the traditional model, a competitive market populated by profit-maximizing firms will produce a higher output than a monopoly, and at a lower price (Keen 2004; Keen and Standish 2006).
- 2 The market demand curve derived from a set of utility-maximizing consumers is necessarily downward sloping (Gorman 1953; Shafer and Sonnenschein 1982).

Once these two assertions are demonstrated to be fallacies, the task of convincing students that a different approach should be considered – even if it is incomplete – is much easier.

Testing Marshall

I begin my course with a computer simulation that demonstrates the falsity of the first proposition, and effectively turns Friedman's methodological defense of orthodoxy on its head (Friedman 1953). Friedman argued that while expert billiard players did not know "the complicated mathematical formulas that would give the optimum directions of travel ... unless in some way or other they were capable of reaching essentially the same result, they would not in fact be expert billiard players" (1953: 21). By analogy, he argued that the same could be said of firms: while they did not do calculus to set their output levels, unless they behaved

as if ... they knew the relevant cost and demand functions, calculated marginal cost and marginal revenue ... and pushed each line of action to the point at which the relevant marginal cost and marginal revenue were equal ... it seems unlikely that they would remain in business for long. Let the apparent immediate determinant of business behavior be anything at all – habitual reaction, random chance, or whatnot. Whenever this determinant happens to lead to behavior consistent with rational and informed maximization of returns, the business will prosper ... whenever it does not, the business will tend to lose resources.

(1953: 21–22)

I put Friedman to the test in class, using a multi-agent model of a market. This model uses standard market demand and aggregate marginal cost curves, with equations and parameter values as shown in Equation (9.1).

$$P(Q) = a - b \cdot Q$$

$$MC(Q) = c + d \cdot Q$$

$$MR(Q) = a - 2 \cdot b \cdot Q$$

$$TC(Q) = c \cdot Q + \frac{1}{2} \cdot d \cdot Q^2 + k$$

$$\text{where } a = 800; b = 10^{-8}; c = 100; d = 10^{-8}; k = 10^6 \quad (9.1)$$

These parameter values generate a model market with realistic output levels so that a simulated comparison can be made between a single monopoly producer and a competitive industry with, say, 10,000 firms.¹ Neoclassical theory then makes the following predictions for the output levels of a monopoly and competitive industry respectively:

$$\text{Monopoly } M_Q = \frac{a - c}{2b + d} = 2.333 \cdot 10^{10}$$

$$\text{Perfect Competition } PC_Q = \frac{a - c}{b + d} = 3.5 \cdot 10^{10} \quad (9.2)$$

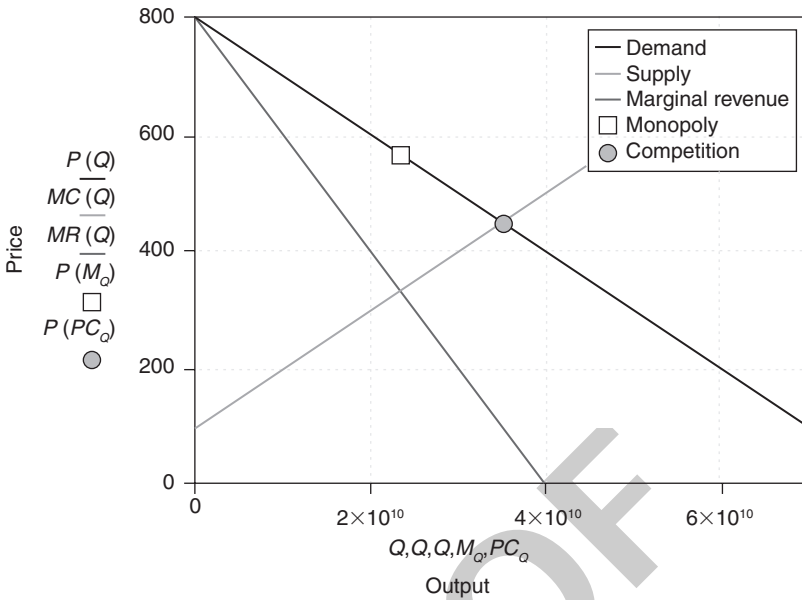


Figure 9.1 Predictions of the Marshallian model.

The model and its predictions are shown in Figure 9.1.

As Friedman notes, actual firms do not do calculus, but follow other procedures which, *if the orthodox model is correct*, must nonetheless correspond to them behaving as if they were setting marginal cost equal to marginal revenue. My model tests this by populating this artificial market with agents who follow the simplest possible rule of thumb for profit maximization: choose an output level, and then change it by a fixed amount (either positive or negative). If profit increases, keep moving in the same direction; if profit decreases, move in the opposite direction by the same amount. I then run the model with a single firm, and also 10,000 firms, and check the results. The results² of two typical runs are shown in Figure 9.2.

The theory's prediction for the monopoly level of output is correct, but the prediction for the competitive industry is clearly wrong: rather than producing where supply equals demand, the competitive industry produces much the same level as the monopoly. "Oh dear, something has gone terribly wrong": these instrumental profit-maximizers *don't* do what neoclassical theory predicts! The individual firms all follow very different strategies (see Appendix A), which are extremely complex despite the simple nature of the behavioral algorithm (see Figure 9.3).

The firms also achieve much higher profits from their simple rule of thumb than orthodox theory predicts (see Figure 9.4). They are clearly better at making profits than orthodoxy is at predicting the profit-maximizing output level. This simulation thus sets the scene for a comprehensive demolition of the Marshallian

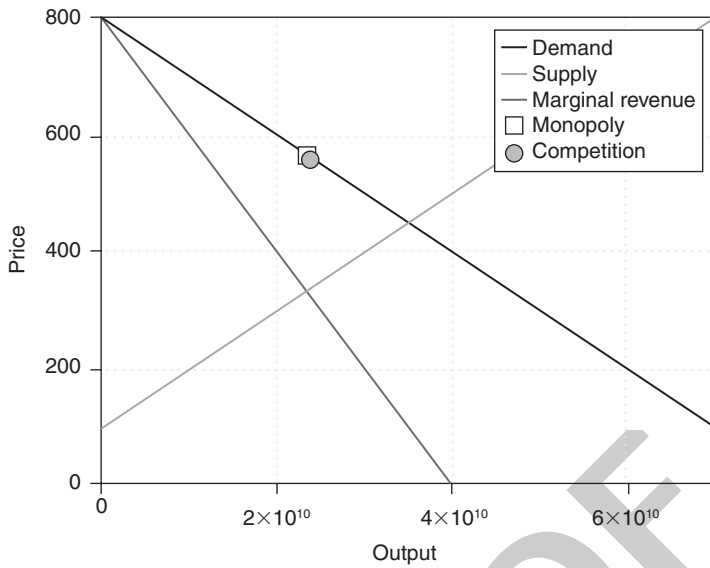


Figure 9.2 Simulation results.

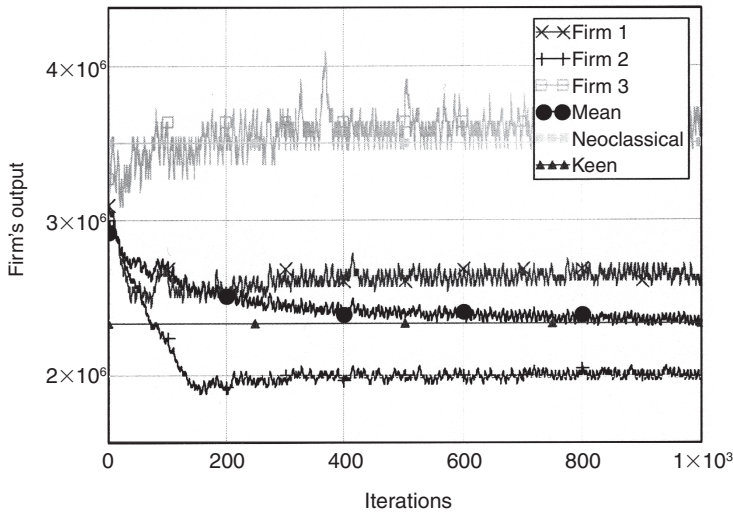


Figure 9.3 Convergence of individual outputs (three randomly chosen firms and average outcome).

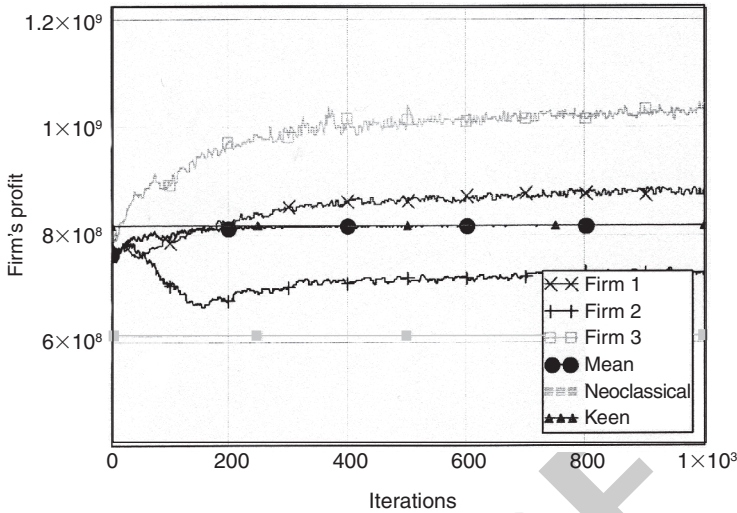


Figure 9.4 Much higher profits result from the firms' "rule of thumb" (three randomly chosen firms and average outcome).

model. The first step in this process is proving that a key proposition of the neo-classical model, that competitive firms face a horizontal demand curve, is mathematically false under the Marshallian assumption of atomism.

Refuting Marshall

This result was first proven in 1957 by, of all people, George Stigler (1957: footnote 31), as shown in Figure 9.5.

$$\frac{dp}{dq_i} = \frac{dp}{dQ}$$

Stigler's logic simply applied the assumption of atomism which characterizes the Marshallian model of competition³ – that competitive firms neither know of, nor react strategically to, the output decisions of other firms. Given that assumption, if the i^{th} firm changes its output by an amount dq_i , other firms in the industry don't react – and therefore industry output Q changes by the same amount, so that $\frac{dQ}{dq_i} = 1$. Given this result, the conclusion that the slope of the demand curve perceived by the competitive firm $\frac{dp}{dq_i}$ is precisely the same as the slope of the market demand curve $\frac{dp}{dQ}$ is derived by simply applying the chain rule:

$$\frac{dp}{dq_i} = \frac{dp}{dQ} \cdot \frac{dQ}{dq_i} = \frac{dp}{dQ} \quad (9.3)$$

This in turn means that the demand curve perceived by the individual firm is *not* horizontal, and that marginal revenue for the competitive firm is less than price:

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PERFECT COMPETITION, HISTORICALLY CONTEMPLATED
GEORGE J. STIGLER

³¹ Let one seller dispose of q_i , the other sellers each disposing of q . Then the seller's marginal revenue is

$$\frac{d(p q_i)}{d q_i} = p + q_i \frac{d p}{d Q} \frac{d Q}{d q_i},$$

where Q is total sales, and $dQ/dq_i = 1$. Letting $Q = nq_i = nq$, and writing E for

$$\frac{dQ}{d p} \frac{p}{Q},$$

we obtain the expression in the text.

Figure 9.5 Stigler's proof.

$$\begin{aligned} MR_i &= \frac{d}{d q_i}(P \cdot q_i) \\ &= P \cdot \frac{d}{d q_i} q_i + q_i \cdot \frac{d}{d q_i} P \\ &= P + q_i \cdot \frac{d}{d Q} P < P \end{aligned} \tag{9.4}$$

Though the mathematics of this result is straightforward, the fallacy of the horizontal demand curve is so strongly ingrained⁴ that I find I have to provide a multi-pronged attack on the commonly held defenses of this fallacy. Multiple counters to defenses of it in the light of this result. The three most common defenses are:⁵

- 1 The equation $(\frac{dp}{dq_i} = 0)$ is just an assumption.
- 2 The omniscient consumer argument, that if a firm charges above the market price, it will have no customers, while if it charges below the market price, it will face the entire industry demand curve (see, for example, Varian 2006: 6, Figure 22.1).
- 3 That competitive firms behave as if they face a horizontal demand curve, or that they are too small to perceive the negative slope of the demand curve they face.⁶

The first proposition appears to be an application of Friedman's dictum that a theory cannot be tested by the "realism" of its "assumptions" (Friedman 1953: 23), but in fact it is a mathematical fallacy. It asserts that it is valid to have a

model in which mathematically incompatible assumptions play an essential role. Assuming a negatively sloped market demand curve $\frac{d}{dQ}P < 0$, and atomism (so that $\frac{\partial}{\partial q_i}q_j = 0$), then it follows that $\frac{d}{dq_i}P = \frac{d}{dQ}P < 0$, as Stigler showed.

The second contradicts the assumption of price-taking behavior, which is also an essential aspect of the model of competitive behavior: competitive firms do not set price, but produce a quantity and then accept whatever price the market demand curve throws back at them. Once a single firm has changed its output, then all firms will receive the new market price, and *there is no seller charging a lower price to whom the consumers can turn.*

The third argument is a possibility, but only if firms behave *irrationally*. If the demand curve for the market is negatively sloped, and atomism applies, then the demand curve for the individual firm is negatively sloped: to believe otherwise is to behave irrationally⁷ (see Figure 9.6). The too-small-to-perceive slope argument is also contradicted by the computer simulation shown above: even with 10,000 firms in the artificial market, the aggregate result contradicts the outcome that would apply if this defense were valid.

Once students have accepted the mathematical truth that $\frac{d}{dq_i}P = \frac{d}{dQ}P$ under the assumption of atomism, we proceed to the coup de grace for the Marshallian model: the neoclassical mantra that profits are maximized by equating marginal cost to marginal revenue is false in a multi-firm industry. The easiest proof for intermediate micro students⁸ is the following: assume that all competitive firms follow the advice of neoclassical theory and set their marginal revenue equal to their marginal cost. Then for an n -firm industry, the sum of this across all firms will also be zero:

$$\sum_{i=1}^n (MR_i(q_i) - MC_i(q_i)) = 0 \quad (9.5)$$

This can be expanded to the following, using the crucial result that $\frac{d}{dq_i}P = \frac{d}{dQ}P$:

$$\sum_{i=1}^n \left(P(Q) + q_i \cdot \frac{d}{dQ}P(Q) \right) - \sum_{i=1}^n MC_i(q_i) = 0 \quad (9.6)$$

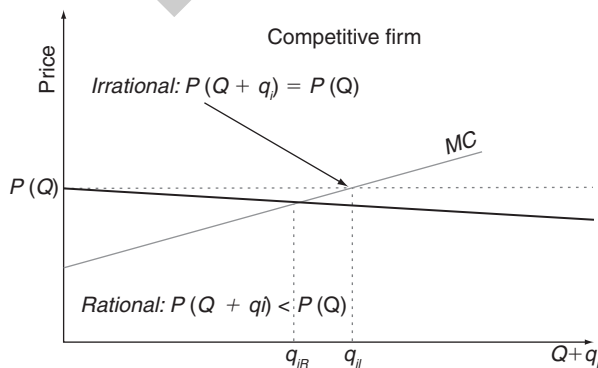


Figure 9.6 The belief that the firm faces a horizontal demand curve.

Expanding the summation over n firms from equation (9.6) yields n copies of P from the first term, $Q \cdot \frac{d}{dQ}P$ from the second, and n copies of marginal cost ($MC(Q)$) from the third⁹ so that:

$$n \cdot P(Q) + Q \cdot \frac{d}{dQ}P(Q) - n \cdot MC(Q) = 0; \text{ or } (n - 1) \cdot P(Q) + MR(Q) - n \cdot MC(Q) = 0 \quad (9.7)$$

It is then possible to rearrange equation (0.7) to yield this expression in terms of industry-level marginal revenue, marginal cost, and price:

$$MR(Q) - MC(Q) = -(n - 1)(P(Q) - MC(Q)) \quad (9.8)$$

This result demonstrates the aggregation fallacy in the neoclassical so-called profit-maximizing formula: if each firm sets its output so that its marginal revenue equals marginal cost at the level of the individual firm, market output will *exceed* the point at which marginal revenue equals marginal cost. As a result, some of the output produced will be produced at a loss – and therefore each individual firm is producing part of its output at a loss if it produces where marginal revenue equals marginal cost. The actual profit-maximizing rule in terms of marginal revenue and marginal cost can be derived by equating equations (9.5) and (9.8):

$$\sum_{i=1}^n (MR_i(q_i) - MC_i(q_i)) = (n - 1) \cdot P(Q) + MR(Q) - n \cdot MC(Q) \quad (9.9)$$

and then rearranging terms to leave market-level $MR(Q)$ and $MC(Q)$ on one side:

$$\sum_{i=1}^n (MR_i(q_i) - MC_i(q_i)) - (n - 1) \cdot (P(Q) - MC(Q)) = MR(Q) - MC(Q) \quad (9.10)$$

then bring terms inside the summation and equate market-level marginal revenue and marginal cost to find the aggregate profit maximum:

$$\sum_{i=1}^n \left(MR_i(q_i) - MC_i(q_i) - \frac{n-1}{n} \cdot (P(Q) - MC(Q)) \right) = 0; \text{ so that}$$

$$\text{For profit maximization set } MR_i(q_i) - MC_i(q_i) = \frac{n-1}{n} \cdot (P(Q) - MC(Q)) \quad (9.11)$$

The actual profit-maximizing rule – the one the instrumental profit maximizers in the multi-agent simulation were clearly following – is thus not to equate marginal cost and marginal revenue, but to make the gap between them equal to $(n - 1)/n$ times the gap between price and marginal cost.

The final step in establishing the hollowness of the Marshallian model of competition is to demonstrate that, if a competitive industry produces the same amount as a monopoly when their cost structures happen to coincide¹⁰ then on Marshallian grounds a monopoly should be preferred to a competitive industry if its costs are lower, since it will produce a larger amount at a lower price. In the

real world, economies of scale normally mean that a monopoly has lower marginal costs than the smaller firms of hypothetical competitive industry, further strengthening the neoclassical case in favor of monopolies over competitive industries!

So much for the neoclassical model of supply. Turning to the model of demand, we find that it is equally flawed.

The shape of the market demand curve

The derivation of an individual demand curve from a set of indifference curves and a budget constraint is straightforward. However, the process of summing individual demand curves to derive a market demand curve is a non-trivial problem because, in the traditional model of a market economy, consumer incomes are determined by prices and quantities set in markets. Changing relative prices therefore changes incomes – something that is ignored when an individual’s demand curve is derived, but which can’t be ignored when aggregating to derive the market demand curve in a single market.

Over half a century ago, Gorman proved that the only condition under which a market demand curve necessarily had the same characteristics as an individual demand curve is “that an extra unit of purchasing power should be spent in the same way no matter to whom it is given” (Gorman 1953: 64) – in other words, that the distribution *and scale* of income have no effect on consumption. This in turn requires (a) that all Engels curves are straight lines (homothetic preferences); and (b) that all consumers have parallel Engels curves. Without these restrictions, then *a market demand curve can have any shape at all*.¹¹ This result – now known as the Sonnenschein–Mantel–Debreu (SMD) conditions after their rediscovery by these researchers in the 1970s – is clearly and emphatically articulated in the authoritative *Handbook of Mathematical Economics*:

First, when preferences are homothetic and the distribution of income (value of wealth) is independent of prices, then the market demand function (market excess demand function) has all the properties of a consumer demand function.... Second, with general (in particular non-homothetic) preferences, even if the distribution of income is fixed, market demand functions need not satisfy in any way the classical restrictions which characterize consumer demand functions.... The utility hypothesis tells us nothing about market demand unless it is augmented by additional requirements.

(Shafer and Sonnenschein 1982: 671–672)

In contrast, the treatment of this same issue in Varian’s *Intermediate Microeconomics* borders on mendacity. In his discussion of individual demand he spends several pages discussing homothetic preferences before concluding that they aren’t very realistic (Varian 2006: 102). Later, in his chapter on market demand, he notes the dilemma that the aggregate demand (for a market) will generally depend on prices and the *distribution* of incomes, but continues:

1 However, it is sometimes convenient to think of the aggregate demand as
2 the demand of some representative consumer who has an income that is just
3 the sum of all individual incomes. The conditions under which this can be
4 done are rather restrictive, and a complete discussion of this issue is beyond
5 the scope of this book.

(Varian 2006: 267)

3 Students are thus left with the impression that realistic individual Engels curves
) are compatible with well-behaved market demand curves – an impression intensi-
0 fied by Varian’s chapter summary that begins: “The market demand curve is
1 simply [*sic!*] the sum of the individual demand curves” (Varian 2006: 281).

2 In reality, the SMD conditions are the transformation problem of neoclassical
3 economics: the two conditions can only strictly apply in a one-consumer *and*
4 *one-commodity* world, since in a multi-agent world changing prices will change
5 the distribution of income, while in a multi-commodity world increasing income
6 will alter relative demand, which in turn will change the distribution of income.

7 An intellectually honest response to these results is,

8
9 If we are to progress further we may well be forced to theorise in terms of
0 groups who have collectively coherent behaviour. Thus demand and
1 expenditure functions if they are to be set against reality must be defined at
2 some reasonably high level of aggregation. The idea that we should start at
3 the level of the isolated individual is one which we may well have to
4 abandon.

(Kirman 1989: 138)

6 The SMD conditions thus validate the focus of the classical economists on class-
7 based analysis: while it is nonsensical to aggregate all consumers into a repre-
8 sentative agent and all products into a representative commodity, there is some
9 validity in treating different classes as having coherent tastes, and consuming
0 uniform commodities. Distribution of income within a class can then be ignored
1 – but distribution *between* classes cannot. Nor can the distribution of income be
2 reduced to a market process, because the dilemma of market demand curves
3 having any shape at all undermines the proposition that the return to a factor of
4 production is its marginal product.

8 **From an empty shell to emergent properties**

9 It would be possible to continue with other flaws in traditional microeconomics¹²
0 but I prefer to use the SMD conditions to segue into a crucial, but hard to under-
1 stand, insight from complexity theory: the concept of emergent properties – that
2 a complex system will have properties that can’t be understood simply by under-
3 standing the isolated properties of the entities that compose it. The SMD con-
4 ditions show that an economy consisting of perfectly well-behaved neoclassical
5 agents will *not* behave like a scaled-up individual consumer at the market level,

