



United States
Department
of Agriculture

ERR-47
September 2007



www.ers.usda.gov

Profits, Costs, and the Changing Structure of Dairy Farming

**James M. MacDonald, Erik J. O'Donoghue,
William D. McBride, Richard F. Nehring,
Carmen L. Sandretto, and Roberto Mosheim**

Abstract

U.S. dairy production is consolidating into fewer but larger farms. This report uses data from several USDA surveys to detail that consolidation and to analyze the financial drivers of consolidation. Specifically, larger farms realize lower production costs. Although small dairy farms realize higher revenue per hundredweight of milk sold, the cost advantages of larger size allow large farms to be profitable, on average, even while most small farms are unable to earn enough to replace their capital. Further survey evidence, as well as the financial data, suggest that consolidation is likely to continue.

Keywords: Dairy farming, economies of scale, economies of size, dairy farm structure, milk costs

Acknowledgments

The authors thank Don Blayney, Noel Gollehon, Marc Ribaud, and Neil Conklin of the Economic Research Service, Howard McDowell and Cliff Carman of the Agricultural Marketing Service, Jeff Gillespie of Louisiana State University, Leslie Butler of the University of California at Davis, and an anonymous external reviewer for comments and advice. They also thank Dale Simms for excellent editing support, and Wynnice Pointer-Napper for a timely and effective design and layout of the report.

Contents

Summary iii

Introduction 1

Changes in the Size and Location of U.S. Dairy Farms 2

Scale Economies and Structure in Dairy Farming: Background 5

 Explicit and Implicit Costs in Dairy Production. 6

 Measuring Dairy Costs With ARMS 7

What Can ARMS Tell Us About Scale Economies in Dairy Farming?. 8

 Cost-of-Production Accounting 8

 Net Returns 10

 Looking to the Future: Expected Structural Changes 11

 Behind Net Returns: Revenues and Farm Size 12

 Behind Net Returns: Estimates of Unpaid Labor Expenses 13

 How Does Structural Change Affect Industrywide Costs?. 15

What Do Econometric Estimates Tell Us?. 16

Using Investment Data To Supplement Cost Estimates. 20

Effects of Structural Change: Manure and Excess Nutrients 23

 Geographic Consolidation of U.S. Dairy Production 23

 Farm Size and the Potential for Excess Nutrients. 24

 Regulations 26

 Manure Management Strategies and Structural Change. 27

Conclusions. 31

References. 32

Appendix: Data Sources 34

Summary

Dairy farming in the United States is undergoing dramatic changes, driven by both supply and demand factors. Consumption is shifting from fluid milk, generally produced for local markets, toward manufactured products, such as cheese, and dairy-based ingredients produced for national and global markets. Innovations in breeding and feeding systems have led to large increases in the amount of milk that a cow produces. Milk production is shifting toward Western States such as California, Idaho, and New Mexico, and to much larger farms. The number of dairy farms with fewer than 200 cows is shrinking, while the number of very large operations, with 2,000 or more cows, doubled between 2000 and 2006.

What Is the Issue?

Large dairy farms first emerged in the Western States, but are now appearing in traditional dairy States as well. This report documents shifts in the location and size of dairy farms and takes a look at what those changes may mean. If the shift in farm size reflects economies of scale in dairy production—that is, lower costs on larger farms—then increasing farm size also enables milk to be produced with fewer resources, thereby reducing prices to consumers. However, the shifts also concentrate animal wastes from manure onto a much smaller land base and may exacerbate pollution associated with concentrated livestock production.

What Did the Study Find?

Large dairy enterprises generate returns that, on average, well exceed their full costs. At the same time, smaller dairy farms mostly incur economic losses—the value of their production does not exceed full costs, including the costs of capital and time committed by their owners. Large farms incur much lower costs, on average, than smaller farms, and these advantages accrue across a wide range of sizes. Costs per hundredweight of milk produced fall by nearly half as herd size increases from fewer than 50 head to 500 head, and continue to fall, but less sharply, at even larger herd sizes.

Dairy investment decisions are consistent with the financial evidence. Farms with fewer than 200 cows accounted for over two-thirds of the nationwide inventory of cows in 1992. By 2006, their share of the nationwide inventory had dropped to 38 percent. Meanwhile, farms with at least 1,000 head of dairy cows are growing more prevalent. They accounted for less than 10 percent of inventory in 1992 but more than a third by 2006. Structural shifts are evident among the largest farms, too. During the 1990s, farms with 1,000–3,000 head were adding the most capacity, but capacity additions have since shifted to even larger farms, with 3,000–10,000 head.

Some small dairy farms are profitable, and others continue to earn enough to remain in operation. As a result, structural change is likely for the foreseeable future, with a continuing decline, rather than a sudden disappearance, of small and midsize dairy operations. The ongoing structural changes will continue to place downward pressure on milk prices.

Excess nutrient applications, which arise from animal manure and can cause water and air pollution, appear to be intensified on larger operations. But their production cost advantages still outweigh the likely additional costs of manure treatment and removal, and it is unlikely that manure management regulations will reverse the ongoing patterns of structural change.

How Was the Study Conducted?

Confidential farm-level records from successive censuses of agriculture (1992, 1997, and 2002) were used to depict changes in the location and size distribution of dairy farms. More aggregated public information on the size distribution of dairy farms is drawn from annual dairy surveys carried out by USDA's National Agricultural Statistics Service (NASS).

Additional farm-level data come from the annual Agricultural Resource Management Survey (ARMS), administered jointly by the Economic Research Service (ERS) and NASS. Dairy farms in major milk-production States were targeted with commodity-specific ARMS versions covering operations during 2000 and 2005. These surveys provide detailed information for analyses of costs, manure management practices, and operator expectations for survival. Data from successive years of version 1 of the ARMS are used to develop measures of potential excess nutrient production on dairy operations.

This study focuses on conventional dairy production, and does not assess costs and farm sizes among organic dairy operations, a rapidly growing but still small segment of the industry. The 2005 ARMS dairy version contains comprehensive information on a sample of organic producers, and other research projects are analyzing those data.