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Location models for ceding market share and shrinking services ☆

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Abstract

New location models are presented here for exploring the reduction of facilities in a region. The first of these models considers firms ceding market share to competitors under situations of financial exigency. The goal of this model is to cede the least market share, i.e., retain as much of the customer base as possible while shedding costly outlets. The second model considers a firm essentially without competition that must shrink it services for economic reasons. This firm is assumed to close outlets so that the degradation of service is limited. An example is offered within a competitive environment to demonstrate the usefulness of this modeling approach.

Keywords: Delocation; Plant closure

1. Introduction

Location science, with its components of theory and modeling, continues to grow dramatically in the disciplinary areas of geography, management, mathematics, economics and operations research. In general, the purpose of this research field is to formulate quantitative models to cite a given set of facilities in a region. The region can be represented by a network, continuous space, or can be a set of discrete points. There are models for locating public facilities such as schools or post-offices, models for locating retail facilities in the presence of competition, models for locating emergency services such as fire stations or ambulances, and models for locating plants and warehouses, among others. These quantitative models can be formulated and solved using linear programming, integer programming, dynamic programming or by heuristic or metaheuristic approaches. Facilities may have capacity restrictions, experience congestion, have minimum thresholds for level of service and other defining characteristics. The demand to be served may be deterministic or stochastic to address uncertainty issues. Thus, a myriad of formulations are available within the field of location science to address very different issues related to the formulation, solution and implementation of location problems. An overview of the state of the art in this area is presented in [1]. But most location models (if not all) have one thing in common: they are proactive, in that they all seek the location of new facilities, or they are reactive, in that they seek to relocate and open new locations at the same time. The literature has paid little attention to

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Table 1
Plant closure in USA and Canada, 2/1/03–7/1/03

Industry	Number of plant closings
Food	74
Chemical	40
Cigarettes	1
Refined oil products	7
Textiles	23
Plastics	48
Wood products	30
Glass, cement	8
Pulp and paper	47
Metal products	163
Chemicals	40
Electronics	72
Other	7
Total	560

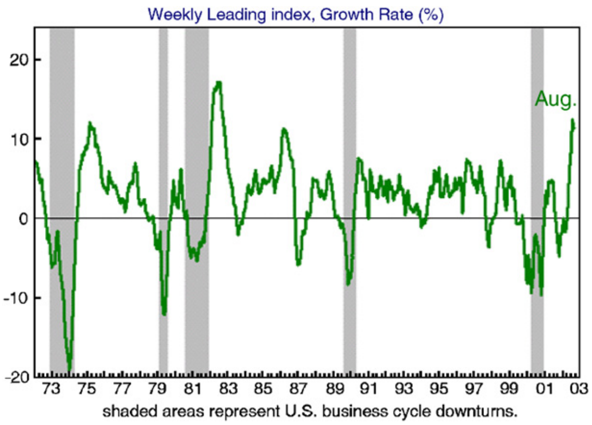

Fig. 1. U.S. business from 1970 to 2003 (source: www.businesscycle.com).

the fact that sometimes it is necessary to close facilities [2], even though the same mathematical modeling framework in choosing new locations would also be applicable in choosing which existing locations to close.

In the private sector, the marketplace for contemporary industrial and service goods is often highly competitive. Firms map out their activities in light of market forces and the action of rival firms in the industry. Changes in the competitive structure of the industry call for new strategies. Strategies do not always succeed as planned, however; plant or store closure may occur as an integral part of strategy or in spite of it. Corporate planners often fail to predict future market trends or are unable to maintain their market share when competitive conditions in the industry change. They may not perceive the gravity of market changes, or they may believe that their established market position leaves them immune to market dynamics. In other cases, production systems do not operate as planned and products fail to meet consumer expectations. As well, new products may be introduced. All these conditions may lead to rivals succeeding in stealing market share. Thus changes in the competitive structure of industries and services may lead to plant or store closures in two distinct ways: as an integral part of the process of strategic adaptation or as a consequence of failure to adapt to new industry conditions.

As an example, Plant Closing News, a biweekly, industry-focused newsletter (see www.plantclosings.com), found that in only the first week of 2003 there were more than 500 industrial plant closures in the U.S. and Canada, in very diverse industrial sectors (Table 1). Plant closings are the most visible manifestation of market dynamics and corporate restructuring on the economic landscape.

Another reason for plant closure is related to business cycles. When the economy is in a growing period, demand for products and services is high, leading to new investments and the building of new facilities. However, when the business cycle is in recession, some investments are no longer profitable and it becomes necessary to close some of the currently operating facilities in order to survive. In Fig. 1, the growth rate for the U.S. from 1972 to 2003 clearly shows the roller-coaster ups and downs of the economy. The shaded areas represent periods of economic crises, with plant closures, massive layoffs and demand downfall. In these periods, firms need to downsize their capacity and infrastructure to an appropriate size in order to cope with the economic situation.

Another argument for plant closures is based on the fact that some economic sectors and industries are in decline. A declining industry is defined as an industry group's employment level decreasing for two quarters by 5% or more over the year. In fact, a significant fraction of U.S. manufacturing output is accounted for by declining industries. In these industries, the important competitive moves pertain to disinvestments rather than investment. Capacity must be reduced in order to restore profitability. Capacity reduction is, however, like a public good; each firm would prefer that its competitors shoulder the reduction.

Some plant location models have been developed to address the issue of plant closure in a multiperiod setting. Klincewicz et al. [3] formulated a large-scale multilocation capacity-planning model. The model chooses a multiperiod schedule of openings, expansions, and