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**EFFECTS OF THE ORDER OF ENTRY ON
MARKET SHARE, TRIAL PENETRATION,
AND REPEAT PURCHASES: EMPIRICAL
EVIDENCE OF STATISTICAL ARTIFACT?**

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Abstract

In their often cited study Kalyanaram and Urban (1992) claim to provide new empirical evidence of the penalties associated with later market entry by statistical estimation of models of market share, cumulative trial, first repeat, and subsequent repeat purchasing. We show that their major findings of lower asymptotic levels in market share, and both in trial and repeat behavior, are owing to an arbitrary choice of an identifying zero restriction among the parameters associated with brand specific dummy variables. The opposite sign of the parameter that is falsely taken to indicate the order of entry penalties can be obtained from the same data just by attaching the identifying zero restriction to another brand.

Keywords: New Products; Order of Entry; Share; Trial; Repeat Purchasing.

1. Introduction

Numerous theoretical and empirical studies have been published analyzing the advantages and disadvantages of a first-mover firm. The theoretical literature does not give a clear answer to the question if pioneers have long-lived market share advantages. Lieberman and Montgomery (1988) present a survey of theories and mechanisms which confer advantages and disadvantages on a pioneering firm. The vast majority of empirical studies finds that market pioneers have substantially higher market shares than later entrants¹. This strong association between order of entry and market share is questioned by some authors, among them Golder and Tellis (1993). They argue that most of the empirical studies have potential limitations. These studies rely on a few established databases, exclude non-survivors and use self-reports for data collection. Golder and Tellis find that 47 % of the pioneering firms do not survive.

Kalyanaram and Urban (1992) use an extensive time series cross-sectional data set to analyze not only market shares but also trial penetration and repeat purchasing behavior for 18 successful later entrants across eight categories of frequently purchased consumer packaged goods over 69 weeks on average. They specify dynamic models of essentially the same formal structure for share, trial penetration, and repeat purchasing. It is the purpose of this note to reveal one simple but consequential failure of their analysis when it turns to measurement and estimation. Because no measure was available for one of their

¹Robinson, Kalyanaram, and Urban (1994), Robinson and Fornell (1985), Kardes and Kalyanaram (1992), Urban, Carter, Gaskin, and Mucha (1986), Lambkin (1988), Kalyanaram, Robinson, and Urban (1995).

explanatory variables – product quality, which is assumed to be constant over time but to vary across brands – the authors compensate for this limitation by introducing cross-sectional brand specific dummy variables. It can easily be seen that, unfortunately, by introducing these dummy variables the order of entry variable is deprived of any meaning.

In the following we briefly introduce the model specification; for the detailed model development and interpretation see Kalyanaram and Urban (1992). Then we focus on their crucial modification caused by data limitations and finally reconsider their empirical results.

2. Model Specification

One interesting feature of Kalyanaram and Urban's approach is that all variables except order of entry are expressed as ratios to the first brand to enter the respective category. The functional form of the equations is multiplicative, with the growth pattern of the dependent variable to an asymptotic level being described by an exponential function. The asymptotic level as well as the rate of growth is modeled to depend on the order of entry. The formal equation for the market share model is:

$$S_{it} = E_i^\alpha D_{it}^\beta P_{it}^\gamma M_{it}^\delta A_{it}^\theta Q_i^\varepsilon [1 - \exp(-\phi t - (\psi/E_i)t)], \quad (1)$$

where

i : Brand number (1, 2, ..., 18),

t : Time period since the introduction of brand i to the respective market,

S_{it} : Ratio of share of i th brand to share of first brand to enter the category as of period t ,

E_i : Order of entry of i th brand,

D_{it} : Ratio of distribution of i th brand to distribution of first brand in period t ,

P_{it} : Ratio of price of i th brand to price of first brand in period t ,

M_{it} : Ratio of promotion of i th brand to promotion of first brand in period t ,

A_{it} : Ratio of advertising expenditure of i th brand to advertising expenditure of first brand
in period t ,

Q_i : Ratio of quality of i th brand to quality of first brand,

$\alpha, \beta, \gamma, \delta, \theta, \phi, \psi, \varepsilon$: Parameters.

The same functional form has been used for the trial penetration model, as well as for the repeat purchasing models for the first repeat and additional repeats, with the dependent variables

- ratio of cumulative penetration of i th brand to first brand in category,
- ratio of cumulative percent of those who tried who repeat for the first time for i th brand to first brand in category,
- ratio of the cumulative number of additional purchases per person who had repeated once after a trial purchase of i th brand to first brand in category,

respectively. In the trial penetration model as well as in the repeat purchasing models the current values of the marketing variables were replaced by geometrically weighted values over two past periods.

As a common characteristic of the four models we observe that the asymptotic level and the growth rate to the asymptote are allowed to depend on the order of entry. We will concentrate on the impact of the order of entry on the asymptotic level which is measured by the parameter alpha. It should be noted that in contrast to the growth rate modeling, the asymptotic level of the dependent variable is allowed to depend not only on the order of

entry, but also on the brand specific quality, while the marketing variables are effective only if they deviate from the pioneer's level.

3. Construction of an Artifact

Due to data limitations – no measure was available for product quality (Q) - Kalyanaram and Urban (1992, p.241) decide to introduce brand specific constants which do not measure only quality but rather the effect of all the missing brand variables. In a footnote (p. 248) they admit: ‘We have 18 brands across 8 categories, so although we have many degrees of freedom due to the multiple periods, we have very few degrees of freedom across brands and we have captured much of this information in the dummy variables.’ In fact, the dummy variables capture all of the cross-sectional variation.

Suppose that asymptotically the marketing variables of the i th brand are at the pioneer's level, i. e. $D_{it} = P_{it} = M_{it} = A_{it} = 1$. Taking logarithms the asymptotic share ratio of the i th brand is specified by

$$\ln S_i = \alpha \ln E_i + \varepsilon_i, \quad i = 1, \dots, 18, \quad (2)$$

with brand specific constants ε_i . Obviously the 19 parameters $\alpha, \varepsilon_i, \quad i = 1, \dots, 18$, are not identifiable without at least one restriction. The authors impose a zero restriction for the 18 th brand. Imposing this restriction, however, the specification is equivalent to

$$\ln S_i = \eta_i, \quad i = 1, \dots, 18, \quad (3)$$

with unrestricted brand constants η_i , $i = 1, \dots, 18$, and

$$\eta_{18} = \alpha \ln E_{18}, \quad \eta_i = \alpha \ln E_i + \varepsilon_i, \quad i = 1, \dots, 17, \quad (4)$$

or

$$\alpha = \eta_{18} / \ln E_{18}, \quad \varepsilon_i = \eta_i - \alpha \ln E_i = \eta_i - \eta_{18} \ln E_i / \ln E_{18}, \quad i = 1, \dots, 17 \quad (5)$$

The parameters α and ε_i , $i = 1, \dots, 17$, are nothing more than a peculiar reparametrization of 18 unrestricted brand constants. The only conclusion that can be drawn from the alpha parameter being negative and statistically significant at the one percent level for each of the four models is that the brand specific constant of the 18 th brand is significantly negative, i. e. the asymptotic market share, trial penetration, and repeat purchasing behavior for the 18 th brand is lower than the pioneer's in the respective category. No empirical evidence is provided so far with respect to a general order of entry penalty.

4. Discussion of Empirical Results

Looking at the parameter estimates for the four models (see Table 1, Kalyanaram and Urban (1992), p. 342), one finds by use of (4) that in each case there are later entrants achieving higher asymptotic levels than the respective pioneer in the category. Although the order of entry E_i of the i th brand in its category is not available to us, we know that E_i is of course greater or equal than two and, as reported by the authors (see p. 246) , never greater than five. Given this information it can be concluded from the parameter estimates

of α and ε_i , $i = 1, \dots, 17$, for example in the trial penetration model, that at least 7 of the 18 later entrants (brands 5, 8, 10, 11, 12, 13, 14) have positive brand specific constants η_i ,

$$\eta_i = \alpha \ln E_i + \varepsilon_i = -0.478 \ln E_i + \varepsilon_i \geq -0.478 \ln 5 + \varepsilon_i > 0,$$

i.e. the asymptotic levels of trial penetration for at least 7 out of 18 later entrants are higher than those of the respective pioneers. If the identifying zero restriction would have been imposed on the ε_i of one of these 7 brands rather than on ε_{18} , the alpha estimate would be positive. This underlines the arbitrariness of any conclusions regarding order of entry penalties which are based on the sign of alpha, as for example in Kalyanaram, Robinson, and Urban (1995), where a stronger negative relationship between order of entry and trial penetration than with repeat purchase is concluded from the alpha estimates in Kalyanaram and Urban (1992). The empirical evidence seems to be much more mixed and requires further research.

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