Comments on

KAREN WADE “ENTRY THRESHOLDS FOR REGIONAL VICTORIA”

by

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Dentists in Perth

According The Yellow Pages, there are almost 1,500 dentists in Perth. With a population of about 1.4 million, that means there are almost 1,000 people per dentist. Suppose that one third of the population never visit a dentist regularly, so that the average dentist has 2/3 of 1,000, or 666 patients. Furthermore, suppose that the fixed costs of running an average dental practice are $300,000 p a, where this includes the opportunity cost of the dentist’s time and capital invested, salary of a nurse, etc. It then follows that to break even the dentist must get on average 300,000/666 = $450 per patient p a, after covering any variable costs. This is illustrated in panel A of Figure 1. If the dental market becomes more competitive, margins fall, the break-even output has to rise to cover the fixed costs and the average dentist sees more patients, as shown in panel B of the figure.

This example shows that if we just observe the total number of dentists and the size of the overall market (population here), we can say that an increase in average firm size (population per dentist) in this case implies an increase in the degree of competition. (However, an increase in fixed costs with the margin constant would have the same effect on firm size, with the degree of competition remaining unchanged.)

What this Paper is About

This very interesting paper by Karen Wade combines elements of industrial organisation and regional economics to analyse the number of firms in several service industries in rural Victoria. Issues investigated are the degree of competition in the various markets, and whether or not individual regions are adequately serviced by the
observed number of firms in the industry. To be able to make statements about the degree of competition, ideally information about prices, profits and output at the individual firm level are required, but this is unavailable. Using information on just the number of firms and the size of the market in different regions, Wade basically uses an approach not too unlike that of Figure 1 to study competition.

Employing a sophisticated ordered probit model introduced by Bresnahan and Reiss (1991), Wade studies the sensitivity of the number of firms in the market to variations in the size of the market. If when the market grows, the number of firms increases slower (so that average firm size rises), then it is inferred that margins are being
eroded, and there are substantial benefits from competition flowing from the entry of an additional firm. On the other hand, if average firm size remains more or less constant as the number of firms expands, the conclusion is that additional entry has little or no impact on competition.

The above analysis leads to the concept of the “entry threshold” for a specified number of firms in the industry (N), denoted by $S_N^*$, the market size needed to support N firms in the industry. This market size allows the N firms to cover their fixed costs. One of the key concerns of the empirical analysis is how rapidly the threshold rises with N, and the “threshold ratio” shows how the entry of another firm affects the degree of competition in the market. This ratio is defined as

$$\frac{S_{N+1}^* / (N + 1)}{S_N^* / N}.$$

As the average firm size increases with additional firms, this ratio is expected to be not less than one; and when it falls to about one, average firm size stabilises and there are no more competitive gains from additional entry.

**The Findings**

Wade applies the above framework to 10 industries in 130 rural towns in Victoria. Some of the key empirical results are as follows:

- The ordered probit results show that the only variable that is consistently significant across industries is regional population.

- Interestingly, the estimated threshold population required to support one dentist is almost 1,300. This is the second highest (to optometrists with a threshold of almost 1,500 people), but not substantially different to dentist-population ratio in Perth of 1,000. However, to compare like with like, we need the threshold corresponding to a large market: For N = 7 dentists (the largest number reported in Table 7 of the paper), the threshold population per dentist is about 5,300, which is substantially above 1,000. Why the difference? Wade attributes these high thresholds to the shortage of dentists in rural areas.

- The thresholds for dentists and optometrists for each number of firms seem to be quite similar. Is this just by chance?

- Thresholds for GP clinics (made up of multiple doctors) are substantially above those for single GPs.
A “10k rule” whereby towns with a population of 10,000 or more have substantially different characteristics. In general, additional entry increases competition until population hits the critical value of 10,000; thereafter, competition falls before increasing again. The paper argues that this reflects towns splitting into sub regions when they hit a population of 10,000. This argument requires further elaboration to make it completely convincing.

Strengths of the Paper

I found the topic fascinating and I imagine that it could form the basis of a good thesis. The paper is very interesting also, and I learnt a lot from reading it. I found the paper relatively easy to read, especially after I had read Bresnahan and Reiss (1991). I can see that considerable work has gone into assembling the data and making sense of the econometric results. I liked the presentation of data in tables and the map -- and would like to see more of that. Finally, the result that some industries become competitive with a surprisingly low number of firms is controversial -- if only two or three firms are required in some instances to achieve competitive conduct, what are rural towns complaining about? Such controversy can only help stimulate interest in the paper.

Criticisms and Suggestions

• At 50 pages, the paper is too long (although page 50 is completely blank!). This is probably a reflection of the old saying “Sorry I had to write you such a long letter, but I didn’t get time to write a short one!” The paper has a “first draft” feel to it, and could benefit from considerable polishing, editing and pruning. It is never a good policy to “go public” with a document that has been rushed.

• The Bresnahan and Reiss framework gets a lot out of little -- inferences are made about the competitive structure of an industry from information only on the number of firms and market size. While the modest information requirements are attractive, there are still no free lunches as the model is based on strong assumptions regarding the similarity of costs, firms and regions. These assumptions are unlikely to hold literally. Does this mean that the inferences regarding market structure are fragile? I would like to see more explicit recognition of the assumptions, as well as an assessment of the possible consequences of their not holding. One approach would be to carry out a Monte Carlo simulation study by first generating artificial data from the model and then using those data to re-estimate to see how accurately the assumed structure can be recovered. Then in the next step, the approach could be repeated but now with the data generated when one or more of the key assumptions are violated. Such an approach could provide some insights regarding the robustness of the results, as well as extending the paper beyond the work of Bresnahan and Reiss.
• Including schools in the empirical application of the model is a bit odd as the majority would be government funded. The question of the appropriate number of schools in a region would seem to revolve around the issue of scale economies in the provision of public services. Thus relating the number of schools to population is reasonable, but to analyse this within an industrial organisation framework requires more justification. Does the same criticism apply to hospitals? Can this explain the high threshold ratios for the entry of one provider for all government-provided services?

• The threshold populations depend on estimated parameters. As these are key to the whole paper, they should have standard errors to reflect the estimation uncertainty. The same comment applies to the estimates of the “cut point” parameters \( \mu_N \) (on which the threshold populations depend).

• There seems to be a computation error in the threshold ratios for GPs in Table 7 -- the data reported in that table do not seem to be internally consistent.

• In Section 5.3 entitled “Implications”, I was expecting to see an in-depth analysis of those towns that had experienced substantial loss of services over the last decade or so, an attempt to link this to national competition policy, microeconomic reform, the activities of the Kennett Government, banks cutting costs by closing branches, etc. I found the brief discussion of what happened in three towns over this period a bit disappointing. Maybe some useful material on this can be obtained from the 1998 Productivity Commission report Impact of Competition Policy Reforms on Rural and Regional Australia.

The Multivariate Structure of Industries and Regions

The paper deals with both industrial organisation and regional considerations, but I feel that these two areas have not been as well integrated as they could be. The approach is to estimate the threshold entry levels for a given industry by using regional data and then to (i) analyse how they change with entry; and (ii) make comparisons of the thresholds for difference industries. But as all regions contribute equally to the estimation of the threshold (in the sense of each region constitutes one data point), they are all the same. This has the inevitable consequence of making the regional analysis of the paper a bit under represented, and below I present a couple of ideas regarding how this could be strengthened.

Let \( S_r \) be the size of the market in region \( r \) \((r = 1,\ldots,R)\), and \( N_i \) be the number of firms in industry \( i \) \((i = 1,\ldots,I)\) in \( r \), so that \( s_i = S_r / N_i \) is the average firm size in \( i \) and \( r \). If we measure market size by population, then \( s_i \) is the number of people per firm for industry \( i \) in region \( r \). If additional firms in the industry substantially add to competition, then we would expect margins to fall and observe average firm size \( s_i \) rising with the number of firms \( N_i \). It would thus be useful to
average over regions and plot average firm size for each industry against the number of firms. One could carry out some simple analysis with these data to test if firm size rises in the predicted manner.

Next, one could more fully exploit the two-dimensional nature of the data by decomposing average firm size into industry and regional effects. A simple logarithmic model is

\[
\log s_{ir} = \alpha_i + \beta_r + \epsilon_{ir}, \quad i = 1, \ldots, I; \quad r = 1, \ldots, R,
\]

where \(\alpha_i\) is a parameter representing the firm size in industry \(i\); the parameter \(\beta_r\) is the regional effect for \(r\); and \(\epsilon_{ir}\) is a disturbance term. According to model (1), firm sizes in different industries and regions are explained by the sum of the industry and regional effects, \(\alpha_i\) and \(\beta_r\). Thus if the nature of industry \(i\) is such that on average firm sizes are large (for example, hospitals), then \(\alpha_i\) will also be large. If there are certain cost disadvantages specific to region \(r\), then cet. par. that region will only be able to support a smaller number of firms given its market size, and \(\beta_r\) will be high. Model (1) is subject to one additive degree of freedom, and to identify the parameters we impose the constraint that the regional effects have a zero sum, \(\sum_r \beta_r = 0\). Thus in (1), there \(I + (R-1)\) parameters to be estimated with \(I \times R\) observations on firm size. The least squares estimators of the parameters are

\[
\hat{\alpha}_i = \frac{1}{R} \sum_{r=1}^{R} \log s_{ir}, \quad \hat{\beta}_r = \frac{1}{I} \sum_{i=1}^{I} \left( \log s_{ir} - \frac{1}{R} \sum_{r=1}^{R} \log s_{ir} \right).
\]

These expressions are attractively simple, with \(\exp (\hat{\alpha}_i)\) the geometric mean (over regions) of the firm size for industry \(i\), while \(\hat{\beta}_r\) is region \(r\)’s average (over industries) deviation of firm sizes from their respective economy-wide averages. The logarithmic formulation implies that \(100 \times \hat{\beta}_r\) is interpreted as (approximately) the average percentage deviation of the sizes of firms in \(r\) from the overall average, with the normalisation ensuring that these percentage deviations sum over regions to zero. Accordingly, the \(\hat{\beta}_r\)’s identify high- and low-cost regions.

Equation (1) could be useful in answering a couple of questions. First, is the average firm size in one industry the same as that in another? Second, which regions tend to have higher costs, and which lower? Third, controlling for the industry and regional effects, is a certain region over- or under-provided with the services of a certain industry? This question can be given a clear answer by adding to the right-hand side of equation (1) a dummy variable for the relevant industry and region and testing its significance.
Another multivariate approach would be to explore the nature of the $I \times R$ matrix $[N_r]$. If we define $N_r = \sum_{i=1}^{I} N_{ir}$ as the total number of firms in all industries in region $r$, then $n_{ir} = N_{ir} / N_r$ is the share of industry $i$ in that total. To fix ideas of under- or over-provision of services, a useful starting point would be a simple comparison of the $I$ shares in each region with the economy-wide averages $n_i = (1/R) \sum_r n_{ir}$. Next, one could proceed more systematically to investigate how the industry shares vary with the total number of firms and the size of the market by estimating the set of equations

$$n_{ir} = \alpha_i + \beta_i \log N_r + \gamma_i \log S_r + \varepsilon_{ir}, \quad i=1, \ldots, I,$$

where $\alpha_i$, $\beta_i$, and $\gamma_i$ are parameters and $\varepsilon_{ir}$ is a disturbance term. Thus for example, the elasticity of the number of firms in industry $i$ with respect to the total number is $1 + \beta_i / n_{ir}$, so that this elasticity exceeds (is less than) one if $\beta_i$ is positive (negative). As the industry shares have a unit sum, it follows that $\sum_i \alpha_i = 1$, $\sum_i \beta_i = \sum_i \gamma_i = \sum_i \varepsilon_{ir} = 0$. The requirement that $\sum_i \beta_i = 0$ means that a share-weighted average of the above elasticities is unity: $\sum_i n_{ir} (1 + \beta_i / n_{ir}) = 1$. This implies that model (2) has the desirable property of being consistent with the identity $N_r = \sum_{i=1}^{I} N_{ir}$. On the other hand, a (relatively minor) defect is that the model does not always imply shares that are nonnegative.

Let $\sigma_{ij}$ be the covariance between the disturbance for industry $i$, $\varepsilon_{ir}$, and that for $j$, $\varepsilon_{jr}$, for $i \neq j$. This covariance tells us something about the extent to which the two industries interact with each other. For example, can a town “get by” with fewer doctors if it has more chemists? As $\sum_i \varepsilon_{ir} = 0$, the $I \times I$ covariance matrix $[\sigma_{ij}]$ is singular and $\sum_j \sigma_{ij} = 0$. Thus as $\sigma_{ii} > 0$, we expect on average the covariances for different industries to be negative, indicating a larger than average size of industry $i$ tends to be offset by a smaller size of $j$, so that industries are substitutes for one another, at least on average. Note that this is the opposite to “network” or “agglomeration” effects associated with larger cities; the impact of these effects is controlled for by including the total number of firms $N_r$ on the right-hand side of equation (2). It would thus be interesting to examine the numerical values of these covariances, perhaps in correlation form, to investigate the magnitude of these interaction effects.

It may also be worthwhile to analyse each region’s share in the total number of firms $N_r / N_r$, where $N_r = \sum_r N_{ir}$. Maybe something interesting could emerge by comparing the regional firm shares with the corresponding population shares by using inequality measures.
Summary

Karen Wade is to be congratulated for writing this stimulating paper. It is quite an achievement to get this far, but I do not think a whole thesis could hang off it. I recommend that an effort be made to extend the existing work of Bresnahan and Reiss (1991), to assess critically the role of the assumptions of their model and to investigate in more depth the regional aspects of the problem. After some further work, the paper could make a strong chapter of a broader study of the under-researched topic of regional competition issues.

Reference