

NOTES ON PROFIT-CONCENTRATION REGRESSIONS

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Abstract

These are my G604 class notes on profit-concentration regressions.

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I have not studied the original articles and books well enough to know whether the models named after them below really correspond to what they meant to say. Martin takes pains to quote Bain to show that Bain realized that firms had heterogeneous costs. The general impression left by Bain, however, is that a significant coefficient on concentration in a profit regression indicates the exercise of market power. It is often the case when an economist lacks a formal model that he is rather foggy in his reasoning, and says things that are actually contradictory and cannot all be put into one formal model. That is why historians of economic thought have an interesting– and sometimes impossible– task when they try to figure out what someone like Bain, Keynes, or Marx really thought. What Martin uses in his explanation is actually a Cournot model with differing marginal costs and no capacity constraint, but the outcome is much the same as with the perfect collusion I use below.

First, there are assumptions common to all the models:

Market demand is inelastic with reservation price \bar{P} and quantity 1.

In a homogeneous industry, each firm has a constant marginal cost of c_h and no capacity constraint.

In a heterogeneous industry, low-cost firms, with marginal cost of $c_l < c_h$, have enough capacity to serve 60% of the market.

Some industries (“unconcentrated industries”) have $N = 100$ firms and some (“concentrated industries”) have $N = 5$.

If $N = 5$ in a homogeneous industry, there are five high-cost firms. If $N = 100$ in a homogeneous industry, there are 100 high-cost firms.

If $N = 5$ in a heterogeneous industry, there are four high-cost and one low-cost firms.

If $N = 100$ in a heterogeneous industry, there are 80 high-cost firms and 20 low-cost firms.

Our various models will all assume that if $N = 100$, the firms use Bertrand competition, as a model for price-taking. The models differ in two dimensions:

1. Are there low cost firms in (a) no industries? or (b) Some industries? Put differently, are firms identical (all high-cost), or heterogeneous?
2. If the industry is concentrated, do firms collude, or are they price-takers?

By “price-taking” we will mean Bertrand pricing, and by “collude” we will mean perfect collusion with side payments to split the profits. The side payments ensure that the cartel will let the low-cost firm produce to capacity before starting to use high-cost firms, since a firm’s net revenue then need not equal its overall profit.

Let there be many industries, each with its own market structure of one of the kinds described above. The theories will make empirical predictions about the effects of a regression which includes different kinds of industries.

The empirical prediction requires different kinds of industries, because otherwise there would be no variation in the data— every industry would have the identical concentration and profitability.

Here are four hypotheses:

BAIN'S NULL HYPOTHESIS: All industries are made up of identical firms. Firms are price-takers in concentrated industries.

BAIN'S ALTERNATIVE HYPOTHESIS: All industries are made up of identical firms. Firms collude in concentrated industries.

DEMSETZ: Some industries have identical firms, and some heterogeneous. Firms price-takers in concentrated industries.

MARTIN: Some industries have identical firms, and some heterogeneous. Firms collude in concentrated industries.

Here is how the models work out. The notation $m_h = .13$ means that the market share of a single high-cost firm is .13. The notation $CR3=.60$ means that the 3-firm concentration ratio is .60.

BAIN'S NULL HYPOTHESIS: All industries are made up of identical firms. Firms compete in concentrated industries. We will observe the following kinds of industries:

1A. ZERO PROFIT. Unconcentrated, identical firms, $N = 100$, $m_h = .01$, $CR3 = .03$, $P = c_h$, $\Pi_h = 0$. All firms have zero profits.

1B. ZERO PROFIT. Concentrated, identical firms, $N = 5$, $m_h = .2$, $CR3 = .6$, $P = c_h$, $\Pi_h = 0$. All firms have zero profits.

If you run a regression, you will find that profits and concentration are uncorrelated.

(The Bertrand price is c_h even if $N = 5$, rather than in mixed strategies as in the Edgeworth Paradox, because we have infinite capacities.)

BAIN'S ALTERNATIVE HYPOTHESIS: All industries are made up of identical firms. Firms collude in concentrated industries. We will observe the following kinds of industries:

1. ZERO PROFIT. Unconcentrated, identical firms, $N = 100$, $m_h = .01$, $CR3 = .03$, $P = c_h$, $\Pi_h = 0$. All firms have zero profits.

2. POSITIVE PROFIT. Concentrated, identical firms, $N = 5$, $m_h = .2$, $CR3 = .6$, $P = \bar{P}$, $\Pi_h > 0$. All firms have positive profits.

If you run a regression, you will find that profits and concentration are positively correlated. That is what Bain did, and he rejected Bain's Null Hypothesis as a result.

DEMSETZ: Some industries have identical firms, and some heterogeneous. Firms compete in concentrated industries.

We will observe the following four kinds of industries:

1A. ZERO PROFIT. Unconcentrated, identical firms, $N = 100$, $m_h = .01$, $CR3 = .03$, $P = c_h$, $\Pi_h = 0$. All firms have zero profits.

1B. ZERO PROFIT. Concentrated, identical firms, $N = 5$, $m_h = .2$, $CR3 = .6$, $P = c_h$, $\Pi_h = 0$. All firms have zero profits.

2A. POSITIVE PROFIT. Unconcentrated, heterogeneous firms, $N = 100$, $m_L = .03$, $m_h = .40/80 \approx .005$, $CR3 = .09$, $P = c_h$, $\Pi_h = 0$, $\Pi_L > 0$. Ten of the 100 firms have positive profits.

2B. POSITIVE PROFIT. Concentrated, heterogeneous firms, $N = 5$, $m_L = .6$, $m_h = .40/4 = .10$, $CR3 = .8$, $P = p_h$, $\Pi_h = 0$, $\Pi_L > 0$. 1 of the 5 firms has positive profits.

If you run an industry-level regression, profits and concentration are positively correlated—thus, Bain's result. If you run a firm-level regression of profits on concentration and market share, Demsetz predicted that you will find concentration insignificant and market share significant.

THE POINT: positive correlation between profits and concentration is not enough to prove that firms are exercising market power, because it might just be that they are earning returns to their ability to produce at low cost.

MARTIN: Some industries have identical firms, and some heterogeneous. Firms collude in concentrated industries. We will observe the following industries:

1A. ZERO PROFIT. Unconcentrated, identical firms, $N = 100$, $m_h = 0$, $CR3 = 0$, $P = c_h$, $\Pi_h = 0$. All firms have zero profits.

1B. POSITIVE PROFIT. Concentrated, identical firms, $m_h = .2$, $CR3 = .6$, $P = \bar{p}$, $\Pi_h > 0$. All firms have positive profits.

2A. LOW POSITIVE PROFIT. Unconcentrated, heterogeneous firms, $N = 100$, $m_L = .03$, $m_h = .40/80 \approx .005$, $CR3 = .09$, $P = c_h$, $\Pi_h = 0$, $\Pi_L > 0$. Ten of the 100 firms have positive profits. (like Demsetz)

2B. HIGH POSITIVE PROFIT. Concentrated, heterogeneous firms, $m_L = .6$, $m_h = .1$, $CR3 = .8$, $P = \bar{p}$, $\Pi_h > 0$, $\Pi_L > 0$. All firms have positive profits.

In an industry-level regression, profits and concentration are positively correlated—Bain's result. In a firm-level regression of profits on concentration and market share, you will find both significant, because even a small firm in a concentrated market will make positive profits, and a large firm will make bigger profits in a more concentrated market.

THE POINT: the exercise of market power and the presence of heterogeneous firms and efficiency rents are not mutually exclusive.

Ravenscraft (1983) did the concentration- market-share regression and found concentration significant but small and in the wrong direction, and market share significant and large. This corresponds best to the Demsetz model.

While this is an interesting topic, and a very good exercise for thinking about industrial organization and about empirical work generally, we must keep in mind that the other problems with profit- concentration regressions, having to do with profit accounting, serial correlation, etc. are big enough that little weight should be put on the regression results.

References

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