Pharmaceutical Vials and the Economics of Package Size

Sherry Glied, Ph.D

Outline

- The Package Size Problem is Ubiquitous
- Decomposing the problem
- Economic theory (full information)
- The vial size choice problem
- Incomplete information

The Problem is Ubiquitous

Eitan Gerstner
Georgetown University and
North Carolina State University
James D. Hess
North Carolina State University

Why Do Hot Dogs Come in Packs of 10 and Buns in 8s or 12s? A Demand-Side Investigation*

I. Introduction

In a recent front-page article in the *Wall Street Journal* titled "Why Do Hot Dogs Come in Packs of 10 and Buns in 8s or 12s?" the author concluded from his interview with several mar-

And new sustainability focus

This paper presents a theory that yields insight into the determination of package prices and sizes. Consumer heterogeneity in

Package Size Decisions

Oded Koenigsberg, Rajeev Kohli
Graduate School of Business, Columbia University, New York, New York 10027
{ok2018@columbia.edu, rk35@columbia.edu}

Ricardo Montoya
Department of Industrial Engineering, University of Chile, Av. República 701, Santiago, Chile, rmontoya@dii.uchile.cl

We describe a model examining how a firm might choose the package size and price for a product that deteriorates over time. Our model considers four factors: (1) the usable life of the product, (2) the rates at which consumers use the product, (3) the relation between package size and the variable cost of the product, and (4) the minimum quantities consumers seek to consume for each dollar they spend (we call these reservation

Studies in Medicine

Palatty, P., et al. (2019). "Financial audit of wastage of anticancer drugs: Pilot study from a tertiary care center in India." Indian journal of cancer 56(2).

Chaudhary, K., R. Garg, A. R. Bhalotra, R. Anand and K. Girdhar (2012). "Anesthetic drug wastage in the operation room: A cause for concern." Journal Of Anaesthesiology, Clinical Pharmacology 28(1): 56-61.

Esaki, R., A. Macario, R. Reduce and R. Recycle (2009). "Wastage of Supplies and Drugs in the Operating Room." Medscape Anesthesiology, http://www. medscape. com/viewarticle/710513.

Hatswell, A. J. and J. K. Porter (2019). "Reducing Drug Wastage in Pharmaceuticals Dosed by Weight or Body Surface Areas by Optimising Vial Sizes." Applied health economics and health policy 17(3): 391-397.

Hess, L. M., Z. L. Cui, X. I. Li, A. B. Oton, S. Shortenhaus and I. A. Watson (2018). "Drug wastage and costs to the healthcare system in the care of patients with non-small cell lung cancer in the United States." Journal of medical economics 21(8): 755-761.

Mankes, R. F. (2012). "Propofol Wastage in Anesthesia." Anesthesia & Analgesia May 114(5): 1091-1092.

Roschangar, F., J. Colberg, P. J. Dunn, F. Gallou, J. D. Hayler, S. G. Koenig, M. E. Kopach, D. K. Leahy, I. Mergelsberg, J. L. Tucker, R. A. Sheldon and C. H. Senanayake (2017). "A deeper shade of green: inspiring sustainable drug manufacturing." Green Chemistry 19(1): 281-285.

Weinger, M. B. (2001). "Drug wastage contributes significantly to the cost of routine anesthesia care." Journal of Clinical Anesthesia 13(7): 491-497.

Decomposing the Problem

- Manufacturers must make two decisions:
  - How many different package sizes should be offered? As variety ↑:
    - Costs of production, shipping, inventory ↑ for manufacturer
    - Costs of inventory, administration costs, safety risk ↑ for provider, costs of waste ↓
  - What should those sizes be?

Product Size is Like Quality or Other Attributes

Durability of Consumption Goods

By PETER L. SWAN*

In a recent article in this *Review*, David Levhari and T. N. Srinivasan, hereafter L-S, attempt to show the conditions under which firms in monopolized industries tend to lessen the durability of their products, compared with the durability of these goods produced under perfect competition. They conclude that when unit costs $c(N)$ of a good are a function of the life N of the of minimizing the cost of the provision of any given service flow from a stock of durable goods. The decision is independent of demand or revenue conditions. It follows that a monopolist will produce goods of the same durability as competitive firms since cost minimization is also achieved under competition.
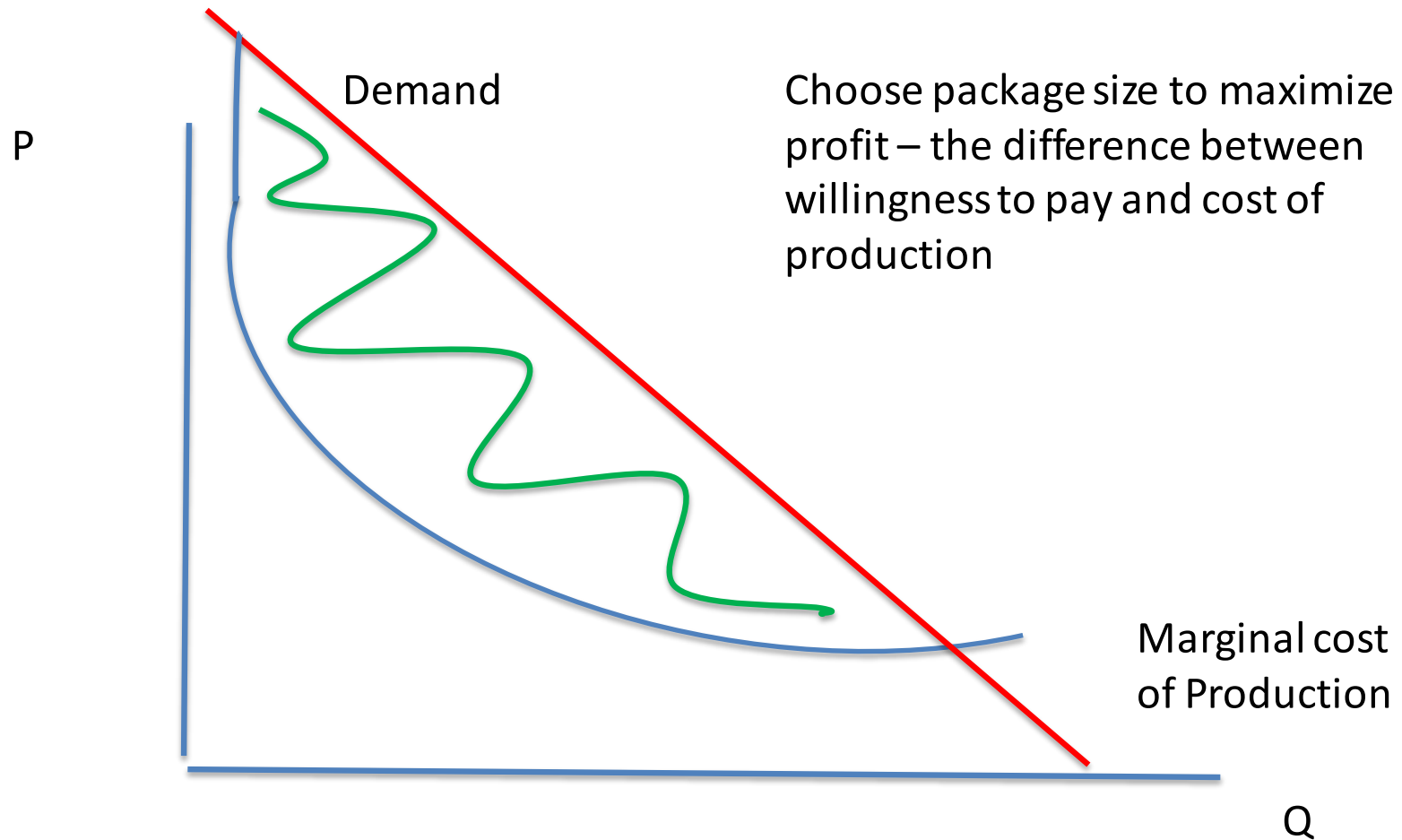
It is shown that L-S have conceived the

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Demand

- Monopolist's choice of price depends on consumer's value of product
  - What is the form of demand?
  - Who is the consumer?

Integrated Producer

P

Demand

Choose package size to maximize profit – the difference between willingness to pay and cost of production

Marginal cost of Production

Q

Will Monopolist Deviate from Choice of Integrated Producer?

- No (assuming consumer can observe vial size).

- If marginal cost = 0, pricing depends only on willingness to pay

- If marginal cost>0, choosing non-optimal vial size wastes potential profits

Is Intervention Likely to Reduce System-wide Costs?

- Regulations of optimal vial size
- Rebates for leftover drugs
- Addressing information problems

Choosing Optimal Vial Size is a Very Challenging Operations Research Problem

- Providers prefer fewer vials per patient to more smaller vials (more waste but lower inventory costs and fewer errors in administration)

- Optimal vial sizes depends on bodyweight and other characteristics of patients seen at a particular institution

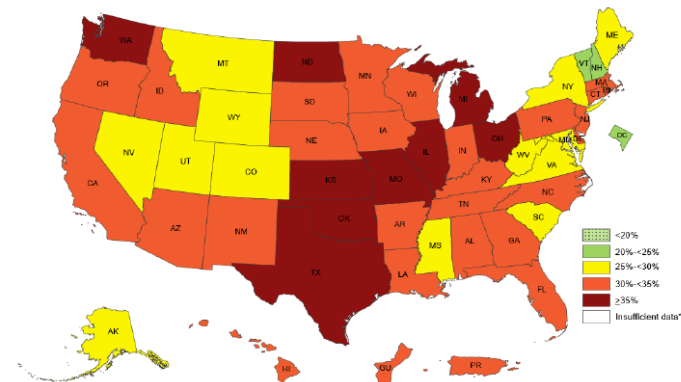# Production is National: Optimal Vial Size Varies by Facility

Prevalence of Self-Reported Obesity Among Non-Hispanic White Adults, by State and Territory, BRFSS, 2016-2018

Prevalence of Self-Reported Obesity Among Hispanic Adults, by State and Territory, BRFSS, 2016-2018
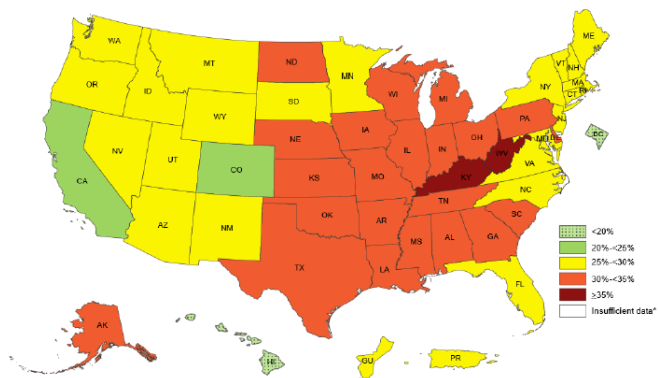
*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.

Rebates for Unused Product or Similar Policies

- If producers do not change vial sizes, a rebate policy would generate significant administrative costs, shipping hazard potential, etc.
- More likely – producers will reduce vial size, raising inventory and shipping costs and increasing real resource use

Information Problems

- Economic literature DOES recognize that package size can be distorted if consumers are misled
  - Don't perceive smaller size (candy bars)
  - Associate size with quality
- Errors in conduct of cost-effectiveness analyses and regulated pricing decisions

Conclusions

- Drug prices are a huge and consequential problem
- It's a good idea to minimize waste throughout the system
- In a heterogenous population, fixed vial sizes will generate waste
- In this context, little incentive to inefficiently manipulate package size
- It's a lot harder to eliminate waste here than it seems

No Reason to Expect Regulators will do Better than Manufacturers