United States Department of Agriculture

USDA

Economic Research Service

Food Assistance and Nutrition Research Report Number 39

WIC and the Retail Price of Infant Formula

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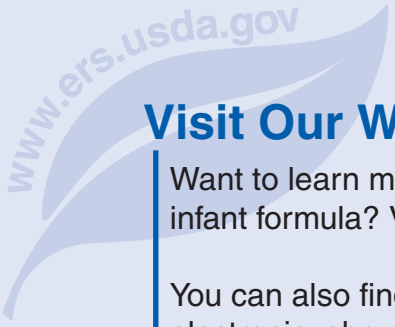
Food Assistance & Nutrition Research Program



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National Agricultural Library Cataloging Record:

WIC and the retail price of infant formula.
(Food Assistance and Nutrition Research report ; no. 39)
1. Special Supplemental Nutrition Program for Women, Infants, and Children (U.S.).
2. Infant formulas--Prices--United States.
3. Rebates--Economic aspects--United States. I. Oliveira, Victor J.
II. United States. Dept. of Agriculture. Economic Research Service.
III. Title.

United States
Department
of Agriculture

Food Assistance
and Nutrition
Research Report
Number 39

May 2004

A Report from the Economic Research Service

www.ers.usda.gov

WIC and the Retail Price of Infant Formula

**Victor Oliveira, Mark Prell,
David Smallwood, and Elizabeth Frazão**

Abstract

Rebates from infant formula manufacturers to State agencies that administer the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) support over one-quarter of all WIC participants. However, concerns have been raised that WIC and its infant formula rebate program may significantly affect the infant formula prices faced by non-WIC consumers. This report presents findings from the most comprehensive national study of infant formula prices at the retail level. For a given set of wholesale prices, WIC and its infant formula rebate program resulted in modest increases in the supermarket price of infant formula, especially in States with a high percentage of WIC formula-fed infants. However, lower priced infant formulas are available to non-WIC consumers in most areas of the country, and the number of these lower priced alternatives is increasing over time.

Keywords: WIC program, infant formula, cost-containment, rebates, food package costs, Special Supplemental Nutrition Program for Women, Infants, and Children, child nutrition, food assistance.

1800 M Street, NW
Washington, DC 20036-5831

May 2004

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Summary

Since 1989, Federal law has required that the State agencies administering the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) enter into cost-containment contracts for the purchase of infant formula used in WIC. Typically, WIC State agencies obtain significant discounts in the form of rebates from the manufacturers for each can of infant formula purchased by WIC participants. In exchange for rebates, a manufacturer is given the exclusive right to provide its products to WIC participants in the State.

Concerned about the rise in the price of infant formula since the WIC rebate program began, Congress in 2000 directed the U.S. Department of Agriculture's Economic Research Service (ERS) to report on several aspects of the infant formula market. While the resulting *Report to Congress* answered the specific questions posed by Congress, this new report extends the original analyses and provides a more indepth examination of the effects of WIC and its infant formula rebate program on the retail prices of infant formula. Wholesale prices of infant formula can indirectly affect retail prices, but this report focuses more narrowly on the pricing behavior of retailers for a given set of national wholesale prices. Therefore, this report's analysis does not capture all effects of WIC and the rebate program, including the extent to which WIC and the rebate program affect wholesale prices in addition to the retail markup. Specifically, this report uses 1994-2000 data to examine the following questions:

What are the recent trends in the infant formula market?

Since 1997, the volume of infant formula sold in the United States has remained relatively stable at about 27 billion ounces to 28 billion ounces (reconstituted) per year. Over three-quarters of all infant formula sold in 2000 was milk-based, while soy-based infant formula accounted for another 20 percent. While most infant formula is sold in supermarkets—69 percent in 2000—the proportion of infant formula sold by mass merchandisers (at prices typically below those in supermarkets) has increased slightly in recent years, accounting for about 28 percent of total volume sold. One of the more dramatic trends in the infant formula market in recent years has been the increase of formula sold in powdered form (generally, the least expensive form of formula)—from 44 percent of all formula sold in 1994 to 62 percent in 2000. The volume of powdered infant formula that is sold in large—24 or more ounces—containers (at lower per unit prices) is also on the rise, increasing from only 4 percent in 1994 to 19 percent in 2000. Specialized formula (which is generally more expensive than standard formula) has made significant inroads in the market in recent years and accounted for 8 percent of all formula sold in 2000. Total dollars sales of infant formula has increased in recent years, much of it attributed to the increased sales of specialized formula. The average retail price of infant formula continues to increase over time, across the different physical forms, product bases, and outlets.

Has the number of infant formula suppliers decreased since WIC's infant formula rebate program began?

In 1987, before WIC's infant formula rebate programs were widely implemented, and in 2000, three manufacturers accounted for about 99 percent of the infant formula market. Furthermore, in both years, two companies—Ross and Mead Johnson—accounted for between 87 percent and 90 percent of all infant formula sold. However, the third-largest producer in 2000—Carnation—entered the U.S. market after the rebate program began. Carnation continues to make inroads into the infant formula market. In 2000, the company accounted for 12 percent of all formula sold. In addition, a fourth company—PBM

Products—entered the infant formula market in 1997. PBM began marketing formula produced by Wyeth (Wyeth withdrew from the U.S. retail market in 1996.). Thus, there is no evidence that WIC's infant formula rebate program has resulted in a reduction of the number of infant formula manufacturers, thereby lessening competition.

Have infant formula prices increased faster than inflation in recent years?

The increase in the retail price of infant formula from 1994 to 2000 varied by manufacturer and type of formula. But in nearly all cases, the average annual increase in the retail price of infant formula exceeded inflation regardless of which of three consumer price indices (CPI) were used to represent inflation—*All Items, Food at Home,* or *Nonprescription Drugs and Medical Supplies*. In addition, in every case the annual rate of increase in retail prices exceeded the annual rate of increase in wholesale prices. Since little information is available on the operating costs associated with selling infant formula at the retail level, it is not possible to determine the extent to which the increase in retail infant formula prices above the rate of inflation is attributable to increased costs of retailing. In addition, infant formula prices were increasing faster than inflation even before the rebate program was implemented.

Does the percentage retail markup of infant formula differ by brand or type of formula?

The size of the retail markups in percentage terms varied by type and manufacturer. Carnation brands of infant formula had a higher retail markup than did Mead Johnson and Ross brands. Since the wholesale prices of Carnation are generally lower than the two other brands, retailers can mark Carnation products up more and still price them lower than the Ross and Mead Johnson brands. In addition, liquid concentrate forms of formula (both milk- and soy-based) had higher markups than powdered forms of formula for all manufacturers. All categories of formula had positive average annual retail markups at the national level. However, in many individual market areas, the retail prices of some infant formula products were priced below their listed wholesale prices, suggesting that many retailers use infant formula as loss leaders to attract customers into their stores.

What is the availability of infant formula products from the major manufacturers by market area?

Infant formulas manufactured by Mead Johnson, Ross, and Carnation are widely available in supermarkets throughout the United States. Formula manufactured by Wyeth and marketed by PBM Products, usually at relatively low retail prices, is available in some supermarkets in most areas of the country.

Is the retail price of formula that is included in the WIC rebate program greater than formula that is not included in the WIC rebate program?

Retail prices of infant formula vary widely across geographic areas. Within market areas, there is not a clear and consistent relationship between a formula being the WIC contract brand and that formula being sold at the highest average retail price.

What effect does being the WIC contract brand have on the retail price of infant formula?

A study of retail prices before and after a change in the WIC contract holder showed that after such a change, the retail price of the new contract brand of formula increased more than that of the old contract holder and the other brands of formula. This finding suggests that being the contract brand of formula results in higher retail prices. This general result of higher prices—but not necessarily the highest price—was robust across all product

bases and all physical forms of formula. A multivariate regression analysis examined retail prices while controlling for a variety of economic, demographic, and WIC program factors. Results showed that a manufacturer's brand of formula had a higher retail price, for a given wholesale price, if that brand was the WIC contract brand. The use of two different analytical approaches that produced comparable findings provides stronger, more credible results.

Does the size of the WIC program affect the retail price of infant formula?

A multivariate regression analysis showed that the greater the relative size of the WIC program in the State, as measured by the ratio of WIC formula feeders to non-WIC formula feeders, the greater the retail price of both the contract and noncontract brands of formula, holding other factors constant. This result held across nearly all brands and types of infant formula. Increasing the prevalence of breastfeeding among WIC mothers would decrease the relative size of the WIC program, thereby resulting in lower retail prices of infant formula.

In conclusion, supermarket prices of infant formula in a market area depend on a number of economic, demographic, and WIC program factors. WIC and its infant formula rebate program each tend to modestly increase the supermarket price of infant formula for non-WIC consumers, for given wholesale prices. The infant formula rebate program affects retail prices due to the designation of a single brand of formula as the contract brand (i.e., sole sourcing). The WIC program also affects retail infant formula prices through changes in WIC's size as measured by the number of formula-fed WIC infants relative to formula-fed non-WIC infants. An increase in the relative size of the WIC program tends to result in higher retail prices.

Accordingly, States with a high percentage of formula-fed infants in WIC had higher prices (other factors equal) with the amount of the increase depending on type and brand of formula consumed. For example, when moving from an area where WIC infants account for half of all formula-fed infants to an area where they account for two-thirds, a family with a typical 12-pound formula-fed infant has monthly expenditures (for milk-based formula) that increase by about $3 to $5 for contract brands of formula and about $1 to $4 for noncontract brands. No evidence was found that suggests that rebate levels affect retail markups. A full discussion of the price effects on non-WIC consumers due to WIC and its infant formula rebate program should consider that over one out of every four participants in the WIC program (i.e., almost 2 million people per month in fiscal 2000) is served with rebate money. Furthermore, recent legislative changes provide USDA with enhanced control of the prices WIC vendors charge for the contract brand of infant formula.

Definitions

Infant formula: defined in the Federal Food, Drug, and Cosmetic Act as a food that purports to be or is represented for special dietary use solely as a food for infants by reason of its simulation of human milk or its suitability as a complete or partial substitute for human milk (U.S. Code (U.S.C.) 321 (z)).

Exempt infant formula: defined in the Federal Food, Drug, and Cosmetic Act as any infant formula that is represented and labeled for use by an infant who has an inborn error of metabolism or a low-birth weight, or who otherwise has an unusual medical or dietary problem (U.S.C. 350a). Exempt infant formulas require prescriptions for use in the WIC program and are not covered by rebate contracts.

Standard infant formula: as defined in this report, standard infant formula includes milk-based and soy-based infant formulas, excluding specialized infant formula, that meet the nutritional needs of most full-term, healthy infants less than 1 year old and is not targeted at "special needs."

Specialized infant formula: as defined in this report, specialized formula is formula for children with special nutritional requirements, such as hypoallergenic formula, thickened formula, formula to treat diarrhea, formula for premature babies, or formula for infants with other diseases or disorders such as phenylketonuria (PKU). This category of formula also includes lactose-free (nonsoy) formula, and formula marketed to children 1 year of age or older. Specialized infant formula may include some nonexempt infant formula, such as thickened formula, which does not require a prescription for use in the WIC program and is covered by rebate contracts.

Contract brand: all the infant formula, other than exempt infant formulas, that is produced by the manufacturer awarded the WIC contract. All contract brand formulas are covered by rebate contracts.

Primary contract brand: the standard infant formula on which bids are solicited.

Manufacturer's wholesale price: the manufacturer's lowest national wholesale price per unit for a full truckload of infant formula.

Medical detailing: the manufacturer's practice of contacting hospitals and medical practitioners directly, providing them with free or discounted infant formula, and encouraging physicians to recommend one particular brand of formula (U.S. General Accounting Office, 1990). Medical detailing also includes providing hospitals with "discharge packs" containing formula samples, cents-off coupons, and company advertising aimed at mothers when they leave the hospital with their babies; such activities may serve as an implicit endorsement of a particular brand of infant formula by the hospital. Medical detailing also includes other types of support, such as donating equipment and services to hospitals (e.g., incubators, nursers, calendars, pens, etc.) and providing funding for research on infant nutrition to hospitals and physicians.

Retail markup: The difference between the retail price and the wholesale price.

Loss leader: An item priced below cost in order to bring customers into the store.

Relative size of WIC: The number of WIC formula-fed infants relative to the number of non-WIC formula-fed infants.

Chapter 1

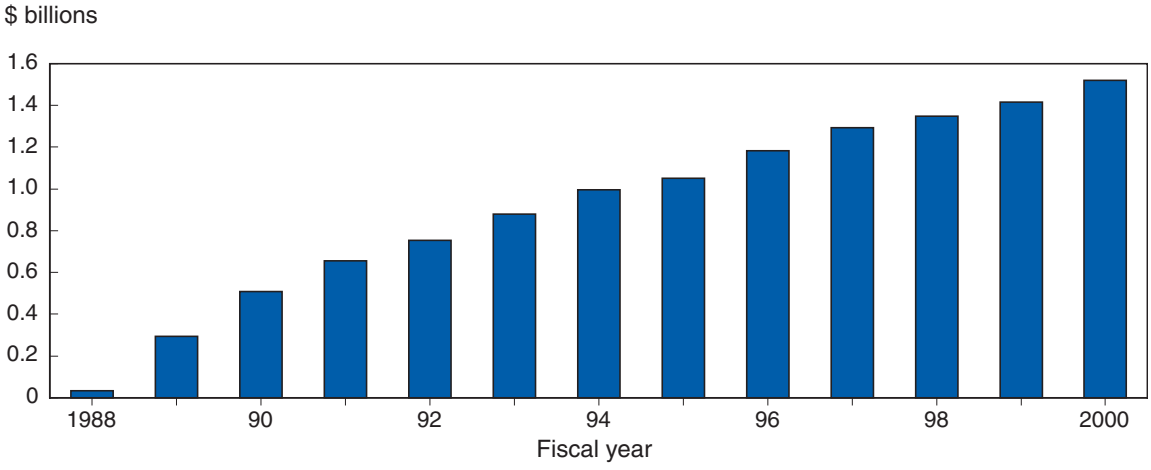
Introduction

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) safeguards the health of low-income infants and children under 5 years of age, as well as pregnant, breastfeeding, and postpartum women who are at nutritional risk, by providing a package of supplemental foods, nutrition education, and health care referrals. On average, 7.5 million people per month participated in the WIC program in fiscal 2002, including 1.9 million infants or almost half of all infants in the United States (U.S. Department of Agriculture (USDA), 2003). Although WIC encourages mothers to breastfeed if possible, most of these participating infants receive infant formula through WIC (see box "Infant Formulas").

Since 1989, Federal law has required that WIC State agencies enter into cost-containment contracts for the purchase of infant formula used in WIC. Typically, WIC State agencies obtain significant discounts in the form of rebates from the manufacturers for each can of infant formula purchased by WIC participants. In exchange for the rebates, a manufacturer is given the exclusive right to provide its products to WIC participants in the State (i.e., sole sourcing). The contract is awarded to the manufacturer offering the State WIC agency the lowest net price as determined by the manufacturer's wholesale price minus the rebate. The contract-winning manufacturer is then billed for the amount of the rebates on the formula issued to WIC participants. Infant formula rebates have increased dramatically over time and have become an important component of the WIC program (fig. 1-1). In FY 2000, infant formula rebates totaled $1.4 billion, an amount that supported about 27 percent of WIC participants (USDA, 2001a).

WIC is an influential agent in the infant formula market: ERS estimates that infants participating in WIC consume about 54 percent of all formula sold in the United States. In most States, WIC participants use food vouchers or food checks to purchase their infant formula, free of charge, at participating retail grocery stores. WIC then reimburses the retail grocery stores for the amount of infant formula purchased. Some observers have hypothesized that WIC and its rebate program may significantly affect the retail infant formula prices faced by non-WIC consumers, either indirectly, through their impact on wholesale prices, or directly, through their effect on the retail markup (the difference between the retail price and the wholesale price).

Figure 1-1
Infant formula rebates, 1988-2000



Source: USDA's Food and Nutrition Service, Office of Analysis, Nutrition, and Evaluation.

Infant Formulas

A wide variety of commercial infant formulas is available to consumers. Conventional milk-based infant formula, containing lactose (a carbohydrate in cow's milk) and cow's milk proteins, is the most widely used formula. Soy-based formulas, free of cow milk proteins and lactose, provide an alternative protein source to infants with milk-based allergies or with symptoms of lactose intolerance, and are also used by parents seeking a vegetarian diet for their infants. According to USDA's Food and Nutrition Service, "the best impartial medical evidence strongly demonstrates that milk-based, lactose-containing and soy-based, lactose-free infant formulas meet the nutritional needs of almost all infants" (*Federal Register* (FR) Vol. 65, No. 164). These milk- and soy-based formulas are available in three different physical forms:

- Powder—the least expensive formula which must be mixed with water and stirred,
- Liquid concentrate—which must be mixed with an equal amount of water, and
- Ready-to-feed—the most expensive form of formula, it does not require mixing.

Milk- and soy-based formulas are available in a wide range of package sizes and in two different iron levels: added iron and low iron. The American Academy of Pediatrics recommends that formula-fed infants receive an iron-fortified formula as a way of reducing the prevalence of iron-deficiency anemia (American Academy of Pediatrics, 1999). Iron-fortified infant formula is routinely issued in WIC. All low-iron infant formula issued through WIC requires medical documentation.

In addition to formulas used for routine infant feeding, other types of formulas designed for infants with unique nutritional needs are also available. For example, hypoallergenic formulas are produced for infants with food protein allergies. These include protein hydrolysate formulas that make milk proteins more digestible and less allergenic and thereby provide alternative sources of protein to children who are allergic to milk and soy proteins. Infant formulas are available for infants with other special nutritional needs (e.g., low-birth-weight and premature infants) and medical disorders, such as phenylketonuria (PKU). Formula is also produced specifically for toddlers 1 year of age or older, who have different nutritional needs than infants.

Potential Effect on Wholesale Prices. Because retailers establish a commodity's retail price based on a number of factors, including its wholesale cost, factors affecting the wholesale price of infant formula may also affect the retail price of formula. By moving a large number of low-income consumers from the out-of-pocket segment of the infant formula market into the WIC-funded segment of the market, WIC may make it profitable for manufacturers to raise the wholesale price of formula for two possible reasons. First, the remaining higher income consumers of formula in the non-WIC market are less sensitive to price changes.[1] Second, the presence of large numbers of price-insensitive customers resulting from the WIC program (since WIC produces a "customer that is essentially unconcerned with the price he or she is paying" for formula) may have "kept the competitive focus of the infant formula companies on promotion rather than pricing" (Post and Wubbenhorst, 1989).

A separate influence on wholesale prices due specifically to the rebate program might occur if, by channeling large volumes of guaranteed purchases to contract-winning manufacturers, the rebate program had the effect of reducing the number of infant formula manufacturers and lessening competition. In addition, the amount of the rebates paid by infant formula manufacturers are

[1] See Salant 2003, chapter 24 for a more detailed discussion of WIC's potential effect on the wholesale price of infant formula.

another possible influence on wholesale prices. If manufacturers change wholesale prices in response to the payment of rebates, then (holding the retail markup constant) retail prices would be affected in turn (for further discussion, see the 1998 U.S. General Accounting Office report GAO/RCED-98-146).

Potential Effect on Retail Markup. WIC and its infant formula rebate program may also affect retail prices directly, independent of any effects on wholesale prices. WIC may make it profitable for retailers to raise infant formula retail prices, for given wholesale prices, for reasons similar to those cited above for wholesale price—removing certain low-income consumers from the out-of-pocket market and converting them into price-insensitive consumers supported by WIC. In addition, the rebate program's feature of sole-source procurement of infant formula can affect retail prices. For example, retailers may increase the retail price of the WIC contract-winning brand of formula because WIC recipients are required to purchase the contract brand of formula. Retailers also may increase the retail price of the contract brand even more if demand for the brand increases in the non-WIC market segment. This increase in demand could occur if retailers increase the contract brand's shelf space in stores or if physicians or hospitals are more likely to recommend the contract brand to their non-WIC patients (U.S. General Accounting Office (GAO), 1998). While the level of infant formula rebates may potentially affect wholesale prices, it is thought that rebates do not affect the establishment of retail prices, for given wholesale prices, since manufacturers—not retailers—pay the rebates.

In recent years, Congress has expressed an interest in the possible effects of WIC's rebate program on non-WIC consumers. In response to a request by the U.S. House of Representatives' Committee on the Budget, the U.S. General Accounting Office in 1998 analyzed several issues related to infant formula rebates including how prices in the infant formula market changed after the introduction of the rebate program (U.S. GAO, 1998). Because data on retail prices were not readily available, the GAO study focused solely on wholesale prices. In May 1999, the U.S. House of Representatives' Committee on Appropriations, while acknowledging the revenue to the WIC program generated through the use of infant formula rebates, expressed concern "that since rebates began infant formula costs appear to have risen far greater than inflation, and the number of suppliers has declined" (H.R. 106-157).

In October 2000, Congress directed USDA's Economic Research Service (ERS) to (1) report on the number of infant formula suppliers in each State or major marketing area; and (2) compare the cost of infant formula that is included in the WIC rebate program versus the cost of formula that is not included in the WIC rebate program (H.R. 106-948). In November 2001, ERS delivered a final Report to Congress that specifically addressed the two issues mandated by Congress (Oliveira et al., 2001).

This report examines other important issues not addressed in the earlier ERS Report to Congress and provides a more indepth analysis of the effects of WIC and its infant formula rebate program on the retail prices of infant formula. This report focuses on local retailer decisionmaking and the establishment of retail prices, treating national wholesale prices as given. In addition to examining retail prices, this report looks at retail markup. To the extent that WIC and the rebate program affect national wholesale prices in addition to the local retail markup, this report's analysis does not capture fully all effects of WIC and the rebate program.

Because the report is an extension of the earlier congressionally mandated study, results from the *Report to Congress* are contained in this report, along with the results from the latter analyses. Specifically, this report examines the following eight issues:

What are the recent trends in the infant formula market?
The report examines the infant formula market in terms of the types, amounts, and prices of formula sold, and how it has changed in recent years.

Has the number of infant formula suppliers decreased since WIC's infant formula rebate program began?
Congress has expressed concern that the WIC rebate program has brought about a decrease in the number of infant formula suppliers.

Have infant formula prices increased faster than inflation in recent years?
Congress also expressed concern that the WIC rebate program may have led to an increase in the real (i.e., inflation-adjusted) cost of infant formula to consumers.

Does the retail markup differ by brand and by type of infant formula?
Because retail price is the sum of an item's wholesale price and its retail markup, the report calculates the amount of the retail markup for each of the major types of infant formula, by brand.

What is the availability of infant formula products from the major manufacturers in different market areas?
The local availability of different infant formula brands directly affects the choices available to consumers in a market area.

Is the retail price of infant formula that is included in the WIC rebate program greater than the price of formula that is not included in the WIC rebate program?
Congress is concerned that non-WIC consumers may be paying a higher price for formula that is included in the rebate program relative to formula not included in the rebate program.

What effect does contract brand status have on the retail price of infant formula?
This report uses two different methodologies—an event study analysis and a multivariate regression analysis—to determine if winning a State's WIC infant formula contract results in higher retail prices for the new contract brand of formula. The event study analysis compares prices before and after changes in the contract brand in various market areas between 1994 and 2000. The multiple regression analysis examines the price effects of contract brand status simultaneously with the effects of other price-determining variables.

Does the size of the WIC program affect the retail price of infant formula?
The multivariate regression analysis also examines retail price effects that are associated with the size of a State's WIC program, as measured by the ratio of WIC infants to non-WIC infants who use infant formula.

The main focus of this report is to provide answers to these last two questions, both of which deal with identifying the effects that the WIC program and its infant formula rebate program have on the retail prices of formula. This report is the most comprehensive national study to analyze prices of infant formula at the retail level; most of the previous work examined wholesale infant formula

prices (for example, see U.S. GAO, 1998). By using scanner-based retail sales data, this study examines directly the infant formula prices faced by non-WIC consumers and the pricing behavior of retailers for a given set of wholesale prices.

The next several chapters provide readers with background information on the WIC program (chapter 2), WIC's infant formula rebate program (chapter 3), the domestic infant formula market (chapter 4), and the primary data set used in the analysis (chapter 5). Recent trends in the infant formula market are examined in chapter 6. Chapter 7 responds specifically to the directives made by Congress. Chapters 8 and 9 present the main empirical analyses of the report—an event study analysis and a multivariate regression analysis. The major implications of the analyses are discussed in chapter 10 while chapter 11 summarizes the study's major findings. Appendix A presents a history of WIC's infant formula rebate system and appendix B contains tables providing detailed information on the event study analysis. Detailed information regarding the regression model used in the analysis of retail infant formula prices is presented in appendices C through E.

Chapter 2

Overview of the WIC Program

WIC was created as a 2-year pilot program in 1972 by an amendment to the Child Nutrition Act of 1966 (Public Law 92-433). The program was made permanent in 1975 by P.L. 94-105, which states that "Congress finds that substantial numbers of pregnant women, infants, and young children are at special risk in respect to their physical and mental health by reason of poor or inadequate nutrition or health care, or both." WIC is based on the premise that early intervention programs during critical times of growth and development can help prevent future medical and developmental problems. Administered by USDA's Food and Nutrition Service (FNS), the program currently provides grants for supplemental foods, nutrition services, and administration to 88 WIC State agencies, including the 50 States, the District of Columbia, Guam, the U.S. Virgin Islands, American Samoa, the Commonwealth of Puerto Rico, and 33 Indian Tribal Organizations.

WIC has expanded dramatically since its beginning, and is now one of the central components of the Nation's food assistance system. Recent program expansion, since 1988, is due in part to the savings generated from infant formula rebates (fig. 2-1). Of the average 7.5 million participants served per month in FY 2002, roughly one-quarter were infants, one-quarter were women, and one-half were children (USDA, 2003). Federal program costs totaled approximately $4.3 billion in FY 2002, making WIC the country's third-largest food assistance program in terms of total expenditures, exceeded only by the Food Stamp Program ($20.7 billion) and the National School Lunch Program ($6.9 billion) (USDA, 2002). WIC accounts for about 11 percent of total Federal Government expenditures for food and nutrition assistance.

Participant Eligibility

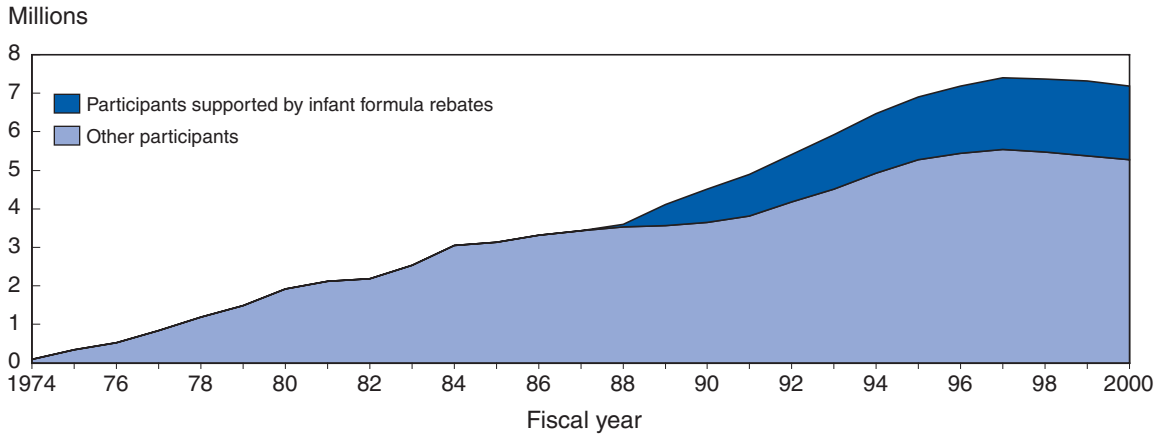
To qualify for WIC, applicants must meet categorical, income, residential, and nutritional risk eligibility requirements.

Categorical Eligibility. To participate in the WIC program, a person must be:

- A pregnant woman (includes women up to 6 weeks postpartum),
- A nonbreastfeeding woman up to 6 months postpartum,

Figure 2-1

Average monthly number of WIC participants, 1974-2000



Source: USDA's Food and Nutrition Service.

- A breastfeeding woman up to 1 year postpartum,
- An infant under 1 year of age, or
- A child up to his/her fifth birthday.

Income Eligibility. The family income of WIC applicants must meet specified guidelines.[1] All States currently set the income cutoff at the maximum 185 percent of the Federal poverty line ($31,543 for a family of four in July 2000). Applicants who participate in or who have certain family members who participate in the Food Stamp, Medicaid, or Temporary Assistance for Needy Families (TANF) programs are adjunctively income eligible; that is, they are deemed to meet the income eligibility criteria automatically.[2]

Residential Eligibility. The applicants must reside in the State in which they apply.

Nutritional Risk. Applicants must be at nutritional risk, as determined by a health professional such as a physician, nutritionist, or nurse. Federal regulations recognize five major types of nutritional risk for WIC eligibility:

(1) detrimental or abnormal nutritional conditions detectable by biochemical or anthropometric measurements,

(2) other documented nutritionally related medical conditions,

(3) dietary deficiencies that impair or endanger health,

(4) conditions that directly affect the nutritional health of a person, including alcoholism or drug abuse, and

(5) conditions that predispose persons to inadequate nutritional patterns or nutritionally related medical conditions, including, but not limited to, homelessness and migrancy (7 *Code of Federal Regulations* (CFR) 246.2).

Participant Benefits

The WIC program offers three types of benefits to participants: a supplemental food package, nutrition education, and referrals to health and other services.

Supplemental Food Package. WIC provides participants with supplemental foods that are high in five target nutrients—protein, calcium, iron, and vitamins A and C. These nutrients are frequently lacking in the diets of the program's target population, which may result in adverse health consequences. There are seven different food packages, based on the category of the participant, as follows:

(1) infants through 3 months old,
(2) infants 4-12 months old,
(3) children 1-4 years old,
(4) pregnant and breastfeeding women (basic),
(5) nonbreastfeeding postpartum women,

[1] WIC regulations state that the maximum allowable family gross income (i.e., before taxes are withheld) must not exceed the guidelines for reduced-price school meals, which are 185 percent of the U.S. Poverty Income Guidelines (7 CFR 246.7). State agencies may set the income guidelines equal to State or local guidelines for free or reduced-price health care, as long as they are equal to or less than 185 percent of the poverty guidelines and greater than 100 percent of the poverty guidelines.

[2] In April 1998, about half of all WIC participants also participated in at least one of these three programs (Bartlett et al., 2000).

(6) breastfeeding women (enhanced), and
(7) children or women with special dietary needs.

WIC supplemental foods include iron-fortified infant and adult cereal, vitamin C-rich fruit and/or vegetable juice, eggs, milk, cheese, peanut butter, tuna fish, carrots, and dried beans or peas, in addition to iron-fortified infant formula.[3] Exempt infant formulas and certain medical foods may also be provided by the WIC food package when prescribed by a physician or health professional for a specific medical condition.[4] Breastfeeding women whose infants do not receive formula from WIC can receive an enhanced food package that includes tuna and carrots in addition to other WIC foods.

Nutrition Education. WIC makes nutrition education, including breastfeeding promotion and support, available to all participants (or to the parents or caretakers of infant or child participants). The nutrition education is designed to achieve two broad goals:

(1) to stress the relationship between proper nutrition and good health and raise awareness about the dangers of using drugs and other harmful substances, and
(2) to assist the nutritionally at-risk individual in achieving a positive change in food habits, resulting in improved nutritional status and in the prevention of nutrition-related problems through the use of the supplemental foods and other nutritious foods (7 CFR 246.11).

Local WIC agencies are required to offer participants at least two nutrition education sessions during each 6-month period, in either an individual or a group setting. However, individuals who do not attend the nutrition education activities are not denied the WIC food package.

Referrals to Health Care and Social Services. WIC was designed to operate as an adjunct to health care. Local WIC agencies assist WIC participants in obtaining health care and social services (such as food stamps, Medicaid, immunizations, etc.), either through onsite health services or referrals to other agencies.

Food Delivery Systems

To provide program participants with supplemental food packages, the States may use three types of food delivery systems (or any combination of the three):

- Retail food delivery systems—participants obtain supplemental food by transacting a food instrument (e.g., check or voucher) at authorized retail vendors.
- Home food delivery systems—supplemental foods are delivered to the participant's home.
- Direct distribution food delivery systems—participants pick up supplemental foods from storage facilities operated by the State or local agency.

[3] The maximum monthly allowance for food package I—infants 0-3 months—is 403 fluid ounces of concentrated liquid infant formula (powdered or ready-to-feed formula may be substituted at specified rates). The maximum monthly allowance for food package II—infants 4-12 months—is the same as that for package I with the addition of 96 fluid ounces of reconstituted fruit juice and 24 ounces of infant cereal.

[4] Exempt infant formula is defined in the Federal Food, Drug, and Cosmetic Act as any infant formula that is represented and labeled for use by an infant who has an inborn error of metabolism or a low-birth weight, or who otherwise has an unusual medical or dietary problem.

The vast majority of WIC participants receive their supplemental foods via retail food delivery systems. Under the retail food delivery system, WIC State agencies issue food instruments to participants, who then transact the food instruments for specific supplemental foods at authorized retail vendors (e.g., grocery stores). The food instrument specifies the type and amount of supplemental foods that can be obtained. Only those vendors who are authorized by the WIC State agency may transact and redeem food instruments. WIC State agencies develop the criteria for selecting vendors. However, the selection criteria must include four mandatory criteria:

(1) the WIC State agency must consider the prices a vendor applicant charges for WIC foods as compared with the prices charged by other applicants and authorized vendors,

(2) the WIC State agency must establish minimum requirements for the variety and quantity of supplemental foods that a vendor must stock to be authorized,

(3) the WIC State agency must consider the business integrity of a vendor applicant, and

(4) the WIC State agency may not authorize an applicant vendor that is disqualified from the Food Stamp Program or that has been assessed a Food Stamp Program disqualification or civil money penalty for hardship, unless it would result in inadequate participant access (7 CFR 246.2).

During FY 2000, 49,682 vendors were authorized by the WIC program nationwide (U.S. Department of Agriculture, 2001c). The vast majority of these vendors were either supermarkets or grocery stores. In addition, about 6 percent of WIC authorized stores were pharmacies that were not operated as part of a retail store.[5] Outlets such as Wal-Mart that contain grocery stores may be authorized as WIC vendors provided that they meet the State agency's vendor selection criteria, including the criteria for minimum variety and quantity of WIC supplemental foods.

WIC Funding and Cost-Containment Measures

WIC is a discretionary grant program funded annually at a specific grant level determined by appropriations law. Therefore, the number of participants that can be served depends upon the annual Congressional appropriation as well as the cost of operating the program.[6,7] In the event WIC does not have the funds to enroll all eligible applicants, WIC developed a priority system in order to ensure that those persons at the greatest nutrition risk receive program benefits. Expansion of the WIC program during the 1990s allowed a greater number of lower priority applicants to participate, and the role of the priority system in allocating available program slots among applicants decreased in importance relative to previous years when program funds were more limited. Anecdotal evidence suggests that in recent years nearly everyone who was eligible and who applied for the program has been able to participate.

Because program funding is a fixed level, cost-containment practices allow WIC to maximize the number of applicants it can enroll. The WIC State agencies use a variety of cost-containment practices in addition to infant formula rebates, including rebate systems for other foods, such as infant

[5] Typically, these pharmacy vendors only provide exempt infant formula and WIC-eligible medical foods. However, some State agencies allow pharmacy vendors to transact and redeem food instruments for all infant food packages, including infant formula (USDA, 2001b).

[6] By contrast, the Food Stamp Program is an entitlement program whereby everyone who meets the eligibility criteria may receive benefits if they so choose.

[7] Although there is no requirement for State matching funds, some States use their own funds to supplement the Federal grant.

cereal and infant fruit juice.[8] However, savings from rebates for other food products are much lower than for infant formula in part because no other single product accounts for as large a portion of WIC costs as infant formula and because the market characteristics of other products make it unlikely that manufacturers would offer large rebates per item (U.S. GAO, 1998).[9]

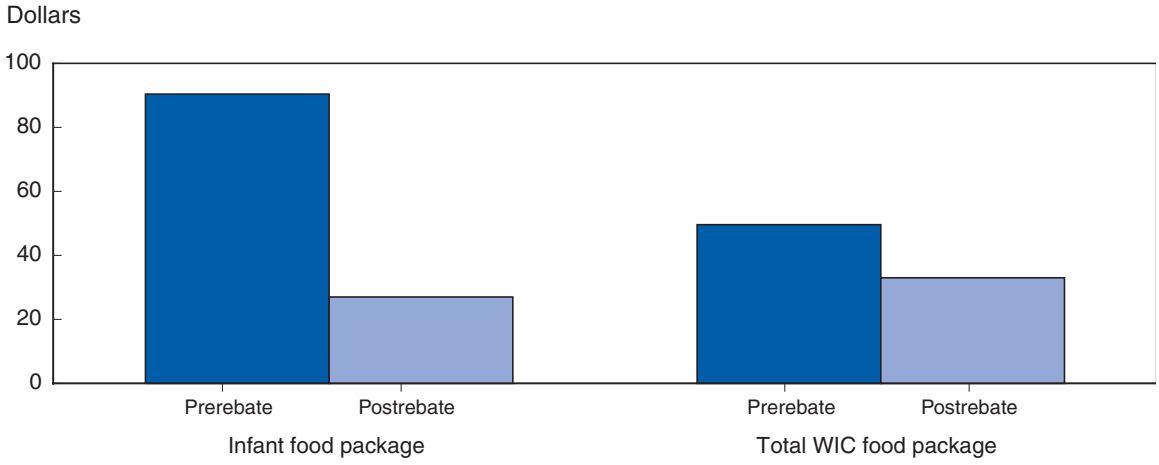
The effect of the infant formula rebates on program costs is significant. For example, the average cost of the monthly WIC food package for infants in FY 2000 was $90.45 before rebates (i.e., estimated retail cost of WIC foods at the time of purchase), but only $27.09 after taking into account savings from infant formula rebates (fig. 2-2). The average prerebate monthly food package for all WIC recipients (including women and children in addition to infants) was $49.72 compared with $33.05 after infant formula rebates. Infant formula accounted for 50 percent of total WIC food costs on a prerebate basis but only 24 percent on a postrebate basis (USDA, 2001a).

[8] Other cost-containment practices used by some WIC State agencies include limiting WIC food selections to the lowest cost brand, limiting the types and package sizes of WIC foods, restricting the number of vendors, and ensuring that the prices vendors charge for WIC foods are competitive (U.S. GAO, 1997).

[9] In addition, the administrative costs associated with operating rebates for other WIC foods could be higher than those of infant formula, partially offsetting the savings in food costs obtained from the rebates (U.S. GAO, 1998).

Figure 2-2

Average monthly WIC food package cost per participant, FY 2000



Source: USDA, 2001a.

Chapter 3

The WIC Infant Formula Rebate Program

In the mid-1980s, infant formula accounted for nearly 40 percent of total WIC food costs and infant formula retail prices were rising more quickly than prices for other foods (U.S. GAO, 1990). These factors led Tennessee and other States to look into cost-containment practices to reduce infant formula costs. In 1987, Tennessee became the first State to initiate a rebate contract system and other States followed soon after.[1] In 1989, P.L. 101-147 required State WIC agencies to use competitive bidding—or an alternate method that would yield savings equal to or greater than those produced by competitive bidding—to procure infant formula.

Current Federal regulations specify that all WIC State agencies must operate a cost-containment system for the procurement of infant formula except those States with home delivery or direct distribution food delivery systems or Indian State agencies with 1,000 or fewer participants (7 CFR 246.16a). Those State agencies required to operate a cost-containment system for infant formula must use a sole-source (i.e., single supplier) competitive system unless an alternative system provides savings equal to or greater than a sole-source competitive system.[2] Under the sole-source competitive system, a WIC State agency uses competitive bidding to award a contract to a manufacturer of infant formula in exchange for a rebate for each can of infant formula that is issued to WIC participants. (The State agency issues only the contract brand of infant formula except (1) when medical documentation supports the use of a noncontract brand of infant formula; or (2) if a noncontract brand of formula is needed for religious reasons.)[3] As a result, the brand of infant formula provided by WIC will vary by State according to which manufacturer holds the contract for that State. Generally, infant formula rebate contracts are for 3 years.

At the WIC State agency's option, solicitation for bids under the sole-source competitive system can take one of two forms: single solicitation or separate solicitations. Under single solicitation, the request for bids is for a single iron-fortified milk-based infant formula that is suitable for routine issuance to the majority of generally healthy, full-term infants.[4] This formula is referred to as the primary contract brand infant formula. The primary contract brand infant formula must be offered in all physical forms—liquid concentrate, powdered, and ready-to-feed—and it cannot be an exempt infant formula, which is defined as any formula that is represented and labeled for use by an infant who has an inborn error of metabolism or a low birth weight, or who otherwise has an unusual medical or dietary problem (exempt infant formula is not required to have a rebate). Manufacturers who submit bids for the WIC contract are required to specify a rebate amount for the primary contract brand infant formula for each of the three physical forms of infant formula.

The sole-source contract is awarded to the bidder offering the lowest total monthly net price, as determined by the submission of sealed bids, for a standardized amount of the primary contract brand infant formula by physical form.[5] WIC regulations define net price as the difference between

[1] See appendix A for a more detailed discussion of the history of the infant formula rebate program.

[2] An interim rule, effective October 2000, strengthened and simplified the requirements for operating a sole-source infant formula rebate system (FR, Vol. 65, No. 164).

[3] GAO (2003) estimated that 90.3 percent of all WIC infants using formula in fiscal year 2002 received the contract brand.

[4] Only iron-fortified infant formulas are authorized for use in the WIC program.

[5] WIC State agencies can elect to award the WIC contract to the bidder offering the highest monthly rebate if the weighted average of retail prices for different brands of infant formula in the State vary by 5 percent or less.

an infant formula manufacturer's lowest national wholesale price per unit for a full truckload of infant formula and the rebate level offered by the manufacturer.

All the different types of infant formula (except exempt infant formula) produced by the contract-winning manufacturer are referred to as contract brand infant formula. Under single solicitation, the winning bidder is required to supply and provide rebates for all the different types of contract brand infant formula the WIC State agency chooses to issue, such as lactose-free formula and formula for older infants. Contract-winning manufacturers that do not produce soy-based infant formulas must subcontract with another manufacturer to supply a soy-based infant formula under the contract. The amount of the rebate on the contract brand infant formula is based on the same percentage discount for the particular physical form of the primary contract brand infant formula. For example, if the rebate offered for the primary contract brand of powdered infant formula was 85 percent of the manufacturer's wholesale price, then the rebate for all other powdered forms of the contract brand infant formula would also be 85 percent of its wholesale price.

Under the process of separate solicitations, solicitations for bids are issued for milk-based and soy-based infant formulas separately. Separate solicitations may increase competition for WIC contracts by allowing new or smaller infant formula manufacturers with a limited product line to bid on contracts (FR, Vol. 65, No. 164). Although States have awarded contracts to two different manufacturers in the past (i.e., one manufacturer held the milk-based contract and another manufacturer held the soy-based contract), in 2000, only one manufacturer in each State held the WIC contract.

The WIC State agency may choose to issue all or some of the different types of contract brand infant formula. Any noncontract brand of infant formula (including exempt infant formulas and formulas not manufactured by the WIC contract manufacturer) may be issued only with medical documentation (provided by a licensed health care professional authorized to write medical prescriptions under State law) that an infant has a condition that dictates the formula's use.[6] The WIC State agency does not receive rebates from noncontract brand infant formula.

The WIC program usually issues infant formula to WIC participants in powdered or liquid concentrate forms. However, formula may be issued in ready-to-feed form in special situations, such as when the participant's household does not have an adequate and safe water supply or refrigeration, or if the person caring for the participant may have difficulty in correctly diluting concentrated liquid or powdered forms of infant formula.

As noted, most WIC participants receive food instruments, such as vouchers, that they transact for the contract brand of infant formula at authorized retailers. The WIC State agency then reimburses the vendor for the full retail price of the infant formula. The State agency, or the State agency's financial institution, then bills the contract-winning manufacturer for the rebate agreed to in the contract. As a result, the actual cost of infant formula to the State WIC agency equals the retail cost minus the amount of the manufacturer's rebate.[7]

In fiscal year 2000, 67 of the 88 WIC State agencies operated a competitive sole-source rebate system in conjunction with a retail food delivery system. The exceptions were Vermont, which used a home delivery system; Mississippi and parts of Chicago, which used a direct distribution system; and 19 Indian Tribal State agencies with participation of less than 1,000, which either

[6] The only exception to this rule is that local WIC agencies may issue noncontract brand infant formula without medical documentation in order to accommodate religious eating patterns (FR, Vol. 65, No. 164).

[7] The net price, as defined in a WIC infant formula rebate contract, is wholesale price minus the rebate. Because the retail price is wholesale price plus the retail markup, the cost of infant formula to the WIC program—retail price minus the rebate—differs from the net price received by the manufacturer by the amount of the retail markup.

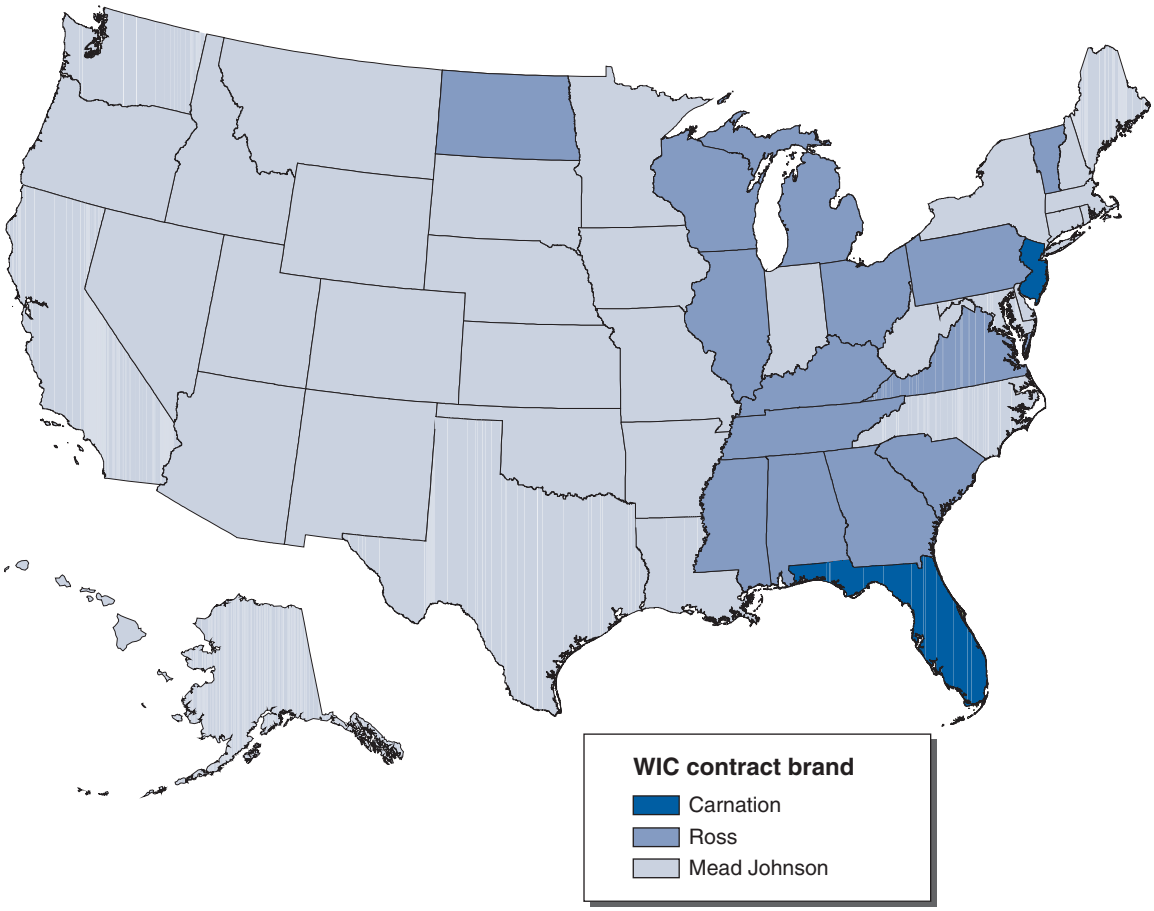
did not operate a cost-containment system for infant formula or else used a cost-containment procedure other than a competitive sole-source rebate system. Of the programs using retail food delivery systems, 7 were multi-State systems, involving 40 WIC State agencies. Under these systems, WIC State agencies join together in a single rebate agreement to obtain infant formula.[8] In this way, WIC State agencies with small- to medium-size populations can pool their buying power to leverage higher rebate levels (Liu, 1991).

As of September 2000, only three manufacturers—Mead Johnson, Ross, and Carnation—held WIC infant formula rebate contracts. Excluding the Indian Tribal Organizations and Puerto Rico, Mead Johnson held the WIC contract in 35 States including the District of Columbia (fig. 3-1). Ross held contracts in 14 States (nearly all of which were in the eastern half of the country). Carnation held the WIC contract in two States—Florida and New Jersey.[9] Mead Johnson is estimated to have provided about 68 percent of all formula distributed through the WIC program in 2000, compared with 27 percent for Ross, and 6 percent for Carnation (USDA, 2000a.).

[8] For example, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and three Indian Tribal Organizations made up the *New England and Tribal Organization* multi-State group.

[9] Since September 2000, Carnation was awarded additional contracts in Virginia, North Dakota, and Kentucky, all of which were previously held by Ross.

Figure 3-1
WIC infant formula rebate contract by State, September 2000



Note: Vermont uses a home delivery system and Mississippi uses a direct distribution system to distribute WIC foods.

In September 2000, the wholesale prices for a 13-ounce can of milk-based liquid concentrate infant formula with iron varied by company—$2.27 for Carnation, $2.91 for Ross, and $2.94 for Mead Johnson. The wholesale price used by WIC is the manufacturer's lowest national wholesale price. Consequently, the wholesale price for an individual manufacturer, used for the determination of its net price, does not vary by State (U.S. territories and Indian Tribal Organizations are excluded from this discussion). On the other hand, the amount of the rebate, determined by the contract awarded by submission of sealed bids, varied by both manufacturer and State, ranging from $2.06 in New Jersey to $2.84 in South Carolina (fig. 3-2). Net price, defined in a WIC infant formula contract as the wholesale price minus the rebate, also varied greatly by State, ranging from only 6.5 cents per can in Florida, to 44.7 cents per can in Nebraska and South Dakota. The average net price among the States was 20 cents.[10] Rebates as a percentage of the manufacturer's wholesale price ranged from about 85 percent in Nebraska and South Dakota to almost 98 percent in South Carolina. In other words, the infant formula purchased through the WIC program cost the South Carolina WIC program about 2 percent of its wholesale cost, plus the amount of the retail markup.

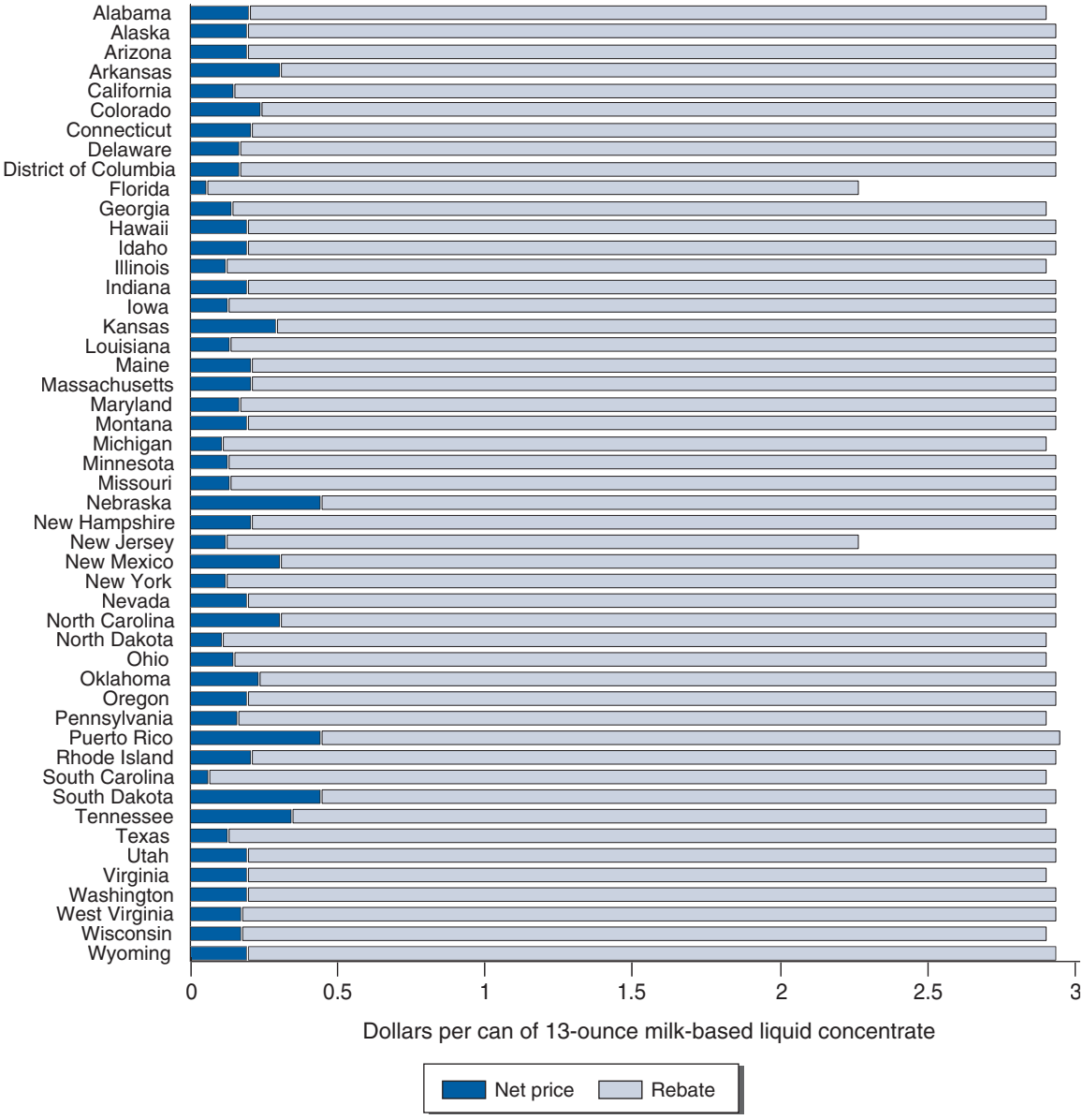
Several factors can influence the net price of formula. Through a variety of practices, firms in concentrated product markets that contain few manufacturers, such as the infant formula market, are often able to charge higher wholesale prices, relative to production costs, than firms in less concentrated product markets. On the other hand, WIC State agencies as large buyers can use their market power to obtain lower net prices for WIC formula through the use of rebates. In order to win a WIC contract, an infant formula manufacturer may choose to offer infant formula at low net prices or even at a loss in the WIC market by bidding a high rebate. To be profitable to a manufacturer, such a below-cost strategy requires that increased sales in the non-WIC market segment offset the loss in the WIC market segment. An increase in non-WIC market sales could take place if retail stores give more shelf space to the WIC brand of infant formula (since, on average, over half of all sales are through WIC) and non-WIC households' brand choices are influenced by shelf space or if physicians or hospitals become more likely to recommend the WIC brand of infant formula to non-WIC consumers.[11]

[10] This estimate was based on unweighted data—i.e., each State had the same weight regardless of the size of its WIC population.

[11] The U.S. General Accounting Office (1998) concluded that, since WIC makes up over half of the market, it is unlikely that infant formula manufacturers sell their product at a loss in the WIC market.

Figure 3-2

Wholesale price, WIC rebate, and net price of milk-based infant formula by State, September 2000[1]



[1]Net price plus rebate equals the wholesale price.

Notes: Mississippi operates a direct distribution system, Vermont operates a home delivery system, and Kentucky uses a composite price for milk- and soy-based infant formula.

Source: USDA's Food and Nutrition Service, 2000.

Chapter 4

The Domestic Infant Formula Market

The development of the infant formula market has been greatly influenced by the demand for infant formula. This section describes some of the major factors that have impacted the demand for formula and the structure of the infant formula market in the United States.

Demand for Infant Formula

Commercially prepared infant formulas in powdered form have been available in the United States since the late 1800s (Fomon, 2001).[1] Prior to 1930, most infants were breastfed through their first year, although many were fed some formula as well, most of which was made in the home from cow's milk or, starting in the 1920s, from evaporated milk. Powdered formulas were appreciably more expensive than these home-prepared formulas and, as a result, the use of commercially prepared formulas was low at the time.

From 1930 to the 1970s, the percentage of breastfed infants in the United States declined and most children were fed cow's milk after 6 months of age (Fomon, 2001).[2] During the early portion of this period, the use of home-prepared formulas exceeded that of commercially prepared formulas. However, the use of commercially prepared formulas increased dramatically after the introduction of concentrated liquid formulas in 1951, when convenience considerations began to outweigh cost considerations. By the late 1950s, liquid concentrate had become the predominant form of commercially made formula (it would remain the predominant form of commercially made formula until the 1990s when powdered formula became predominant).[3] During the early 1960s, commercially prepared formulas replaced home-prepared formulas as the predominant source of infant formula, due in part to the introduction of iron-fortified formulas in 1959 and the promotion of these formulas by the infant formula industry and pediatricians.

The downward trend in breastfeeding reached its nadir in 1971 when fewer than 25 percent of infants in the United States were breastfed while in the hospital, and fewer than 6 percent were breastfed at 5 to 6 months (Martinez and Krieger, 1985). At this time, most of the infants not breastfeeding were fed commercially prepared formulas until they reached 4 to 6 months of age and then they were fed cow's milk, which was considerably less expensive and more convenient to use than formula (Fomon, 2001). Breastfeeding rates increased during the rest of the 1970s. The increase in breastfeeding decreased the use of commercially prepared formulas among infants younger than 4 months of age. However, the use of commercially prepared formulas among infants older than 4 months of age rose as cow's milk was increasingly being introduced to infants at later ages, thereby extending the duration of formula use.

Although breastfeeding rates dipped slightly in the 1980s, they increased again during the 1990s. By 2000, 68 percent of mothers initiated breastfeeding in the hospital, and 31 percent of mothers

[1] The early commercially prepared formulas were milk-based. The first soy-based infant formulas, developed for infants allergic to cow's milk, were introduced in 1929 (Fomon, 2001).

[2] This decline in breastfeeding has been widely attributed, at least in part, to the concurrent increase in maternal employment.

[3] Prior to the early 1970s, the physical properties of powdered formulas were such that they were less readily suspended in water than today's powdered form of formulas (Fomon, 2001).

were breastfeeding at 6 months, the highest rates since data were first collected in 1955 (see box "Breastfeeding Rates Among WIC Participants") (Abbott Laboratories, 2001).[4] Although breastfeeding rates have increased in recent years, breastfeeding duration is still generally short—only a minority of children in the United States are still being breastfed by the time they are 6 months old. At the same time, the feeding of cow's milk continues to occur at later ages (Fomon, 2001). As a result, a large majority of infants in the United States are fed at least some formula.[5]

Structure of the Infant Formula Market

Although a number of firms manufacturing infant formula appeared during the early 1900s, their ranks were reduced considerably during the 1930s depression (Post and Wubbenhorst, 1989). It was not until the baby boom following World War II that the large-scale manufacture of infant formula appeared.

The Infant Formula Act of 1980 (the amendment of the Federal Food, Drug, and Cosmetic Act) had a significant impact on the manufacture of infant formula. The Act provided the legislative basis for greater regulatory control over the production of infant formula.[6] Provisions of the Act (along with 1986 amendments) established minimum (and in some cases maximum) nutrient levels for infant formula, thereby standardizing its nutritional content to a large degree. The Act also provided the legislative basis for quality control procedures for producing infant formula and gave the Food and Drug Administration (FDA) the authority to enforce standards for infant formula marketed in the United States.

Even before the WIC infant formula rebate program was implemented, the infant formula industry was highly concentrated. A small number of manufacturers, usually owned by pharmaceutical companies, produced the vast majority of the infant formula sold in the United States. In 1987, three manufacturers, all owned by pharmaceutical companies, accounted for 99 percent of the total U.S. market share of infant formula:

- Ross Labs, owned by Abbott Laboratories,
- Mead Johnson, owned by Bristol-Myers, and
- Wyeth-Ayerst Laboratories, owned by American Home Products (table 4-1).[7]

The fact that only a few firms were producing infant formula for the U.S. market suggests that the costs of entering the market were high. One factor that may have contributed to the high cost of entry is medical detailing. Medical detailing is the manufacturer's practice of contacting hospitals and medical practitioners directly, providing them with free or discounted infant formula, and encouraging physicians to recommend one particular brand of formula (U.S. GAO, 1990). Medical detailing also includes providing hospitals with "discharge packs" containing formula samples,

[4] Reasons cited for the continued increase in breastfeeding initiation rates since the early 1970s include the publication of numerous reports documenting the advantages of breastfeeding, recognition of breastfeeding as the preferred method of infant feeding from a number of professional societies, the influence of the natural childhood movement which emphasized breastfeeding, and increased breastfeeding promotion efforts, particularly those conducted through the WIC program (American Dietetic Association, 1997; Wright and Schanler, 2001).

[5] Over 80 percent of infants ages 3-11 months of age in 1998 were estimated to be fed at least some formula (includes infants who were also breastfed) (Fomon, 2001).

[6] Congress passed the Act in response to a substantial number of infants having been made seriously ill in 1979 due to the inadvertent omission of chlorides (an essential nutrient for growth and development) in some infant formula when a manufacturer reformulated several of its infant formula products (FR, Vol. 61, No. 132).

[7] All three of these companies entered the infant formula market in the 1920s (Post and Wubbenhorst, 1989).

Breastfeeding Rates Among WIC Participants

The American Academy of Pediatrics (AAP) recognizes breastfeeding as the ideal method of feeding infants and achieving optimal infant and child health, growth, and development (American Academy of Pediatrics, 1997). AAP recommends exclusive breastfeeding for approximately the first 6 months after birth and the gradual introduction of iron-enriched foods in the second half of the infant's first year to complement the breast milk diet. Breastfeeding is recommended for at least 12 months and thereafter for as long as mutually desired. Despite the wide acknowledgement of breastfeeding as the best method of feeding most infants, many women do not breastfeed their infants.

Since 1955, the Ross Laboratories Mothers Survey, a large national mail survey of infant feeding practices conducted by the infant formula manufacturer, has been used to monitor breastfeeding trends in the United States. From 1990 to 2000, the initiation of breastfeeding (i.e., breastfeeding while in the hospital) increased by almost 33 percent (see table below). By 2000, 68.4 percent of women were initiating breastfeeding, the highest rate ever recorded. Rates of breastfeeding infants at 6 months of age increased by 78 percent over the same period, from about 18 to 31 percent (breastfeeding women included those who breastfed exclusively as well as those who supplemented breast milk with infant formula or milk from other sources). Despite the recent increases in breastfeeding rates, they remain far below the Healthy People 2010 target that 75 percent of mothers breastfeed their babies during the early postpartum period, 50 percent of mothers breastfeed their babies at 6 months of age, and 25 percent of mothers breastfeed their babies at 1 year (U.S. Department of Health and Human Services, 2000).

WIC participants showed even greater increases in the prevalence of breastfeeding during the 1990s (mothers who, since the birth of their child, participated in WIC themselves, or whose child participated in the program, were considered to be WIC participants). The percentage of WIC participants who initiated breastfeeding increased by 69 percent from 1990 to 1998, while the percentage who were breastfeeding at 6 months increased by 145 percent. Despite these gains, WIC participants are still less likely to breastfeed (both in the hospital and when the infants reach 6 months) than non-WIC participants.

Some have questioned whether WIC, by supplying free infant formula, provides an incentive not to breastfeed (the average cash value of the WIC food package received by a nonbreastfeeding postpartum woman and her formula-fed infant is more than three times that received by a breastfeeding woman whose infant does not receive formula through WIC) (Rossi, 1998). However, historically, the more vulnerable and less affluent groups of mothers who are more likely to participate in WIC, including mothers who are Black, poor, and have low education levels, have been less likely to breastfeed their children (Ryan, 1997). Furthermore, through its nutrition education and breastfeeding promotion programs, the WIC program encourages mothers to breastfeed their infants if possible. Breastfeeding women also have a higher priority for certification into the program than nonbreastfeeding postpartum women and they are eligible to receive program benefits for up to 1 year postpartum (as long as they continue to breastfeed), as opposed to only 6 months of postpartum benefits for nonbreastfeeding women.

Breastfeeding rates by WIC status, 1990-2000

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
In hospital:											
All infants	51.5	53.3	54.2	55.9	57.4	59.7	59.2	62.4	64.3	67.2	68.4
By WIC participation status:											
WIC	33.7	36.9	38.8	41.6	44.3	46.6	46.6	50.4	55.8	56.1	56.8
Non-WIC	62.9	65.2	66.4	67.9	68.8	71.0	70.8	73.4	75.2	76.9	77.8
At 6 months:											
All infants	17.6	18.2	18.9	19.0	19.7	21.6	21.7	26.0	28.6	30.7	31.4
By WIC participation status:											
WIC	8.2	9.0	10.1	10.8	11.6	12.7	12.9	16.5	18.9	19.9	20.1
Non-WIC	23.6	24.6	25.6	25.8	26.5	29.2	29.5	35.5	38.5	40.3	40.7

Source: Abbott Laboratories, 2001.

Table 4-1—Share of the U.S. infant formula market by company, 1987, 1994, and 2000

Company	1987	1994	2000
		Percent	
Ross	55	53	35
Mead Johnson	35	27	52
Wyeth	9	9	NA
Carnation	NA	7	12
Gerber (Mead Johnson)	NA	3	NA
PBM (Wyeth)	NA	NA	1

NA=Not applicable.

Notes: Market share was determined by volume of infant formula sold. Companies accounting for less than 1 percent of the market are not identified. Infant formula sold under the Gerber name was manufactured by Mead Johnson. Infant formula sold by PBM was manufactured by Wyeth.

Sources: Data for 1987 are from U.S. General Accounting Office, 1990. Data for 1994 and 2000 are from ERS analysis of InfoScan data.

cents-off coupons, and company advertising aimed at mothers when they leave the hospital with their babies; such activities may serve as implicit endorsement of a particular brand of infant formula by the hospital. To the extent that parents of formula-fed infants develop a strong brand loyalty, their responsiveness to price differentials across brands is reduced. Thus, medical detailing may provide some market power to pharmaceutical companies. According to GAO, the practice of medical detailing by the pharmaceutical manufacturers of infant formula may have limited the ability of nonpharmaceutical companies to compete in the domestic infant formula market (U.S. GAO, 1990).

The industry's high concentration may also have been a reflection of high costs due to regulatory requirements of the Federal Food, Drug, and Cosmetic Act. For example, the Act requires that manufacturers demonstrate that infant formulas new to the U.S. market provide nutrients to the infant in usable form, and testing of every batch of infant formula to ensure its nutrient composition. The costs associated with meeting these regulatory requirements may increase firm unit costs more for small firms than large firms.[8]

The U.S. infant formula market has undergone several changes since 1987, the most important of which has been the introduction of several lower priced infant formulas being marketed directly to consumers (a marketing strategy that shows that medical detailing is not a necessary condition to enter the infant formula market). For example, Carnation introduced their infant formula products into the U.S. market in 1988.[9] Unlike the other major infant formula manufacturers, which are subsidiaries of pharmaceutical companies, Carnation is a subsidiary of Nestlé, a large Swiss-owned food company. Nestlé markets its formula directly to consumers rather than to medical professionals. Although the wholesale prices of infant formula charged by the other major manufacturers have historically been very similar, Carnation has offered its product at substantially lower wholesale prices (fig. 4-1). Carnation has steadily increased its share of the U.S. market over time: ERS analysis of scanner data indicates that in 2000, Carnation accounted for an estimated 12 percent of the market in volume sales.

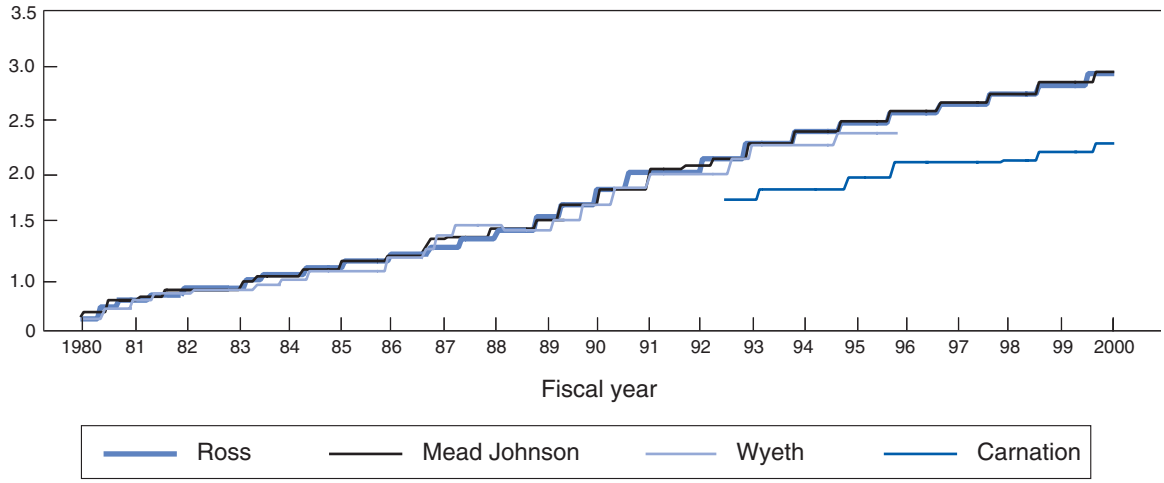
[8] A technical point—even if all firms have identical unit cost curves and batch testing raised cost curves for all firms by the same amount, industry concentration may be increased by testing requirements if the higher level of costs, relative to a (fixed) product demand curve, means that the market could not support as many firms at minimum efficient scale.

[9] Carnation had been producing infant formula for the international market for many years prior to this time.

Figure 4-1

Wholesale prices of selected infant formula by manufacturer, 1980-2000

Dollars per can of 13-ounce milk-based liquid concentrate



Source: Data provided by USDA's Food and Nutrition Service.

In 1989, Bristol-Myers, the parent company of Mead Johnson, entered into a marketing agreement with a nonpharmaceutical company—Gerber Products Company (a large baby food producer)—to manufacture formula to be marketed under the Gerber name (Gerber, 1989).[10] Gerber infant formula was generally priced below the leading brands and, like Carnation formula, was marketed directly to consumers. The agreement ended in 1997, and the production of Gerber brand infant formula ceased (Mead Johnson Nutritionals, 1997).

After many years of producing infant formula for the U.S. market, Wyeth phased out production of its infant formulas for the U.S. market during 1996.[11] Among the reasons the company cited for its exit from the domestic market were the increasing costs of competing in the overall nutrition market and the spiraling growth of the WIC program (Wyeth-Ayerst Laboratories, 1996). In 1997 Wyeth re-entered the domestic infant formula market, not as a distributor of infant formula but as a producer for PBM Products. PBM Products markets the formula under its own label as well as under private-label brands in supermarkets and mass merchandiser chains such as Wal-Mart and Target, at prices below the major brands (*The Washington Post*, Sept. 11, 1999). PBM product marketing is aimed at consumers rather than the medical community (PBM does little medical detailing). ERS analysis of retail scanner data from supermarkets, mass merchandisers, and drugstores, indicates that in 2000, infant formula sold by PBM Products (virtually all of it in powdered form) accounted for just over 1 percent of all infant formula sold and 2 percent of all powdered formula sold.

Another recent change in the infant formula market has been the switch in market shares between Mead Johnson and Ross. Mead Johnson's share of the national market increased from 27 percent in 1994 to 52 percent in 2000 (table 4-1). During this period, Mead Johnson was successfully bidding for new WIC contracts as its share of the WIC infant formula market almost tripled from

[10] This was Gerber's second attempt to enter the infant formula market. Gerber produced an infant formula from 1967 until the formula was discontinued in 1972 (*The New York Times*, 1989).

[11] Wyeth continued to manufacture infant formula for the international market.

23 percent to 68 percent.[12] Meanwhile, Ross's share of the national market declined from 53 percent in 1994 to 35 percent in 2000 as its share of the WIC market fell from 54 to 27 percent.

Since 2000 (the last year for which retail price data for this report were analyzed), other changes have occurred in the infant formula market. Anecdotal evidence suggests that PBM continues to gain market share. Recently PBM has introduced both liquid concentrate and ready-to-feed versions of infant formula into the market. In the spring of 2001, Abbott Labs, the parent company of Ross, began producing a private label infant formula for sale in Costco stores. This product, priced well below the Ross brand of formula, will compete with other brands—including Ross products—in the infant formula market. Lastly, in the summer of 2001, the U.S. Food and Drug Administration (FDA) approved the use of the fatty acids docosahexaenoic acid (DHA) and arachidonic acid (ARA) in domestic infant formula (*The New York Times*, 2001). Manufacturers that choose to add the fatty acids to their formula are required to do postmarketing surveillance, to ensure that infants consuming the product do not experience bad effects, that may result in higher costs.[13]

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[12] Much of this dramatic shift occurred between fiscal years 1995 and 1996 when Mead Johnson's share of the WIC market increased from 33 percent to 62 percent (appendix table A-1).

[13] Mead Johnson, Ross, Carnation, and PBM have all introduced formula containing DHA and ARA into their product line while continuing to offer formula without the fatty acids as well.

Chapter 5

Source of Infant Formula Data

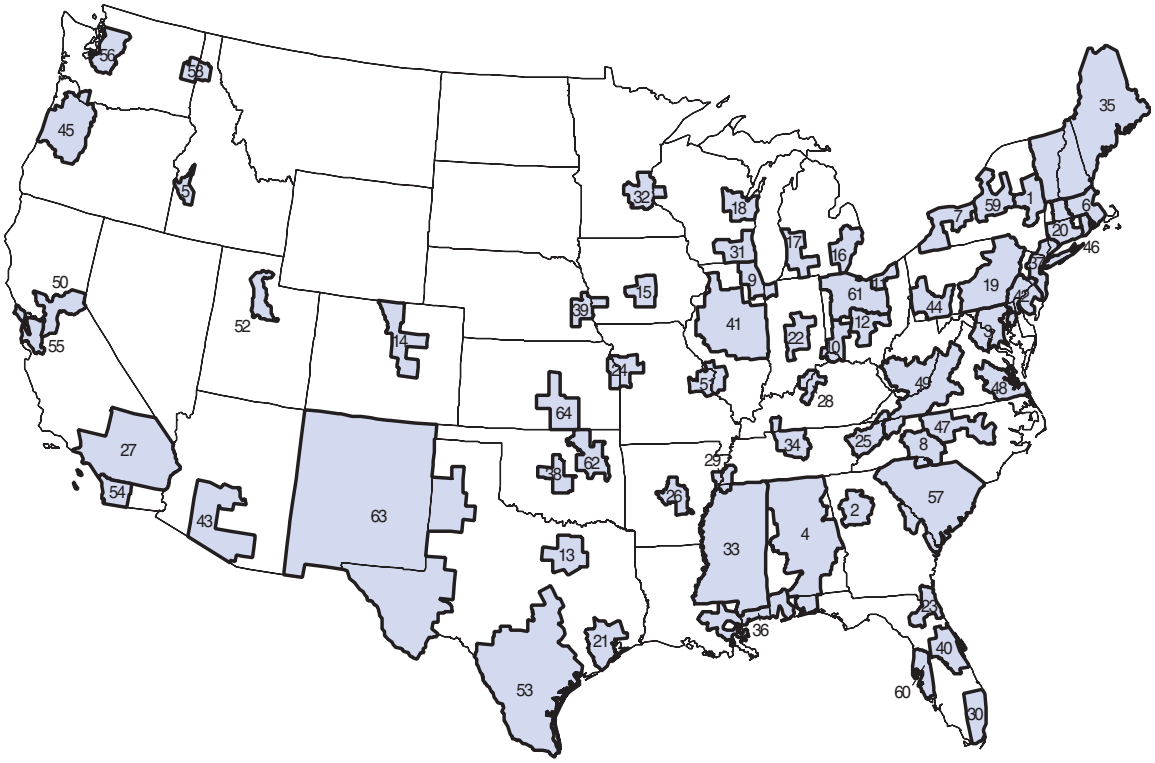
The primary source of data on the retail prices of infant formula used in the following analyses is InfoScan, a scanner-based retail sales tracking service provided by Information Resources Incorporated. InfoScan is based on weekly retail scanner information from a sample of 11,300 supermarkets, 7,500 drugstores, and 288 mass merchandisers across the United States. The retail stores in the sample are statistically selected and must meet strict data quality standards. Once a week, the sampled retailers provide retail scanner data, including the price and description of all products scanned in these stores during that week. In addition, an extensive network of professional field auditors collects weekly information on promotional activities from all sample stores. This information is used to differentiate everyday volume from volume due to promotional activity, as well as to quality-check the data and to ensure that changes in volume correlate to the relevant in-store promotional activity.

After the data are reviewed and checked for errors or inconsistencies, InfoScan applies projection factors to extrapolate total volume of product sold and total dollar sales of the product for chains, market areas, regions, and the total United States. InfoScan data are averages across a specified geographic area; data from individual stores were not available for this analysis. Supermarket data, representing supermarkets that have at least $2 million in sales annually, are projected to 64 market areas (fig. 5-1). The market areas are sets of counties selected on the basis of their retail trading environment. The market area data are then combined with data from sample stores representing the counties outside the 64 market areas to project regional and national supermarket sales. Data from mass merchandisers (stores belonging to chains that sell at least $200 million annually) and drugstores are not projected to the market area; rather, individual store-level data are projected directly to eight standard regions that, when combined, reflect the total for the United States.

The InfoScan infant formula category includes information on dollar sales, unit sales, volume sales, and prices per unit for more than 500 distinct items. These items are unique in terms of such characteristics as product brand, package size, product form, and product base and usually conform to a unique universal product code (UPC). One exception to the correspondence of individual items and UPCs is private-label items. In this case, items are grouped by unique package characteristics. Consequently, individual private label brands or store labels are not identified. Fortunately, this does not create a problem for this study because PBM, which entered the infant formula market in 1997, was the only company marketing private-label infant formula during the study period. As a result, InfoScan private-label infant formula as well as all infant formula identified as being manufactured by Wyeth after 1996 was coded as PBM infant formula (all PBM infant formula is manufactured by Wyeth).

Each item in the infant formula category on the InfoScan data base was examined by ERS analysts and classified as to type: standard formula (382 items), specialized formula (58 items), or not infant formula (90 items). As defined in this report, standard infant formula includes milk-based and soy-based infant formulas that meet the nutritional needs of most full-term, healthy infants younger than 1 year old and is not targeted at "special needs." Specialized formula includes formula for children with special nutritional requirements, such as hypoallergenic formula (e.g., hydrolyzed-protein formula), thickened formula, formula to treat diarrhea, formula for premature babies, formula for infants with other diseases or disorders (such as PKU), lactose-free (non-soy)

Figure 5-1
Market areas, 2000



1 Albany	23 Jacksonville	45 Portland, OR
2 Atlanta	24 Kansas City	46 Providence
3 Baltimore-Washington	25 Knoxville	47 Raleigh-Greensboro
4 Birmingham-Montgomery	26 Little Rock	48 Richmond-Norfolk
5 Boise	27 Los Angeles	49 Roanoke
6 Boston	28 Louisville	50 Sacramento
7 Buffalo-Rochester	29 Memphis	51 St. Louis
8 Charlotte	30 Miami-Ft. Lauderdale	52 Salt Lake City
9 Chicago	31 Milwaukee	53 San Antonio-Corpus Christi
10 Cincinnati-Dayton	32 Minneapolis-St. Paul	54 San Diego
11 Cleveland	33 Mississippi	55 San Francisco-Oakland
12 Columbus	34 Nashville	56 Seattle-Tacoma
13 Dallas-Ft. Worth	35 New England	57 South Carolina
14 Denver	36 New Orleans-Mobile	58 Spokane
15 Des Moines	37 New York	59 Syracuse
16 Detroit	38 Oklahoma city	60 Tampa-St. Petersburg
17 Grand Rapids	39 Omaha	61 Toledo
18 Green Bay	40 Orlando	62 Tulsa
19 Harrisburg-Scranton	41 Peoria-Springfield	63 West Texas-New Mexico
20 Hartford-Springfield	42 Philadelphia	64 Wichita
21 Houston	43 Phoenix-Tuscon	
22 Indianapolis	44 Pittsburgh	

Source: Information Resources Incorporated.

formula, as well as formula marketed to toddlers 1 year or older.[1] In general, specialized infant formulas are not marketed to the broad population of infants under 1 year of age but rather to a particular segment of infants with special needs. In many cases, the composition and price structure of specialized formulas differs substantially from that of standard formulas. The terms "standard" and "specialized" were developed for this report to categorize these different types of infant formula. They do not coincide with categories used either for the regulation of infant formula or in the administration of the WIC infant formula rebate program.

Items determined not to be infant formula, such as Pedialyte and other electrolyte maintenance solutions, were excluded from this analysis. Each formula item was further classified as to the product base (milk, soy, or other), and product form (liquid concentrate, powder, or ready to feed). ERS further processed the InfoScan data to convert the volume measures to single strength equivalents. Each ounce of liquid concentrate is equivalent to 2 ounces of ready-to-feed formula. Conversion factors for powder formula range from 7.08 to 7.5, depending on brand and product base.

Infant formula prices reported in this study are converted to apply to a standard unit of volume, 26 ounces of ready-to-feed formula.[2] This volume was chosen as the standard because it is the ready-to-feed equivalent of a 13-ounce can of liquid concentrate, the unit used most often in previous studies of infant formula pricing. This conversion allows one to easily compare retail prices for different package sizes and product forms. The price is calculated by dividing dollar sales by volume sales in single-strength, ready-to-feed equivalents. This procedure creates a volume-weighted average price.

ERS obtained InfoScan quarterly data on infant formula covering the 1st quarter of 1994 through the 3rd quarter of 2000. The quarterly data were then aggregated to represent annual periods; infant formula sales and volume figures for the year 2000 were annualized based on data for the first three quarters of the year, the most recent data available at the time the study was initiated.

Limitations of the Data

One of the limitations of the data for this study is that the InfoScan data are not available at the State level. In some cases, the 64 market areas span State boundaries. Whereas 41 of the 64 market areas fall within the boundaries of a single State, the remaining 23 cover more than one State (e.g., the Philadelphia market area includes parts of Pennsylvania, New Jersey, Delaware, and Maryland). Seven States—Alaska, Hawaii, Montana, Nevada, North Dakota, South Dakota, and Wyoming—are not included in any of the 64 market areas.

Another limitation of the data for this study is that only supermarket data are projected to the market area level; sales data from drug stores and mass merchandisers are available at the national level only. Mass merchandisers and drugstores account for a considerable—and increasing—proportion of all infant formula sales, amounting to nearly 29 percent of dollar sales and 32 percent of volume sales of all infant formula in 2000.

Furthermore, the scanner data used in this report do not measure sales in other types of outlets, such as convenience and food stores with less than $2 million in sales annually, and nonfood stores that sell baby food, such as Toys "R" Us. In addition, consumers can now order infant formula

[1] Since the focus of this report is formulas for infants, formulas for toddlers 1 year of age and older (which has a different nutrient composition than formulas for infants) were classified as specialized.

[2] As a result, an item's retail price as cited in this report may differ from the item's actual shelf price found in supermarkets.

through the Internet, often at a discount. The contribution of these other outlets of infant formula to total volume sales or prices is unknown but it is believed that they currently account for only a small proportion of overall sales of infant formula in the United States.

This study's analysis of InfoScan data was limited to the years 1994 through 2000. Prior to 1994, information on mass merchandisers was not collected. In addition, by 1994, most WIC State agencies (excluding Indian State agencies with 1,000 or fewer participants) with infant formula rebate operations had switched to sole-source competitive rebate systems (see appendix A).

Chapter 6

Infant Formula Trends

Examination of InfoScan data from 1994 to 2000 shows recent trends in infant formula in terms of volume sold, dollar sales, and retail prices. The data also allow for a comparison of the rate of increases in infant formula prices to the rate of inflation, and for an examination of the retail markup.

Volume of Infant Formula Sold

According to the Infoscan data, the total volume of infant formula sold in the United States (measured in reconstituted ounces) decreased by 10 percent between 1994 and 2000 (fig. 6-1). Most of this decrease occurred between 1994 and 1997; since 1997, the volume of infant formula sold in this country has remained relatively stable at about 27 to 28 billion ounces per year.[1]

Most infant formula is sold in supermarkets (69 percent in 2000) (fig. 6-1). However, since 1994, the proportion of infant formula sold by mass merchandisers has increased slightly relative to both supermarkets and drugstores. In 2000, mass merchandisers accounted for about 28 percent of total volume sold compared with 24 percent in 1994. Drugstores accounted for less than 4 percent in 2000.

Over three-quarters (76 percent) of all infant formula sold in the United States in 2000 was milk-based, up slightly from 1994 (fig. 6-2). Soy-based infant formula accounted for about 20 percent of all formula sold in 2000, down slightly from 1994. Other-based formula, accounting for the remaining 4 percent of all formula sold in 2000, consists mostly of protein hydrolysate formula, a type of hypoallergenic infant formula produced for infants with food protein allergies.[2]

One of the more dramatic trends in the infant formula market in recent years has been the increase of formula sold in powdered form. Powdered infant formula accounted for 62 percent of all formula sold in 2000 up from only 44 percent in 1994 (fig. 6-3). Over the same period, liquid concentrate decreased from 42 to 27 percent of all formula sold, and ready-to-feed decreased from 14 percent to 11 percent. The increased use of powdered formula has been attributed in part to the increase in breastfeeding. Powdered infant formulas "are commonly used to make up an occasional formula feeding for breastfed infants and many mothers may have continued to use powdered formulas after cessation of breastfeeding" (Fomon, 2001).

Infant formula is available in a variety of container sizes, especially formula in powdered form which is sold in containers ranging in size from just over one ounce to 96 ounces. The vast majority (80 percent in 2000) of all powdered infant formula is sold in 12- to 16-ounce containers (fig. 6-4). However, the volume of powdered infant formula sold in large containers—24 or more ounces—is on the rise, increasing from only 4 percent in 1994 to 19 percent in 2000.

Sales of "specialized" infant formula account for a relatively small percentage of all formula sold; however, its use has been increasing significantly in recent years. The proportion of infant formula

[1] A possible factor contributing to the decrease in the volume of infant formula sold was the continuing increase in breastfeeding rates during this period. In addition, the number of live births in the United States decreased by almost 2 percent between 1994 and 1997 before increasing in 1998, 1999, and 2000 (U.S. Department of Health and Human Services, various years).

[2] "Other-based" infant formula also includes formula from which the base could not be ascertained from the data. This category of unknown base infant formula accounted for less than 1 percent of all infant formula sold in 2000.

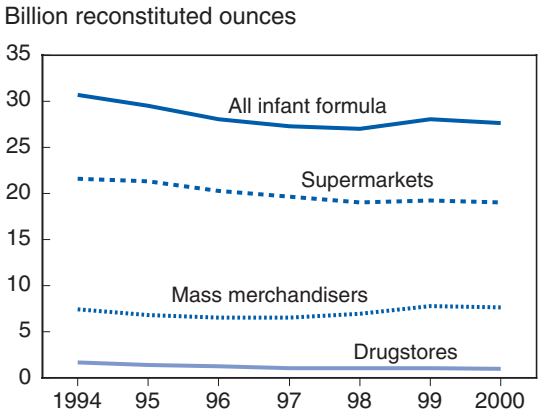
that is specialized increased from 3 percent in 1994 to over 8 percent in 2000 (fig. 6-5). It is not clear if this increase is due to research leading to new product formulation, emerging nutritional needs, or a change in marketing strategies by increasing product differentiation.

Dollar Sales of Infant Formula

Although the volume of infant formula sold decreased between 1994 and 2000, total dollar sales in nominal terms (i.e., not adjusted for inflation) increased by almost 13 percent over the same period to total over $2.9 billion in 2000 (fig. 6-6). Over half (57 percent) of this increase in total dollar sales was due to specialized formula, which increased by 149 percent over the 1994-2000 period. Sales of standard formula were much flatter, increasing only 6 percent during the same period.

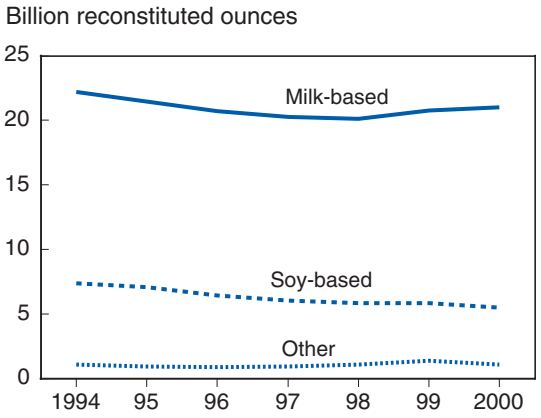
Similar to the results found for volume sales of infant formula, most of the total dollar sales of infant formula in 2000 was for powdered formula (55 percent of total dollar sales), milk-based formula (73 percent of total), and formula sold in supermarkets (71 percent of total).

Figure 6-1
Volume of all infant formula sold in the United States by outlet



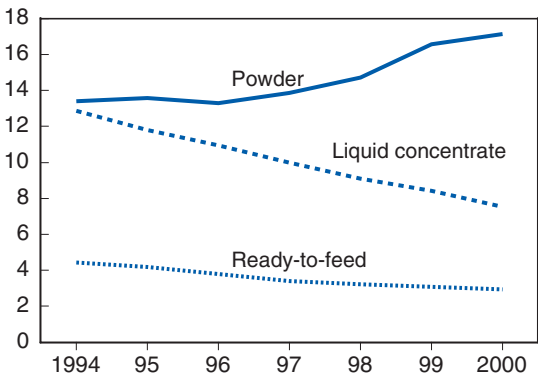
Source: ERS analysis of InfoScan data.

Figure 6-2
Volume of infant formula sold in the United States by product base



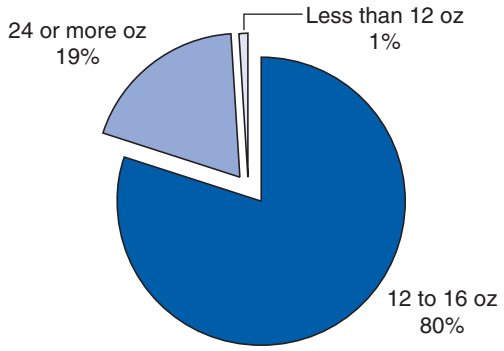
Source: ERS analysis of InfoScan data.

Figure 6-3
Volume of infant formula sold in the United States by physical form



Source: ERS analysis of InfoScan data.

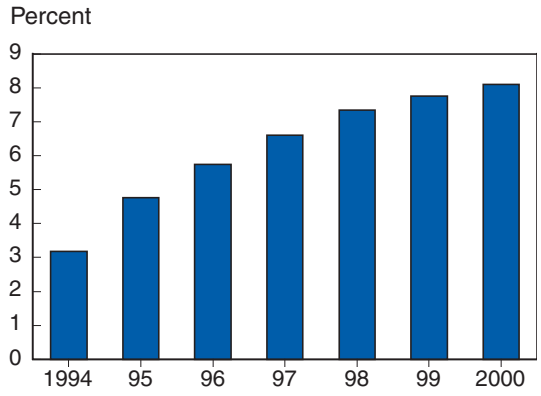
Figure 6-4
Powdered infant formula sold in the United States by size of container, 2000



Source: ERS analysis of InfoScan data.

Figure 6-5

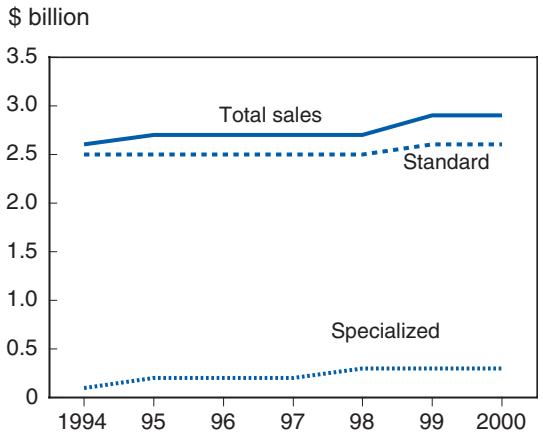
Specialized infant formula as a percentage of all infant formula sold in the United States



Source: ERS analysis of InfoScan data.

Figure 6-6

U.S. dollar sales of infant formula by type



Source: ERS analysis of InfoScan data.

Retail Price of Infant Formula

The increase in dollar sales of infant formula at the same time that the volume of formula sold was declining reflects the increase in retail prices over this period. In general, the different types of infant formula followed the same general trend of increasing prices over time.[3]

The average retail price of infant formula (on a reconstituted basis) differed by physical form. In 2000, ready-to-feed infant formula was on average 53 percent more expensive than powdered formula, and liquid concentrate was 25 percent more expensive than powdered. This basic price relationship among product forms held fairly constant over the entire analysis period (fig. 6-7). The average retail price of powdered infant formula also differed by can size, with larger cans having lower prices per 26 reconstituted ounces than smaller sized cans (fig. 6-8).

Retail prices also differed by outlet. Compared with the price of formula sold in supermarkets in 2000, formula sold in drugstores was 19 percent more expensive, while formula sold by mass merchandisers was 16 percent less expensive (fig. 6-9).

The retail prices of the two major product bases of infant formula differed only slightly. Soy-based formula averaged 5-8 percent more than milk-based formula over the 1994-2000 period (fig. 6-10). However, infant formula composed of other bases (predominantly protein hydrolysate formulas) were considerably more expensive than either the milk- or soy-based formula.

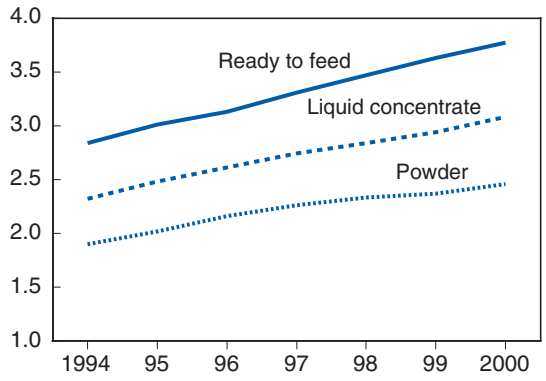
The price of specialized infant formula was significantly higher than standard infant formula throughout the study period. For example, in 2000, the average retail price of specialized infant formula was 35 percent greater than that of standard infant formula (fig. 6-11). The higher price of specialized infant formula may be the result of smaller market volume and higher manufacturing costs (Hansen et al., 1988). Although the price of most specialized formula is greater than that of standard infant formula on average, there are some exceptions. For example, infant formula marketed to toddlers 1 year of age and older is often priced less than standard infant formula. This price rela-

[3] Product mix will affect the average price of infant formula across the various subgroups of formulas. For example, average prices can differ across outlets (supermarkets, mass merchandisers, drug stores) not only when outlets charge different prices for the same infant formula product but also when outlets sell different product mixes (i.e., combinations) of infant formula products. Each of the average prices cited in this section are based on different product mixes.

Figure 6-7

Average U.S. price of infant formula by physical form

$ per 26 reconstituted ounces

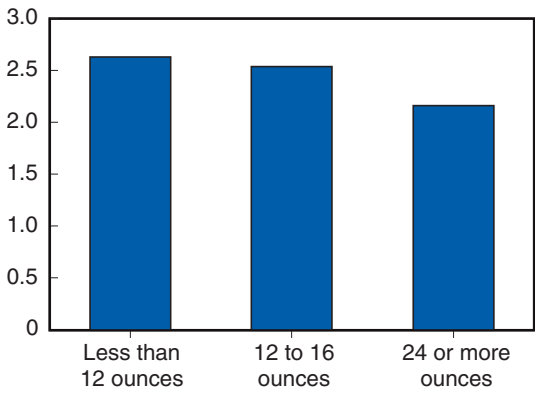


Source: ERS analysis of InfoScan data.

Figure 6-8

Retail price of U.S. powdered infant formula by can size, 2000

$ per 26 reconstituted ounces

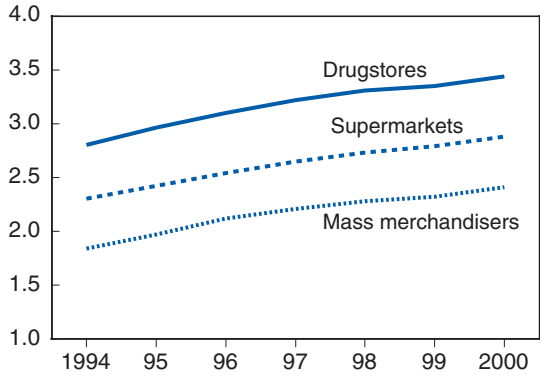


Source: ERS analysis of InfoScan data.

Figure 6-9

Average U.S. price of infant formula by outlet

$ per 26 reconstituted ounces

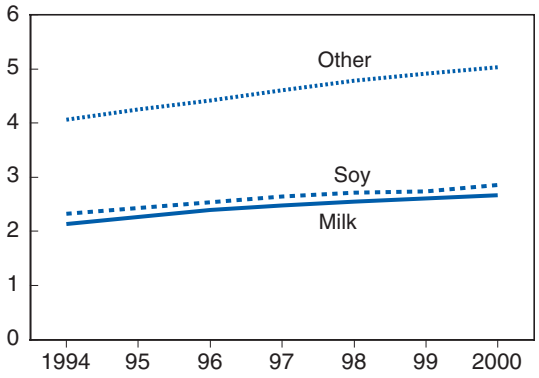


Source: ERS analysis of InfoScan data.

Figure 6-10

Average U.S. price of infant formula by product base

$ per 26 reconstituted ounces

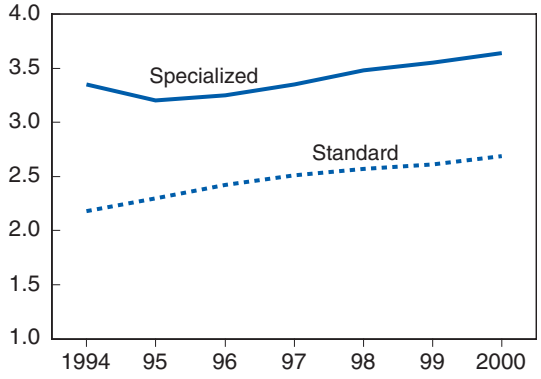


Source: ERS analysis of InfoScan data.

Figure 6-11

Average U.S. price of infant formula by type

$ per 26 reconstituted ounces



Source: ERS analysis of InfoScan data.

tionship may be due in part to toddler formula competing with the much cheaper cow's milk for a place in the toddler's diet.

The rest of this chapter examines increases in retail infant formula prices relative to inflation and the relationship between a brand's retail and wholesale prices. Because the retail price of infant formula varies by a wide range of factors (e.g., product base, physical form, outlet, and even size of container), it was necessary to narrow the focus of the study to similar infant formula products, otherwise the inclusion of infant formulas with different price structures could bias the results of the study. Therefore, the remainder of this report

examines retail prices for each of the four major infant formula types (milk-based powder, milk-based liquid concentrate, soy-based powder, and soy-based liquid concentrate) represented by one specific product per manufacturer as determined by the universal product code (UPC) with the largest volume of sales in 2000 for that manufacturer (table 6-1).[4] (The analysis excluded both specialized formulas and ready-to-feed formulas since they account for a relatively small portion of the infant formula market.) The selected infant formula products, all of which were iron-fortified, accounted for the majority of infant formula sold by each manufacturer in that specific category. The price data represent only supermarkets, which account for 69 percent of all infant formula sold by volume in 2000.

Increases in the Retail Price of Infant Formula Relative to Inflation

In 1999, the members of the House Committee on Appropriations stated that they were "concerned that since rebates began, infant formula costs appear to have risen far greater than inflation" (H.R. 106-157). Up to now, this report's discussion of the retail prices of infant formula has been in nominal terms only, that is, not adjusted for inflation. This section looks at the increase in infant formula prices relative to the *Consumer Price Index (CPI) for All Items*.[5] The *CPI for All Items* is a broad, comprehensive price index that is used to measure the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services. It is the most widely used measure of inflation, or general price changes, in the United States. The study also used indexes for two other groups of consumer expenditures. The *CPI for Food At Home*, the Nation's principal indicator of changes in retail food prices, was used since most infant formula is sold in retail food stores. Lastly, the *CPI for Nonprescription Drugs and Medical Supplies* was used since most infant formula is produced by pharmaceutical companies and all formula must conform to regulatory standards enforced by the Food and Drug Administration.

Figures 6-12 through 6-14 show the average annual rate of increases in both wholesale and retail prices for the four major types of formula by the three larger manufacturers (resulting in 12 cases) during the 1994-2000 period.[6] Although the increases in retail prices varied by manufacturer and type of formula, they exceeded the average percentage increase in both the *CPI for All Items* and the *CPI for Food At Home* in all cases except one (Carnation soy-based powder). With the exception of the two Carnation soy-based formulas, the increase in retail prices exceeded the *CPI for Nonprescription Drugs and Medical Supplies* as well. That is, regardless of type of formula and manufacturer, the average annual increase in the retail price of infant formula during the study period nearly always exceeded price inflation regardless of which of the three price indexes was used. In addition, the data indicate that in all 12 cases the annual rate of increase in retail prices exceeded the annual rate of increase in wholesale prices. Note that retail infant formula prices were rising faster than overall food prices even before the rebate program began nationwide in 1989.[7] Since little information is publicly available on the operating costs associated with retailing infant formula (e.g., shelving, overhead, etc.), it is not possible to determine the extent to which

[4] In other words, one infant formula product per manufacturer for each of the major types of infant formula was chosen as the standard of measurement for comparison purposes.

[5] Specifically, this analysis uses the *Consumer Price Index for All Urban Consumers (CPI-U) for the U.S. City Average for All Items*, not seasonally adjusted, constructed by the U.S. Department of Labor, Bureau of Labor Statistics (BLS).

[6] Since Wyeth dropped out of the market in 1996, and PBM Products did not enter the market until 1997 and accounted for only 1 percent of the infant formula market in 2000, neither were included in this comparison of formula prices to the CPI and the following analysis of the retail markup.

[7] The rapid increase in the retail price of infant formula during the 1980s has been cited as one of the primary reasons the infant formula rebate system was first implemented (U.S. GAO, 1990).

Table 6-1—Specific powder and liquid concentrate infant formula products included in the analysis of retail prices

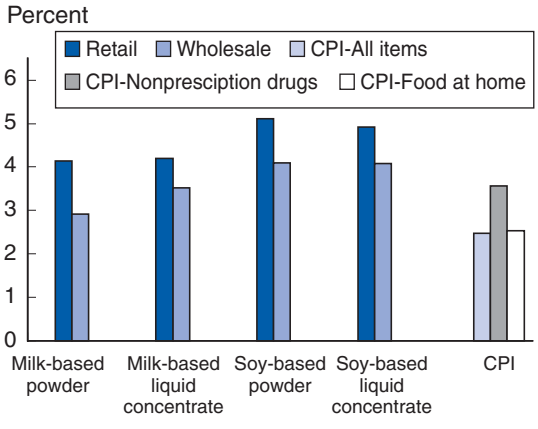
Products	Wholesale price per 26 reconstituted ounces as of September 2000
	Dollars
Milk-based powder:	
Mead Johnson—Enfamil with iron in 16-oz cans	2.50
Ross—Similac with iron in 14.1-oz cans	2.54
Carnation—Good Start in 12-oz cans	2.07
PBM—16-oz cans	1.28
Milk-based liquid concentrate:	
Mead Johnson—Enfamil with iron in 13-oz cans	2.94
Ross—Similac with iron in 13-oz cans	2.91
Carnation—Good Start in 13-oz cans	2.27
Soy-based powder:	
Mead Johnson—Prosobee in 14-oz cans	2.86
Ross—Isomil with iron in 14-oz cans	2.73
Carnation—Alsoy in 14-oz cans	1.89
PBM—16-oz cans	1.32
Soy-based liquid concentrate:	
Mead Johnson—Prosobee in 13-oz cans	3.22
Ross—Isomil with iron in 13-oz cans	3.19
Carnation—Alsoy in 13-oz cans	2.10

Notes: PBM infant formula is sold under a number of different store brand labels. During the study period, PBM sold infant formula in powdered form only. Wholesale prices represents the price per truckload of formula, except for formula sold by PBM which represents the average price of formula sold.

Source: Wholesale prices were obtained from each company's Trade Price Catalogs, except for PBM's prices which were obtained by personal communication. The conversion of wholesale prices into prices per 26 reconstituted ounces were conducted by ERS.

Figure 6-12

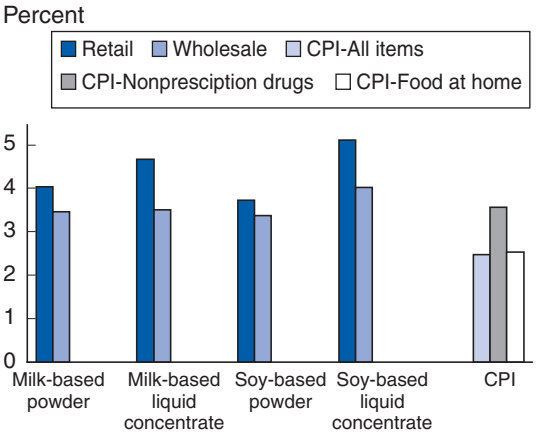
Average annual rate of increase in prices for Mead Johnson infant formulas, 1994-2000



Source: ERS analysis of InfoScan data.

Figure 6-13

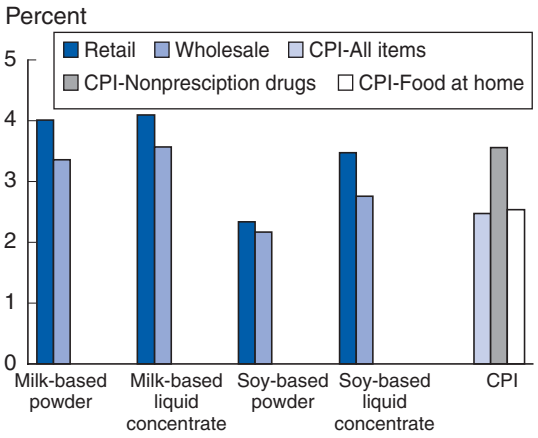
Average annual rate of increase in prices for Ross infant formula, 1994-2000



Source: ERS analysis of InfoScan data.

Figure 6-14

Average annual rate of increase in prices for Carnation infant formulas, 1994-2000



Source: ERS analysis of InfoScan data.

the increase in retail infant formula prices above the increase in wholesale prices is attributable to increased retailing costs.

Retail Markup

Infant formula manufacturers publish wholesale price lists for their products. The listed prices are set at the national level, and vary only by volume, with larger volume purchases (up to a truckload of formula) receiving a bulk discount.[8] For example, both Mead Johnson's and Ross' listed wholesale per unit price (as of September 2000) for a 13-ounce can of milk-based liquid concentrate decreased by about 14-15 percent as the quantity of formula purchased increased from less than 10 cases up to a truckload. It is not known whether manufacturers offer undisclosed or off-schedule discounts to customers based on other factors. The listed wholesale prices include delivery of the product to the buyer, generally to a warehouse. Retailers incur additional costs of transporting the formula from the warehouse to their stores.

Infant formula manufacturers do not set retail prices: retailers establish the retail price. Although wholesale prices are a major determinant of retail prices, retailers consider additional factors such as the cost of transporting the formula to the store, shelf space, overhead, product movement, and other local supply and demand factors, as well as retailer profit. Some retailers may also use infant formula as a loss leader, whereby they price the product below cost for the purpose of attracting people into their store where the shoppers buy additional items at full markup, making up for the store's loss on infant formula.

The difference between the wholesale and retail price is referred to as the retail markup. The average annual retail markup, on a percentage basis, of the major brands of infant formula by type during the 1994-2000 period is shown in fig. 6-15.[9] Although all categories of formula had positive markups, the size of the markups in percentage terms varied by manufacturer. Carnation brands of infant formula had a higher percentage markup than did Mead Johnson and Ross brands. Because the wholesale prices of Carnation are generally lower than the two other brands, retailers tend to mark them up more and still price them lower than the Ross and Mead Johnson brands. For three of the four types of infant formula, Ross formulas had the lowest percentage markups.

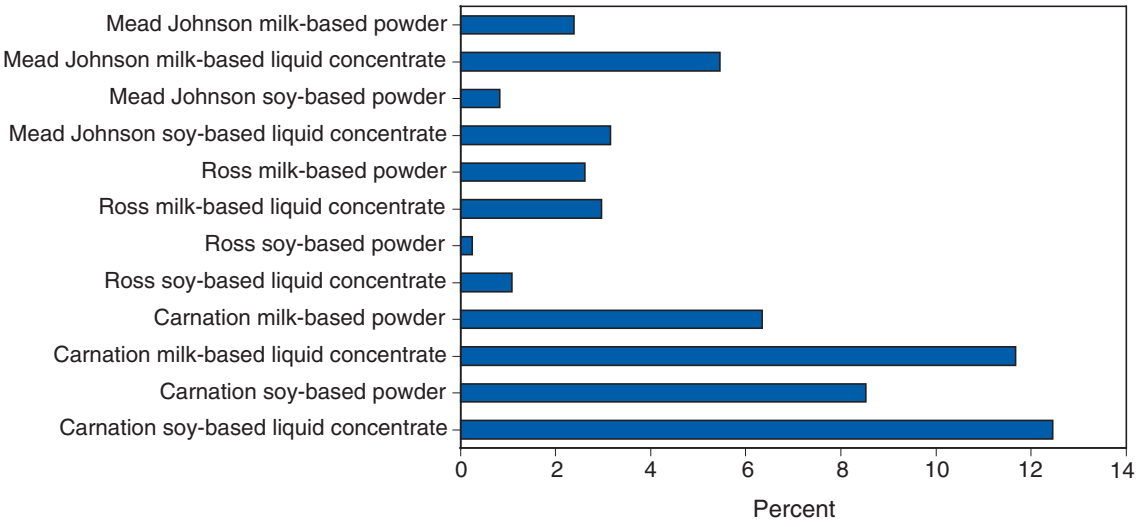
In addition to the differences by manufacturer, the size of the markup also differed by product form, as liquid concentrate forms of formula (both milk- and soy-based) had higher markups than powdered forms of the same brand and product base of formula. Since liquid concentrate is more expensive than powdered infant formula, purchasers of liquid concentrate infant formula (i.e., the mothers of infants) may be less sensitive to price than purchasers of powdered infant formula.

[8] Large retail stores that purchase larger volumes of infant formula than smaller stores will therefore pay lower per unit costs for the formula.

[9] The percentage retail markup is the difference between the retail and wholesale price as a percentage of the retail price.

Figure 6-15

Average annual percentage retail markup of infant formula sold in supermarkets by type and manufacturer, 1994-2000



Note: The average percentage retail markup is the difference between the retail and wholesale price as a percentage of the retail price.

Source: ERS analysis of InfoScan supermarket data.

Chapter 7

Infant Formula Prices and Availability by Market Area

In 2000, ERS was directed by Congress to report "on the number of suppliers of infant formula in each State or major marketing area, and to compare the cost of formula that is included in the WIC rebate program versus the cost of formula that is not in the WIC rebate program" (H.R. 106-948). This chapter presents findings from the *Report to Congress* that responded to these directives made by Congress (Oliveira et al., 2001). The section "Availability of Infant Formula" examines the number of infant formula suppliers by market area while the section "Retail Infant Formula Prices by Market Area" compares the cost of formula that is included in the WIC rebate program versus the cost of formula that is not in the WIC rebate program. In addition, two new sections, not included in the *Report to Congress*, examine the use of infant formula as a loss leader and discuss the implications of variations in the contract brand retail prices on costs to WIC State agencies, respectively.

Availability of Infant Formula by Market Area

InfoScan data contain information on the volume sales of infant formula in supermarkets by company for the 64 local market areas.[1] The data indicate that milk-based formulas produced by Mead Johnson, Ross, and Carnation were available in all 64 market areas in 2000.[2] Milk-based formula produced by Wyeth but sold in supermarkets by the new marketing firm PBM Products was available in 53 of the 64 of the market areas (fig. 7-1). This may be an undercount since data based solely on supermarket sales may underestimate the availability of PBM Products. Unlike the other manufacturers of infant formula, PBM sells a larger proportion of its formula through mass merchandisers and drugstores (41 percent in 2000) relative to the industry as a whole (31 percent). Despite the possible undercount, the results indicate that formula sold by PBM products was widely available throughout the country (in 83 percent of the market areas). Furthermore, PBM has continued to expand its market since 2000 and recently introduced both liquid concentrate and ready-to-feed infant formulas to their line of products.

Retail Infant Formula Prices by Market Area

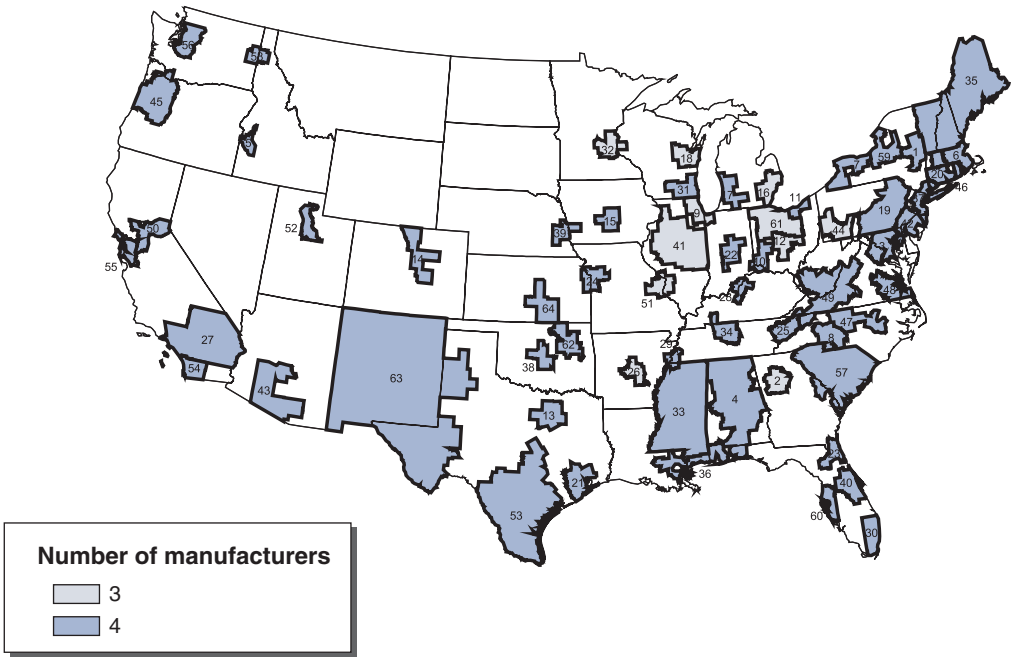
The InfoScan data contained retail price information for 64 market areas. Of those areas, 23 spanned 2 or more States. In some of these multi-State areas, the WIC contract brand was the same throughout the market area. In others, a different WIC contract brand made up only a small share of the market area. Since the objective of this analysis is to compare the cost of WIC contract brand infant formula with other brands of infant formula, those market areas located in two or more States with different WIC contract-winning manufacturers present a problem in identifying the WIC contract brand of infant formula. The criterion for including a multi-State market area in this analysis was that a market area had to have at least 90 percent of the area's population in an area that had the same WIC contract brand throughout the reference period, which ran from January 2000 through September 2000.[3] Fifty-four of the market areas met this criterion. However, one of these market areas, Mississippi, does not use a retail food delivery system and was excluded from the analysis on this basis. There-

[1] About 69 percent of all infant formula was sold in supermarkets in 2000.

[2] Availability was determined by whether any of that company's formula was sold in the area. Data on the number of supermarkets in which the product was sold were not available.

[3] Geocoding analysis was used to estimate the proportion of the population within each market area that resided in specific States.

Figure 7-1
Number of milk-based infant formula powder manufacturers with products in supermarkets, 2000



Note: Numerical identifiers of markets are provided in figure 5-1.
Source: ERS analysis of Infoscan supermarket data, 2000.

fore, a WIC contract brand was designated in 53 of the 64 market areas (fig. 7-2).[4] Mead Johnson had the WIC contract in 32 of these market areas, Ross in 17 market areas, and Carnation in 4 market areas. It was not possible to assign a meaningful "WIC brand" to the remaining market areas.

Milk-Based Powdered Formula. The average retail price of milk-based powdered infant formulas sold in supermarkets in the 64 market areas in 2000 is shown in table 7-1.[5] Prices differed significantly by brand across the market areas. PBM brand formula (in those market areas where sales were recorded) was always the lowest priced, and with several exceptions, Carnation brand formula was priced below the Mead Johnson and Ross brands. Similarly, within the same brand of formula, retail prices varied significantly across market areas. For example, the price of Mead Johnson formula ranged from $1.97 per 26 reconstituted ounces in Albany, NY, to $3.12 in Chicago, IL.

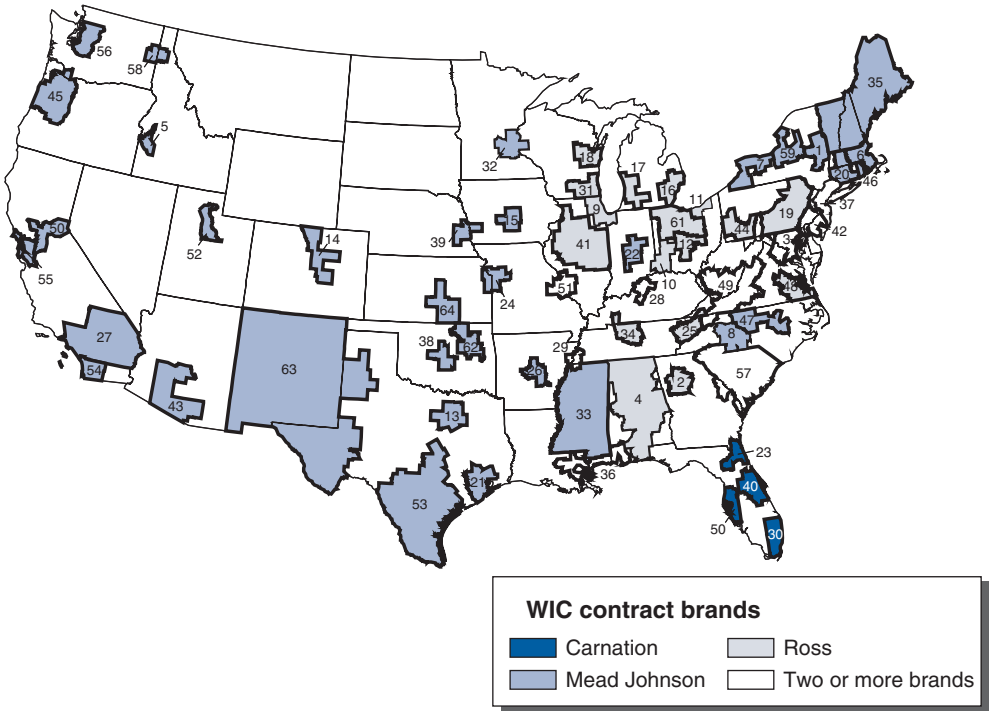
There was no apparent relationship between a formula being the WIC contract brand and being the highest priced formula. In 23 of the 53 market areas in which a WIC contract brand was designated (43 percent), the WIC brand was the highest priced milk-based formula. In the remaining 30 market areas, the WIC contract brand was not the highest priced formula.

Milk-Based Liquid Concentrate Formula. The comparison of the average retail price of WIC contract brand and other brands of milk-based liquid concentrate infant formula by market area is

[4] The *Report to Congress* recognized 55 market areas (including Mississippi) in which a WIC contract brand was designated.

[5] Prices are based on the specific infant formula products specified in table 6-1 plus an aggregate average price of all PBM Products milk-based powdered infant formula sold in 16-oz cans.

Figure 7-2
WIC infant formula contract brand by market area, 2000



Note: Numerical identifiers of markets are provided in figure 5-1.
Source: ERS analysis of FNS WIC contracts.

shown in table 7-2. Because the data did not identify any PBM Products in liquid concentrate, only three companies—Ross, Mead Johnson, and Carnation—were represented. In all 53 market areas in which a WIC brand was designated, Carnation brand formula had the lowest retail prices. The company producing the highest priced formula varied between Ross and Mead Johnson. There was not a consistent relationship between being the WIC contract brand of formula and having the highest average price. In 30 of the 53 market areas with a designated WIC contractor (57 percent), the WIC contract brand of infant formula was the highest priced formula, and in one additional market area it tied for the highest price. In the remaining 22 market areas, the WIC contract brand was not the highest priced infant formula.

Soy-Based Powdered Formula. Infant formula sold by PBM was the lowest priced soy-based powdered formula in each of the 44 market areas in which it was available, followed by Carnation brand formula (table 7-3). In 43 market areas, Mead Johnson had the highest priced formula. In 33 of the 53 market areas (62 percent) in which a WIC contract brand was designated, the WIC brand was the highest priced soy-based powdered formula, and in an additional market area it tied for the highest price.

Soy-Based Liquid Concentrate Formula. The average retail prices of soy-based liquid concentrate infant formulas made by Carnation, Mead Johnson, and Ross are shown in table 7-4 (PBM did not market liquid concentrate formula during the study period). In all 53 market areas, Carnation had the lowest priced formula. The WIC contract brand was the highest priced formula in 32 of the 53 market areas (60 percent), and in 4 more it tied for the highest.

Table 7-1—Infant formula average retail prices: 12- to 16-oz cans of milk-based powder in supermarkets by market area, 2000[1]

Market area	PBM (Wyeth)	Carnation	Mead Johnson	Ross
		Dollars per 26 ounces reconstituted		
Albany	1.72	2.13	***1.97***	*2.31*
Atlanta	—	2.16	*2.46*	**2.62**
Baltimore/Washington	1.51	2.09	2.57	2.60
Birmingham/Montgomery	1.81	2.14	2.53	**2.66**
Boise	1.50	2.16	***2.38***	*2.53*
Boston	1.73	2.12	***2.29***	*2.50*
Buffalo/Rochester	1.43	2.11	***2.22***	*2.30*
Charlotte	1.49	*2.06*	**2.51**	2.58
Chicago	—	2.57	3.12	**2.94**
Cincinnati/Dayton	1.73	*1.98*	*2.12*	***2.43***
Cleveland	1.62	2.17	*2.41*	***2.52***
Columbus	—	2.10	*2.38*	**2.56**
Dallas/Ft. Worth	1.60	2.24	**2.54**	2.73
Denver	1.50	2.28	**2.62**	2.68
Des Moines	1.67	2.23	**2.67**	2.72
Detroit	—	2.16	2.53	**2.74**
Grand Rapids	1.64	2.11	*2.14*	***2.34***
Green Bay	—	2.28	2.77	**2.86**
Harrisburg/Scranton	1.51	2.12	*2.40*	**2.55**
Hartford/Springfield	1.73	2.18	***2.43***	2.60
Houston	1.53	2.12	***2.48***	2.66
Indianapolis	1.73	2.29	***2.43***	*2.40*
Jacksonville	1.50	**2.18**	*2.49*	2.55
Kansas City	1.58	2.27	**2.65**	*2.51*
Knoxville	1.44	2.09	*2.48*	**2.60**
Little Rock	—	2.32	**2.70**	2.90
Los Angeles	1.64	2.22	**2.86**	2.81
Louisville	1.53	*1.99*	*2.37*	*2.41*
Memphis	1.63	2.30	2.76	2.93
Miami/Ft. Lauderdale	1.62	**2.34**	2.53	2.60
Milwaukee	1.54	2.25	2.67	**2.78**
Minneapolis/St. Paul	—	2.13	***2.46***	2.63
Mississippi	1.60	2.20	**2.57**	2.81
Nashville	1.49	2.13	2.53	**2.72**
New England	1.73	2.18	*2.16*	*2.51*
New Orleans/Mobile	1.51	2.23	2.73	2.68
New York	1.71	2.13	2.56	2.59
Oklahoma City	1.60	2.28	**2.62**	2.73
Omaha	1.58	2.16	**2.52**	2.60
Orlando	1.60	**2.29**	2.53	2.61
Peoria/Springfield	—	2.27	*2.40*	**2.66**
Philadelphia	1.81	2.11	*2.49*	2.65
Phoenix/Tucson	1.66	2.10	***2.27***	*2.39*
Pittsburgh	—	2.21	*2.42*	***2.48***
Portland, Oregon	1.62	2.37	**2.69**	2.82
Providence	1.73	2.11	***2.26***	*2.52*

See notes at end of table.

Continued—

Table 7-1—Infant formula average retail prices: 12- to 16-oz cans of milk-based powder in supermarkets by market area, 2000[1]—Continued

Market area	PBM (Wyeth)	Carnation	Mead Johnson	Ross
		Dollars per 26 ounces reconstituted		
Raleigh/Greensboro	1.49	*2.06*	**2.51**	2.57
Richmond/Norfolk	1.51	*2.05*	2.52	**2.59**
Roanoke	1.48	2.12	2.54	2.60
Sacramento	1.67	2.18	**2.82**	2.68
St. Louis	—	2.51	*2.48*	2.65
Salt Lake City	1.57	2.34	**2.65**	2.71
San Antonio/Corpus Christi	1.50	2.16	***2.28***	*2.50*
San Diego	1.64	2.21	**2.68**	2.79
San Francisco/Oakland	1.66	2.23	**2.66**	2.77
Seattle/Tacoma	1.70	2.07	**2.52**	*2.48*
South Carolina	1.50	2.09	2.50	2.59
Spokane	1.63	*2.03*	***2.46***	*2.51*
Syracuse	1.39	2.19	***2.11***	*2.33*
Tampa/St. Petersburg	1.64	**2.28**	2.52	2.64
Toledo	—	2.17	*2.42*	**2.58**
Tulsa	1.59	2.26	**2.62**	2.73
West Texas/New Mexico	1.57	2.31	**2.79**	2.77
Wichita	1.58	2.27	**2.60**	*2.30*
U.S. average	1.56	2.21	2.57	2.63

— = Not applicable.

[1] Numbers in color indicate WIC contract brand. Numbers in italics indicate a retail price below the wholesale price. Average refers to volume-weighted average during the first three quarters.

Source: ERS tabulations of InfoScan supermarket data.

Infant Formula as a Loss Leader

The earlier analysis of the retail markup by major brand of infant formula showed that, on average, the different categories of formula had positive retail markups, ranging from less than 1 percent to over 12 percent. However, in some individual market areas, the average retail price of infant formula in 2000 was priced below the listed wholesale price shown in table 6-1.[6] While it may be that the listed wholesale prices may not represent the actual costs to retailers of purchasing infant formula, we have no information to support the presence of off-schedule adjustments. It seems reasonable to conclude that the wholesale prices do represent actual transaction costs to the retailer and that some retailers use infant formula as a loss leader.[7] If a major retailer in an area sells a particular brand of infant formula at a low price, many of the other retailers may follow suit and drop their prices, resulting in an entire market area selling a particular brand of formula below the wholesale price. Formulas with higher sales volumes—i.e., the Mead Johnson and Ross brands, (which are also the highest priced)—were more likely to be priced below wholesale costs (tables 7-1 through 7-4). For milk-based powder, the retail price for the Mead Johnson brand of infant formula was less than the wholesale price in 28 of the 64 market areas. In 19 market areas, the retail price of the Ross brand of milk-based powder was below wholesale, and in 6 market areas, the retail price of the Carnation brand of the milk-based powder was below wholesale. In no market area was the average retail price of formula marketed by PBM below the wholesale price. This same general pattern held across the other three types of formula as well.

[6] Not all retailers in these market areas are necessarily pricing formula below the wholesale price. The retail price refers to the average price for a given market area. Prices may vary considerably within an area.

[7] A recent study of WIC vendors conducted by an association of food retailers and wholesalers stated that most retailers treat infant formula as a loss leader, setting prices "very low in order to draw customers into the store" (Food Marketing Institute, 1998).

Table 7-2—Infant formula average retail prices: 13-oz cans of milk-based liquid concentrate in supermarkets by market area, 2000[1]

Market area	Carnation	Mead Johnson	Ross
		Dollars per can	
Albany	2.45	***2.56***	*2.38*
Atlanta	2.47	2.99	**3.11**
Baltimore/Washington	2.41	3.10	2.96
Birmingham/Montgomery	2.54	3.15	**3.17**
Boise	2.60	**3.14**	3.23
Boston	2.34	***2.85***	2.92
Buffalo/Rochester	2.44	***2.86***	*2.78*
Charlotte	2.43	**3.01**	3.02
Chicago	2.80	3.30	**3.46**
Cincinnati/Dayton	*2.20*	*2.71*	**2.91**
Cleveland	2.45	*2.76*	***2.88***
Columbus	2.48	*2.91*	**2.99**
Dallas/Ft. Worth	2.56	**3.11**	3.20
Denver	2.38	**3.01**	*2.88*
Des Moines	2.51	**3.24**	3.08
Detroit	2.51	3.14	**3.14**
Grand Rapids	2.35	*2.63*	**2.92**
Green Bay	2.47	3.26	**3.27**
Harrisburg/Scranton	2.38	*2.93*	**2.91**
Hartford/Springfield	2.46	**2.98**	3.04
Houston	2.41	**2.98**	3.05
Indianapolis	2.59	**2.95**	2.91
Jacksonville	**2.57**	3.02	3.04
Kansas City	2.52	**3.19**	*2.84*
Knoxville	2.37	2.94	**2.95**
Little Rock	2.74	**3.48**	3.55
Los Angeles	2.56	**3.54**	3.34
Louisville	2.49	*2.86*	*2.88*
Memphis	2.69	3.56	3.63
Miami/Ft. Lauderdale	**2.72**	3.13	3.15
Milwaukee	2.46	3.33	**3.25**
Minneapolis/St. Paul	2.45	**3.15**	3.18
Mississippi	2.52	**3.26**	3.34
Nashville	2.45	3.18	**3.16**
New England	2.46	*2.79*	*2.66*
New Orleans/Mobile	2.61	3.37	3.30
New York	2.40	3.17	3.12
Oklahoma City	2.50	**3.11**	3.19
Omaha	2.40	**3.03**	*2.84*
Orlando	**2.72**	3.20	3.15
Peoria/Springfield	2.47	3.00	3.09
Philadelphia	2.60	3.03	3.11
Phoenix/Tucson	2.28	***2.74***	*2.80*
Pittsburgh	2.37	*2.74*	***2.78***
Portland, Oregon	2.72	**3.70**	3.27
Providence	2.51	***2.87***	3.03

See notes at end of table.

Continued—

Table 7-2—Infant formula average retail prices: 13-oz cans of milk-based liquid concentrate in supermarkets by market area, 2000[1]—Continued

Market area	Carnation	Mead Johnson	Ross
		Dollars per can	
Raleigh/Greensboro	2.41	**2.99**	2.96
Richmond/Norfolk	2.41	2.99	**2.96**
Roanoke	2.44	3.10	2.96
Sacramento	2.37	**3.41**	3.29
St. Louis	2.65	3.28	3.31
Salt Lake City	2.76	**3.39**	3.27
San Antonio/Corpus Christi	2.39	**2.96**	2.93
San Diego	2.55	**3.59**	3.36
San Francisco/Oakland	2.43	**3.13**	3.34
Seattle/Tacoma	2.62	**3.10**	3.03
South Carolina	2.44	3.01	3.09
Spokane	2.31	**3.00**	3.02
Syracuse	2.42	***2.77***	*2.72*
Tampa/St. Petersburg	**2.68**	3.09	3.12
Toledo	2.49	2.96	**3.05**
Tulsa	2.53	**3.11**	3.32
West Texas/New Mexico	2.67	**3.34**	3.16
Wichita	2.54	**3.01**	2.95
U.S. average	2.59	3.11	3.09

[1] Numbers in color indicate WIC contract brand. Numbers in italics indicate a retail price below the wholesale price. Average refers to volume-weighted average during the first three quarters.

Source: ERS tabulations of InfoScan supermarket data.

Often the average retail prices of two or more brands of formula within the same market were priced below their respective wholesale prices. For example, in 65 percent of the cases (across the four different types of formula—i.e., milk-based powder, milk-based liquid concentrate, soy-based powder, and soy-based liquid concentrate) in which the average retail price of the Mead Johnson brand of formula in a market area was below its wholesale price, the Ross brand was also priced below its wholesale price. In 81 percent of cases in which the Ross brand was priced below the wholesale price, the Mead Johnson price was also below its wholesale price. In 60 percent of the cases in which the Carnation brand was priced below the wholesale price, either the Mead Johnson or Ross brand was also priced below its wholesale price, and in 50 percent of the cases, both the Mead Johnson and Ross brands were priced below their respective wholesale prices.

Contract brand status and loss leaders. The relationship between WIC contract brand status and loss leader pricing varied across the different brands. For example, in 36 percent of the cases (excluding Mississippi which does not use the retail food delivery system) across the various types of formula in which Mead Johnson was the contract brand, the Mead-Johnson product's average retail price was below the wholesale price. In 25 percent of the cases in which Ross was the contract brand, the Ross product's average retail price was below the brand's wholesale price. In contrast, there were no cases in which the Carnation brand was priced below its wholesale price when it was the contract brand.[8]

[8] By comparison, in 32 percent of the cases in which Mead Johnson was *not* the contract brand, the Mead-Johnson product had average retail prices below the wholesale price. In 30 percent of the cases in which Ross was *not* the contract brand, the Ross product was priced below the wholesale price. In 4 percent of the cases in which the Carnation brand was *not* the contract brand, the Carnation product was priced below the wholesale price.

Table 7-3—Infant formula average retail prices: 14- to 16-oz cans of soy-based powder in supermarkets by market area, 2000[1]

Market area	PBM (Wyeth)	Carnation	Mead Johnson	Ross
		Dollars per 26 ounces reconstituted		
Albany	1.79	2.04	***2.32***	*2.29*
Atlanta	1.52	2.03	2.87	**2.77**
Baltimore/Washington	1.59	2.01	2.87	2.78
Birmingham/Montgomery	1.75	2.11	*2.84*	**2.88**
Boise	1.55	2.04	***2.65***	*2.59*
Boston	1.79	2.06	***2.71***	*2.62*
Buffalo/Rochester	1.60	1.94	***2.46***	*2.38*
Charlotte	1.51	2.00	***2.84***	2.76
Chicago	—	2.21	3.38	**3.09**
Cincinnati/Dayton	1.51	1.93	*2.52*	***2.56***
Cleveland	1.68	2.09	*2.77*	***2.65***
Columbus	1.53	*1.81*	*2.79*	***2.72***
Dallas/Ft. Worth	1.63	2.11	**2.95**	2.89
Denver	1.69	2.10	**2.91**	2.90
Des Moines	1.75	2.12	**3.26**	2.84
Detroit	1.55	2.01	*2.81*	**2.79**
Grand Rapids	1.46	1.95	*2.43*	***2.44***
Green Bay	—	2.09	3.13	**3.04**
Harrisburg/Scranton	1.55	2.01	*2.79*	***2.70***
Hartford/Springfield	1.78	2.09	***2.68***	*2.69*
Houston	1.57	2.07	***2.83***	2.77
Indianapolis	1.62	1.98	***2.78***	*2.54*
Jacksonville	1.58	**2.09**	2.87	*2.72*
Kansas City	1.62	2.14	**3.06**	2.86
Knoxville	1.54	1.99	*2.80*	***2.72***
Little Rock	1.59	2.06	**3.09**	3.18
Los Angeles	1.80	2.05	**3.14**	2.89
Louisville	1.56	1.96	*2.67*	*2.59*
Memphis	1.60	2.10	3.15	3.17
Miami/Ft. Lauderdale	1.69	**2.10**	2.92	2.73
Milwaukee	1.73	2.13	2.92	**3.02**
Minneapolis/St. Paul	—	2.05	**2.94**	2.78
Mississippi	1.49	2.10	**2.94**	3.03
Nashville	1.55	1.98	*2.83*	**2.89**
New England	1.79	2.09	*2.68*	*2.55*
New Orleans/Mobile	1.56	2.14	3.14	2.85
New York	1.75	2.18	2.88	*2.70*
Oklahoma City	1.64	2.10	**3.05**	2.91
Omaha	1.66	2.06	***2.83***	2.75
Orlando	1.66	**2.09**	2.93	2.78
Peoria/Springfield	1.56	2.10	2.87	**2.73**
Philadelphia	1.83	2.21	*2.82*	2.74
Phoenix/Tucson	1.66	*1.85*	***2.48***	*2.35*
Pittsburgh	—	2.19	2.87	***2.60***
Portland, Oregon	1.64	2.23	**3.13**	2.94
Providence	1.79	2.13	***2.72***	*2.62*

See notes at end of table.

Continued—

Table 7-3—Infant formula average retail prices: 14- to 16-oz cans of soy-based powder in supermarkets by market area, 2000[1]—Continued

Market area	PBM (Wyeth)	Carnation	Mead Johnson	Ross
		Dollars per 26 ounces reconstituted		
Raleigh/Greensboro	1.53	2.01	**2.86**	2.74
Richmond/Norfolk	1.58	1.99	*2.84*	**2.76**
Roanoke	1.60	2.14	3.00	2.78
Sacramento	1.74	1.99	**3.09**	2.82
St. Louis	—	2.31	2.86	*2.65*
Salt Lake City	1.63	2.06	**3.06**	2.82
San Antonio/Corpus Christi	1.55	2.00	***2.66***	*2.68*
San Diego	1.77	2.05	**3.05**	2.85
San Francisco/Oakland	1.74	2.05	**3.01**	2.90
Seattle/Tacoma	1.72	2.03	***2.84***	*2.50*
South Carolina	1.51	2.07	*2.83*	2.79
Spokane	1.69	1.91	***2.85***	*2.65*
Syracuse	1.58	1.96	***2.45***	*2.39*
Tampa/St. Petersburg	1.69	2.09	2.92	2.80
Toledo	1.52	1.91	*2.83*	**2.74**
Tulsa	1.66	**2.09**	**2.93**	2.93
West Texas/New Mexico	1.71	2.08	**3.08**	2.93
Wichita	1.58	2.07	**2.94**	2.81
U.S. average	1.61	2.08	2.90	2.74

— = Not applicable.

[1] Numbers in color indicate WIC contract brand. Numbers in italics indicate a retail price below the wholesale price. Average refers to volume-weighted average during the first three quarters.

Source: ERS tabulations of InfoScan supermarket data.

The finding that the retail price of the WIC contract brand is being priced below the manufacturer's listed wholesale price in some market areas raises the question: if WIC consumers are not sensitive to changes in price since they receive the formula free of charge, why should retailers price the contract brand so low? One reason may be that the relative size of the WIC program is a major factor that influences retail price in a market area. The presence of WIC consumers, relative to non-WIC consumers who pay for formula out of pocket, differs across market areas. If the WIC program has a relatively small presence in a market area, then the presence of out-of-pocket consumers is relatively large and a retailer may use loss-leader pricing to attract the latter group to the supermarket. In most of the areas in which the retail price of the contract brand was below the wholesale price, the relative size of the WIC program—as measured by the number of WIC formula-fed infants divided by the number of non-WIC formula-fed infants—was below the average for the market areas in the sample. That is, if an area has relatively few WIC infant formula consumers, then the program has relatively little influence on prices. The analysis of other factors behind the use of loss leader pricing in some market areas is discussed in appendix C.

Contract Brand Retail Prices and Costs to the WIC Program

Variation in the retail prices of the contract brand of infant formula across geographic areas has cost implications for WIC. As described previously, the actual cost of infant formula to a WIC State agency equals net price (i.e., national wholesale price minus the rebate level offered by the manufacturer) plus the retail markup.[9] Since wholesale prices for a specific brand and type of

[9] It was not possible to determine the actual cost of infant formula to specific WIC State agencies since (1) none of the market areas included in the study covered an entire State and only that State; and (2) information on the retail price of contract formula paid specifically by WIC authorized vendors was not available.

Table 7-4—Infant formula retail prices: 13-oz cans of soy-based liquid concentrate in supermarkets by market area, 2000[1]

Market area	Carnation	Mead Johnson	Ross
		Dollars per can	
Albany	2.33	***2.67***	*2.71*
Atlanta	2.36	3.34	**3.39**
Baltimore/Washington	2.23	3.27	3.26
Birmingham/Montgomery	2.39	3.27	**3.31**
Boise	2.32	**3.34**	3.25
Boston	2.39	***3.12***	*2.92*
Buffalo/Rochester	2.38	***2.89***	*2.85*
Charlotte	2.33	**3.30**	3.26
Chicago	2.74	3.87	**3.59**
Cincinnati/Dayton	2.04	*3.02*	***3.11***
Cleveland	2.46	*3.02*	***3.01***
Columbus	2.31	3.23	**3.22**
Dallas/Ft. Worth	2.33	**3.43**	3.39
Denver	2.37	***3.20***	3.19
Des Moines	2.22	**3.66**	3.49
Detroit	2.26	3.27	**3.29**
Grand Rapids	2.22	*3.04*	***3.04***
Green Bay	2.18	3.56	**3.58**
Harrisburg/Scranton	2.15	*3.08*	***3.16***
Hartford/Springfield	2.50	***3.20***	*3.20*
Houston	2.13	**3.23**	3.25
Indianapolis	2.53	***2.96***	*2.96*
Jacksonville	**2.39**	3.28	3.29
Kansas City	2.24	**3.52**	3.36
Knoxville	2.24	3.25	**3.21**
Little Rock	2.44	**3.77**	3.80
Los Angeles	2.31	**3.60**	3.47
Louisville	2.48	*3.13*	*3.08*
Memphis	2.38	3.81	3.85
Miami/Ft. Lauderdale	**2.52**	3.38	3.35
Milwaukee	2.31	3.60	**3.46**
Minneapolis/St. Paul	2.29	**3.30**	3.34
Mississippi	2.34	**3.45**	3.57
Nashville	2.26	3.31	**3.41**
New England	2.32	*3.13*	*2.85*
New Orleans/Mobile	2.36	3.62	3.65
New York	2.49	3.36	*3.15*
Oklahoma City	2.34	**3.41**	3.38
Omaha	2.25	**3.34**	*3.06*
Orlando	**2.49**	3.35	3.35
Peoria/Springfield	2.44	3.22	**3.27**
Philadelphia	2.56	3.26	3.26
Phoenix/Tucson	2.38	***3.05***	*2.93*
Pittsburgh	2.39	*3.03*	***3.03***
Portland, Oregon	2.75	**3.60**	3.45
Providence	2.57	**3.26**	*3.04*

See notes at end of table.

Continued—

Table 7-4—Infant formula retail prices: 13-oz cans of soy-based liquid concentrate in supermarkets by market area, 2000[1]—Continued

Market area	Carnation	Mead Johnson	Ross
		Dollars per can	
Raleigh/Greensboro	2.33	**3.29**	3.23
Richmond/Norfolk	2.30	3.29	**3.24**
Roanoke	2.33	3.43	3.26
Sacramento	2.42	**3.64**	3.45
St. Louis	2.64	3.34	3.27
Salt Lake City	2.37	**3.72**	3.63
San Antonio/Corpus Christi	2.26	***3.05***	3.20
San Diego	2.31	**3.59**	3.36
San Francisco/Oakland	2.40	**3.44**	3.54
Seattle/Tacoma	2.34	**3.41**	3.30
South Carolina	2.31	3.29	3.31
Spokane	*2.02*	**3.23**	3.30
Syracuse	2.53	***2.88***	*2.87*
Tampa/St. Petersburg	**2.39**	3.37	3.36
Toledo	2.29	3.22	**3.27**
Tulsa	2.38	**3.47**	3.41
West Texas/New Mexico	2.45	**3.50**	3.46
Wichita	2.21	**3.34**	*3.16*
U.S. average	2.43	3.35	3.29

[1] Numbers in color indicate WIC contract brand. Numbers in italics indicate a retail price below the wholesale price. Average refers to volume-weighted average during the first three quarters.

Source: ERS tabulations of InfoScan supermarket data.

formula (see table 6-1) do not vary across areas, variation in the retail markup is determined solely by variation in the retail price.

Because WIC receives rebates that are generally large relative to the wholesale price, the net price is relatively small—for example, the average net price for a can of milk-based liquid concentrate was only 20 cents as of September 2000. Since the retail markup may approach or even exceed net price in areas with high retail prices, the retail price of the contract brand of formula as well as the amount of the manufacturer's rebate play important roles in determining the cost of infant formula to the WIC program.[10]

[10] ERS analysis of InfoScan data indicate that, at the national level, the average retail markup per can of milk-based liquid concentrate, regardless of contract brand status, was about 21 cents for Mead Johnson products, 20 cents for Ross products, and 35 cents for Carnation products.

Chapter 8

Event Study Analysis of Retail Infant Formula Prices

The primary objective of this report is to determine the effects of WIC and its infant formula rebate program on infant formula retail prices beyond their effect on wholesale prices. The examination in the previous section of average retail prices across market areas did not reveal a clear and consistent relationship between being the WIC contract brand and having the highest average retail price. However, comparing the retail prices of contract and noncontract brands of formula by market area does not necessarily identify WIC-related price effects since other factors may affect retail prices, too. For example, a brand's wholesale price is an important determinant of that brand's retail price, and therefore differences in wholesale price across manufacturers can confound price effects due to WIC and its rebate program.[1]

An event study methodology and a multivariate regression methodology are two approaches for holding other factors constant in order to isolate WIC-related price effects. The event study is simpler to implement than a regression approach, and as a result of that simplicity, the event study's results may be more transparent and easier to interpret. On the other hand, the event study approach has certain inherent limitations and statistical weaknesses that can be remedied by using the more sophisticated regression approach—but at the cost of greater complexity in both implementation and interpretation. This chapter describes the event study and its results, while the next chapter explains the regression analysis approach and its results.

The event study analysis used here examines the change in retail infant formula prices when the holder (i.e., the infant formula manufacturer) of the WIC contract changes. Thus, the specific "event" referred to in this "event study" analysis is a change in the *contract brand* in a particular market area. The event differed in time from market area to market area, and some market areas had two events during the 1994-2000 study period. A new WIC contract does not in itself constitute an event: if a State WIC agency awarded a new contract without a change in contract brand—i.e., the new contract was awarded to the same manufacturer that held the old contract—then no change in contract brand took place.

The event study analysis may also be called a "pre-/postanalysis." Specifically, it compares the prechange and postchange retail prices of the infant formula brand of the contract winner (i.e., the new WIC contract holder) in a market area with the pre- and postchange retail prices of both the infant formula brand of the contract loser (i.e., the old WIC contract holder) and the other brand of infant formula in the market area (other brands of formula are brands in which their WIC contract status did not change during the period—that is, they neither won nor lost the WIC contract).[2] If the change in retail prices during the pre- and postchange period is greater for the new contract holder relative to the old contract holder and the other brand of formula, it would suggest that being the WIC contract brand results in higher retail prices.

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[1] Carnation's wholesale price, for example, is well below the wholesale prices of Mead Johnson and Ross. Even after taking into account that retailers generally establish a percentage retail markup for Carnation that is greater than that of the other two brands, Carnation products can be expected to be sold in most market areas at a relatively low retail price due to Carnation's relatively low wholesale price. Thus, any price-increasing effect of Carnation being the WIC contract brand would have to be so large as to overcome the price-dampening effect of its relatively low wholesale price. As a result, being the WIC contract brand in a specific area can increase the retail price of that formula in the area and yet its price may still be below the prices of the other noncontract brands.

[2] In this analysis, one "other" brand was designated per market area. In those instances in which there were several brands of formula none of which won or lost the WIC contract during the period in question, the "other" brand was represented by the brand of the larger manufacturer.

A key assumption underlying the event study analysis is that the prechange and postchange periods are sufficiently close together so that, within the given market area for each event, other price-determining factors are essentially constant.[3] The InfoScan data on infant formula retail prices were collected by quarter. To determine the effect of a change in the holder of the WIC contract in this study, the price of formula in the quarter before the change occurred was compared with the price in the quarter after the change occurred. For example, if the change in the WIC contract occurred during the 3rd quarter of 1998, then the price of infant formula in the 4th quarter of 1998 (postchange) was compared with the price in the 2nd quarter of 1998 (prechange).[4]

Within the 54 market areas in which a WIC contract brand was designated, the holder of the WIC milk-based contract changed 51 times during the 1994-2000 study period and the holder of the WIC soy-based contract changed 47 times.[5] In 12 cases, the change in the WIC contract holder in both the milk- and soy-based markets involved Wyeth losing the WIC contract in 1996, the same year that Wyeth phased out their production of infant formulas for the U.S. market. Because Wyeth's exit during this period could have affected the retail pricing of their formulas, these 12 cases were excluded in the following analysis.[6]

Appendix B contains tables of infant formula retail prices, pre- and postchange, by individual market areas. In 33 of the 39 events in which the WIC contract for milk-based powder changed (excluding those cases where Wyeth lost the contract in 1996), the price of WIC contract-winning brand of formula increased more than the price of the contract-losing formula (appendix table B-1).[7] In 30 of the 39 events, the price of the winning contract holder's formula increased more than the price of the "other" brand of formula. With regard to milk-based liquid concentrate, in 35 of the 39 events the change in the price of the contract-winning brand of formula exceeded the change in price of the contract-losing brand and in 31 of the 39 events, the price change in the contract-winning formula exceeded that of the "other" formula (appendix table B-2). Tests indicated that these results were statistically significant at the 5 percent level of significance (i.e., there was less than a 1 in 20 chance of these results occurring as a random event).[8]

This statistically significant pattern also held for the soy-based infant formulas. In 23 of the 35 events in which the WIC contract for powder changed (excluding those cases where Wyeth lost the contract in 1996), the price of the contract-winning brand of formula increased more than the price of the contract-losing brand, and in 20 of 27 events, the price of the contract-winning brand increased more than that of the "other" brand (in 8 market areas, there were no sales data for the "other" brand during the period in which the contract changed) (appendix table B-3). For liquid concentrate formula, the change in the price of the winning contract brand of formula exceeded the change in price of the contract-losing brand in 24 of the 35 events, while in 19 of the 27 events,

[3] For example, changes in a market area's average income or its poverty rate may affect the area's infant formula prices, but in short spans of time such factors do not usually fluctuate by large amounts.

[4] The quarter after the change was used to represent the "postchange" since the contract may have changed late in a quarter and most of that quarter's data would be more representative of the period before the change. In addition, because of existing inventory at the time of the change, retailers may wait until they have sold off their existing stock of formula before instituting a price change.

[5] In some market areas with separate solicitations, the holder of the milk-based contract changed while the holder of the soy-based contract remained the same (or vice versa). Some market areas experienced two changes in the holder of the WIC contract during the study period.

[6] The same general conclusions concerning price effects would be reached whether or not these 12 cases were included in the analysis; see appendix B.

[7] Two "events" could occur in a market area if that market area experienced two changes in the holder of the WIC contract during the study period.

[8] Sign tests were used to test for statistical significance.

the price change in the contract-winning brand exceeded that of the "other" formula (there were no sales data for the "other" brand in 8 of the events) (appendix table B-4).

The average change in the retail price of formula after a change in the WIC contract holder by product base and form is summarized in figure 8-1. The results clearly show that the average increase in infant formula prices pre- and postchange in contract holder was greater for the contract-winning brand of formula than for both the contract-losing brand of formula and the "other" brand of formula. For example, the retail price of milk-based powdered formula for the contract-winning brand increased by an average of 10 cents compared with 3 cents for the contract-losing brand of formula and 5 cents for the other" brand. This general result held regardless of product base and physical form. These findings are consistent with economic theory. Winning the WIC contract increases the demand for the contract brand of formula resulting in an increase in its retail price since price-insensitive WIC recipients are required to purchase the WIC brand of formula.[9] Demand for the contract brand of formula may also increase among non-WIC consumers to the degree that winning the WIC contract results in increased shelf space in stores or if physicians recommend the contract brand to non-WIC mothers.

Table 8-1 shows the average change in the retail price of infant formula by brand when the WIC contract holder changes.[10] For example, the average price of Carnation brand milk-based powdered formula increased by 14 cents when it won the contract but increased only 8 cents when it lost the contract.[11] In every case, the average price of a manufacturer's infant formula increased more when it gained the WIC contract than when it lost the contract. That is, regardless of the brand of formula, winning the WIC contract resulted in an average increase in its retail price greater than when it lost the contract.

One might expect that after losing the WIC contract, the retail price of the contract-losing brand would decrease, or at least increase to a lesser degree than the price of the "other" brand. That is, since it no longer was the WIC contract brand of formula (and therefore no longer guaranteed all the WIC sales), the demand for that product would lessen, resulting in lower prices, or at least prices that increase by relatively little. At the same time, the "other" brand neither gains nor loses the demand of the WIC household. Tests were conducted to determine whether the percentage of cases in which the change in the price of the "other" brand was greater than that of the old WIC contract holder was statistically significant. However, the proportion of market areas in which the change in the price of the "other" infant formula exceeded the change in the price of the old WIC contract holder was not statistically different from 50 percent. For example, in 24 of the 39 market areas in which the WIC contract for milk-based powder changed (excluding those cases where Wyeth lost the contract in 1996), the price of the "other" WIC contract holder increased more than the price of the contract-losing brand. For milk-based liquid concentrate formula in 20 of the 39 market areas, the price of the "other" WIC contract holder increased more than the did the price of the contract-losing brand. With regard to soy-based powder, in only 8 of the 27 market areas did the change in the price of the "other" brand exceed the change in price of the contract-losing brand and, in 11 of these 27 areas, the price change in the "other" brand's soy-based liquid concentrate formula exceeded that of the contract-losing brand of formula.

One possible explanation for this result is that demand for infant formula exhibits strong brand preference or habit persistence. This may result from the effects of medical detailing and/or the

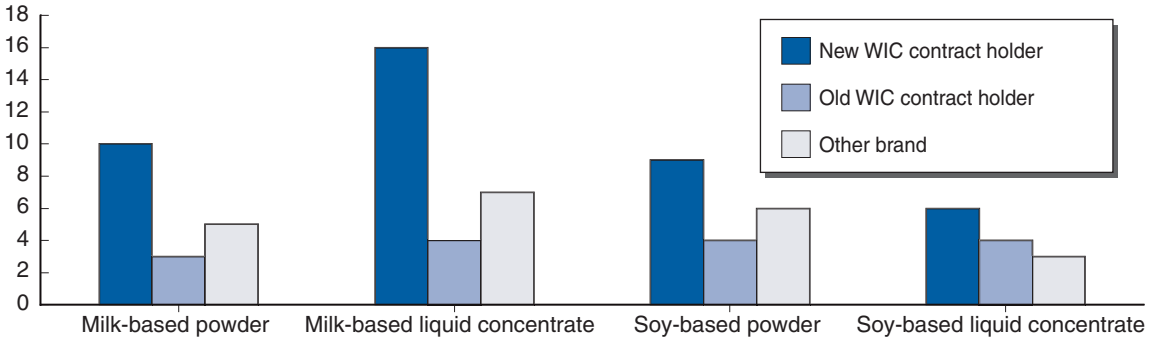
[9] For an additional discussion on the economic theory on how WIC contracts may affect retail prices, see appendix C.

[10] For this analysis, all market areas in which the WIC contract changed (even those areas in which Wyeth lost the contract in 1996) were included.

[11] Note that the average increase in prices of Carnation brand formulas was based on only a small number of observations.

Figure 8-1

Change in the retail price of infant formula when the holder of the WIC contract changes



Note: The change in price reflects the difference in the price of infant formula in the quarter before the holder of the WIC contract changed and the price in the quarter after the change occurred. Based on unweighted data, that is, each market area was given the same weight.

Source: ERS analysis of InfoScan supermarket data.

Table 8-1—Average change in retail price of formula when the holder of the WIC contract changes, by formula type and manufacturer

Formula type/manufacturer	New WIC contract holder	Old WIC contract holder
	Dollars	
Milk-based powder:		
Carnation	0.14 (n=4)	0.08 (n=5)
Mead Johnson	0.11 (n=32)	0.04 (n=12)
Ross	0.1 (n=12)	0.0 (n=20)
Milk-based liquid concentrate:		
Carnation	0.16 (n=4)	0.11 (n=5)
Mead Johnson	0.17 (n=32)	0.04 (n=12)
Ross	0.11 (n=12)	0.02 (n=20)
Soy-based powder:		
Carnation	0.1 (n=4)	NA (n=0)
Mead Johnson	0.06 (n=28)	0.05 (n=12)
Ross	0.06 (n=12)	0.03 (n=21)
Soy-based liquid concentrate:		
Carnation	0.14 (n=4)	NA (n=0)
Mead Johnson	0.09 (n=28)	0.03 (n=12)
Ross	0.12 (n=12)	0.04 (n=21)

Notes: N=number of observations. NA=No data available. Change in price reflects the difference in the price of infant formula in the quarter before the holder of the WIC contract changed and the price in the quarter after the change occurred.

Source: ERS analysis of InfoScan supermarket data.

actual or perceived digestive sensitivities of infants to product changes.[12] Consequently, prices of infant formula may be "sticky downwards"—that is, they tend not to decrease. Although some retailers may lower the price of infant formula to act as a loss leader at least in some instances, the event study analysis indicates that, on average, retailers do not lower price when a particular brand loses the WIC contract. Instead, retailers simply do not raise the price of the contract-losing brand of formula as much as the price of the new WIC contract brand.

[12] For example, parents who are satisfied with an infant formula may be reluctant to change brands out of concern that their infant will not tolerate the new formula as well.

Chapter 9

Multivariate Analysis of the Determinants of Retail Infant Formula Prices

Although the event study analysis described earlier strongly suggests that being the WIC contract brand leads to higher retail prices relative to the noncontract brands, the analysis has several limitations. First, it examines changes in price over a relatively short period—from shortly before to shortly after a change in the holder of the WIC contract. The analysis does not indicate if the positive effect that being the WIC contract holder has on the price of infant formula holds up over longer periods: a more thorough analysis requires that differences in infant formula retail prices by WIC contract status be examined over a longer period. Second, the event study analysis looks only at market areas in which the WIC contract brand changed over the 1994-2000 study period. Thirteen of the 54 market areas in which a WIC brand was designated did not experience a change in the milk-based contract brand during the study period while 17 market areas did not experience a change in the soy-based contract brand. A methodology that can also examine market areas with no changes in the WIC contract holder would support broader conclusions. Third, the event study analysis does not control for other factors that may have influenced changes in infant formula prices by brand. The possible confounding effects of these various factors must be disentangled in order to definitively determine the relationship between WIC contract brand status and retail price.

In order to assess the quantitative relationship between the WIC infant formula rebate program and retail infant formula prices within individual market areas over the entire 1994-2000 study period, a multivariate regression analyses was used. Multivariate regression analysis is a statistical tool used to study the statistical dependence of a variable, called the dependent variable, on two or more other variables, called explanatory or independent variables. It measures the net effect of an independent variable on the dependent variable, given that other independent variables are in the model. It has the benefit of simultaneously controlling for multiple factors that may influence the retail price of infant formula, such as the wholesale price of infant formula, consumer income, and the presence of discount stores. (See appendix C for a discussion of the theoretical basis of the regression model.)

The Regression Model

The dependent variable in the model was the average real (i.e., inflation-adjusted) retail price of infant formula in supermarkets in a particular market area. Since retail prices may be influenced by a number of factors, it is important to control for as many of these confounding factors as possible when assessing the quantitative relationship between WIC's infant formula rebate system and the retail price of formula. Therefore, the model included a number of independent variables to represent economic, demographic, and WIC program factors thought to influence the retail price of infant formula (table 9-1).These independent variables included the median household income in the area, the poverty rate, the wholesale price of infant formula, the presence of Wyeth and PBM infant formula products, and a measure of number of discount stores (see appendix E for detailed information on the construction of the variables used in the model).[1] One potential complicating factor to modeling factors influencing the retail price of infant formula is

[1] While a market area's median household income and its poverty rate may be (negatively) correlated, both variables are included in the regression model. The former measures the income level at which a market area's income distribution is centered while the latter reflects the shape of the income distribution; in principle, either variable can change separately from the other and both variables can affect infant formula retail prices.

Table 9-1—The independent variables included in the regression analyses

Variable	Hypothesized effect on retail infant formula prices
Wholesale price	The greater the wholesale price of infant formula, the greater the costs to the retail store, and the greater the expected retail price.
Discount stores	The greater the number of discount stores (who also sell infant formula) per 100,000 residents, the greater the competition for the infant formula market and the lower the expected retail price.
Supermarket concentration	Higher supermarket concentration (i.e. the greater the degree to which a few supermarket chains dominate the market in an area), means less competition and higher retail prices.
Household income	The greater the household income in the market area, the greater the expected retail price of formula.
Poverty rate	The greater the poverty rate in the market area, the lower the expected retail price.
Presence of Wyeth	The presence of Wyeth brand formulas in the market area is expected to increase competition and lower retail prices.
Presence of private label	The presence of lower priced private label formula is expected to increase competition and lower retail prices.
Relative size of WIC if contract brand	The larger the size of the WIC program, the greater its influence on the infant formula market, and the higher the retail price of the contract brand.
Relative size of WIC if noncontract brand	The larger the size of the WIC program, the higher the retail price of the noncontract brand.
Change in contract brand	The more times the WIC contract brand has changed, the greater the retail price of formula.

that infant formula, unlike most products, is often used as a loss leader by retailers in order to bring customers into the store (see discussion of loss leaders in Chapter 7—Infant Formula Prices and Availability by Market Area). The model for this study specifically included an independent variable believed to be an important factor in explaining the use of loss leaders—the degree of supermarket concentration in an area.[2]

Three independent variables were included to help assess the influence of the WIC program or its infant formula rebate program on the retail price of formula. Two of these variables are intended to reflect the influence of the WIC program in an area, as measured by the relative size of the WIC program, where:

> *relative size of WIC* = the number of WIC formula-fed infants in the State containing the market area / the number of non-WIC formula-fed infants in the State containing the market area.

Note that *relative size of WIC* reflects the size of the WIC formula-fed infant population relative to the size of the non-WIC formula-fed infant population and not the absolute number of WIC formula-fed infants in an area. For example, a value of 0.50 indicates that the number of WIC formula-fed infants in a State is half the number of non-WIC formula-fed infants, a value of 1 indicates that the number of WIC formula-fed infants equals the number of non-WIC formula-fed infants, and a value of 2 indicates that the number of WIC formula-fed infants is twice the number

[2] See appendix C for further information on the rationale behind the inclusion of this variable in the model.

of non-WIC formula-fed infants.[3] The mean value of *relative size of WIC* for the market areas included in the regression analysis over the 1994-2000 period was 1.14 (fig. 9-1). The mean value for the *relative size of WIC* variable by individual market areas during the study period ranged from 0.59 (Denver) to 2.36 (Knoxville and Nashville).[4] The lowest value for the relative size of WIC variable across all market areas in any one quarter was 0.42, while its highest value was 4.2. These values are used below to depict graphically the minimum and maximum effects of the *relative size of WIC* variable.

The first WIC-related variable included in the model—*relative size of WIC if contract brand*—represents the relative size of the WIC program interacted with the contract brand status (where contract brand status = 1 if contract brand and contract brand status = 0 if noncontract brand). The coefficient for *relative size of WIC if contract brand* derived from the regression analysis is expected to be positive. The rationale for this hypothesis is that winning the WIC contract will increase the demand for the contract brand of formula since WIC recipients must obtain the WIC brand of formula with their vouchers. Furthermore, since these WIC recipients receive the formula for free with their vouchers, they are price insensitive—i.e. they do not respond to changes in price.[5] The greater the number of these price-insensitive WIC formula-fed infants relative to non-WIC formula-fed infants, the greater the likelihood that retailers (i.e., authorized WIC vendors) will respond by increasing the retail price of the contract brand.[6] Retailers cannot increase the price of the contract brand too much, however, or else non-WIC consumers who prefer the contract brand of formula will switch to some other lower priced brand or possibly shop for formula in a lower price store.[7] However, the greater the ratio of WIC to non-WIC infants in an area, the less the vendor needs to be concerned about these non-WIC consumers.[8]

Changes in *relative size of WIC* may also affect the price of the noncontract brands of formula. If the price of the contract brand of formula increases as *relative size of WIC* increases, economic theory would suggest that the price of the noncontract brand of formula may increase as well. This is because the contract brand of formula is a substitute for the noncontract brand of formula for non-WIC households, and the higher the price of a commodity's substitutes, the more that retailers can increase the commodity's price.[9] That is, a high price associated with the contract brand of formula could induce some non-WIC consumers who were purchasing the contract brand of formula to switch to a lower price substitute formula—i.e., a noncontract brand. This increase in demand for the noncontract brand may lead to retailers increasing its price. The extent to which

[3] The *relative size of WIC* variable is a ratio of formula-fed WIC infants to formula-fed non-WIC infants. An alternative measure of the prevalence of formula-fed WIC infants in a market area is the share of those infants in comparison to all formula-fed infants. The former specification was adopted in part to incorporate a hypothesized nonlinear price responsiveness. Preliminary analysis suggested that the two specifications yielded similar qualitative results for the range of data under study.

[4] These figures represent the values of the *relative size of WIC* variable by market areas averaged over the 1994-2000 study period. However, in the regression analyses, *relative size of WIC* was calculated separately by market area for each of the 27 quarters.

[5] In economic terms, the effect of winning the WIC contract is to shift the demand curve for the contract brand of formula to the right and make it steeper (i.e., more price inelastic).

[6] This cause-effect relationship—that the relative size of WIC affects retail infant formula prices—is the basis of the report's statistical analysis. The analysis supposes that, in the range of infant formula prices observed for 1994-2000, price changes do not affect WIC participation. See appendix C for more detail.

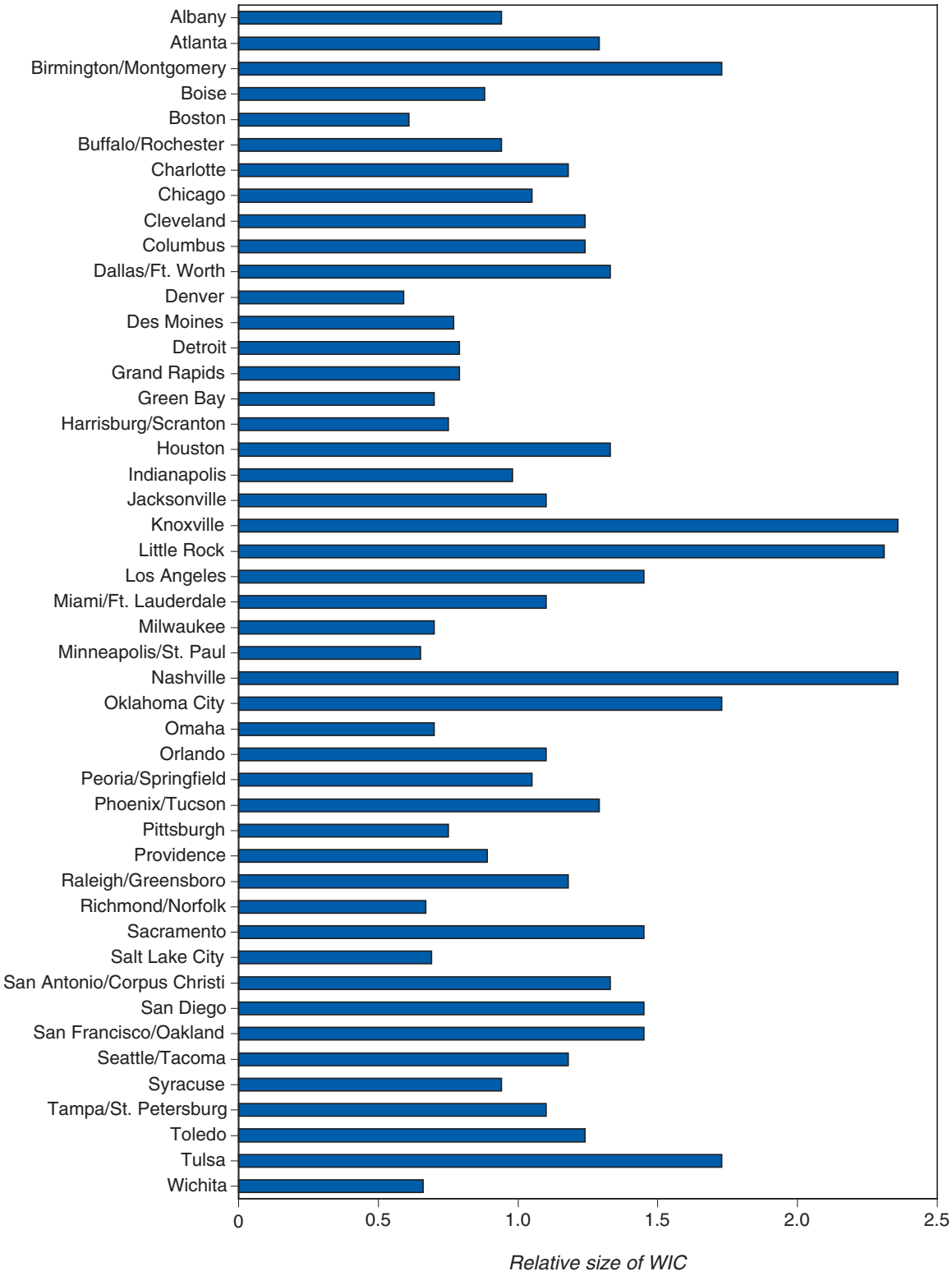
[7] WIC may also place restrictions on how much WIC vendors can charge for the contract brand of infant formula. See the following chapter for further discussion.

[8] That is, the increase in revenue from increasing the price to WIC consumers will outweigh the loss in revenue from non-WIC consumers switching to another alternative.

[9] In economic terms, the higher the price of substitutes, the steeper (i.e., more price inelastic) the demand curve for a particular brand of infant formula.

Figure 9-1

Relative size of WIC by market area, 1994-2000 averages



Note: *Relative size of WIC* reflects the size of the WIC formula-fed infant population relative to the size of the non-WIC formula-fed infant population. Values reported represent the mean value of the *relative size of WIC* variable during 1994-2000 reference period.

retailers can increase the price of the noncontract brand of formula depends on the price of the contract brand of formula and consumers' willingness to switch forms, brands, outlets, and/or breastfeed.[10] Therefore, the coefficient for the second WIC-related variable—*relative size of WIC if noncontract brand*—derived from the regression analysis is also expected to be positive.[11] Both the *relative size of WIC if contract brand* variable and the *relative size of WIC if noncontract brand* variable were included in the regression model because the price effects of *relative size of WIC* are expected to be larger for the contract brand than the noncontract brand.

The third WIC-related variable—*change in contract brand*—measured for a given quarter the number of times the WIC contract had changed in a market area over the 1994-2000 period.[12] This variable was included in the model to determine if a change in the WIC contract holder acts as a "trigger event" that results in retailers reassessing and possibly increasing the price of the all infant formula brands, contract and noncontract brands alike. That is, a change in the WIC contract brand may signal to retailers of an opportune time to increase the retail price of infant formula. The reason retailers do not raise prices during other times of the year (or at least not to the same degree as when the WIC contract brand changes) is that if one retailer increases its prices and the others do not, the first retailer may lose some of the market to the others. That is, no "trigger event" signals to all retailers simultaneously that this is the time to increase prices. If the major supermarket retailers in an area increase their prices of formula similarly, revenue for all the retailers will increase (as long as they don't increase prices excessively and lose customers to lower priced mass merchandisers).

Separate regression models were run for real prices of infant formula made by each of the three manufacturers currently holding WIC contracts—Mead Johnson, Ross, and Carnation—by each of the four product base/physical form categories—milk-based powder, milk-based liquid concentrate, soy-based powder, and soy-based liquid concentrate—for a total of 12 separate regressions. The retail price of formula was based on InfoScan supermarket data from the first quarter of 1994 to the third quarter of 2000. Within each market area, each quarter represents a separate observation. The data were restricted to the 47 market areas in which a WIC contract brand was designated and at least 90 percent of the area's population resided in one State.[13]

Regression Results

This section focuses on the statistical results of the regression analysis that deal specifically with the WIC-related variables. See appendix D for descriptive statistics on all the variables included in the model as well as complete results of the regression analyses. Regression coefficients were considered to be statistically significantly different from zero at the 5 percent level of significance.

Effect of *relative size of WIC if contract brand* on retail prices. The results of the regression analyses show that, after controlling for other factors, *relative size of WIC if contract brand* had a statistically significant positive effect on the retail price of the contract brand of formula. Specifi-

[10] Given the small number of infant formula manufacturers, consumers have only a limited (although increasing) number of alternatives available.

[11] The variable *relative size of WIC if noncontract brand* represents *the relative size of WIC* interacted with the *contract brand status* where *contract brand status* = 0 if contract brand and *contract brand status* = 1 if noncontract brand.

[12] The milk-based contract brand changed in 42 market areas during the study period, including 9 market areas in which the WIC contract brand changed twice. The soy-based contract brand changed in 38 market areas during the study period, including 9 market areas in which the WIC contract brand changed twice.

[13] Since some of the independent variables included in the model represent the characteristics of an individual State (such as relative size of WIC), those market areas in which more than 10 percent of the population lived in a different State were excluded from the regression analysis.

cally, an increase in the percentage of a State's infant formula-fed population participating in WIC was statistically associated with an increase in the retail price of the contract brands of formula. Figures 9-2 to 9-13 present this result graphically by product base, product form, and brand and show the estimated prices of formula at the minimum, mean, and maximum values of *relative size of WIC*. Using Mead Johnson's contract brand of milk-based powdered formula as an example, having a *relative size of WIC* of 0.42 (the minimum value among all market areas and periods) results in a retail price of $2.37 (26 ounces reconstituted) compared with a price of $2.45 for an area that had a *relative size of WIC* value of 1.14 (the mean across market areas and periods), and a price of $2.82 for an area with r*elative size of WIC* of 4.20 (the maximum value among all markets areas and periods), while controlling for all other factors (fig. 9-2).

Stated another way, increasing the *relative size of WIC* from 1.0 (where the number of WIC formula-fed infants equals the number of non-WIC formula-fed infants in an area) to 2.0 (where the number of WIC formula-fed infants is twice the number of non-WIC formula-fed infants in an area) results in a 11.9-cent increase in the retail price of the Mead Johnson milk-based formula (per 26 reconstituted ounces) in a market area in which it has the WIC contract. The finding that the retail price of the WIC contract brand of formula increases as relative size of WIC increases held for each of the 12 different types and brands of the contract brand of formula.[14]

Effect of *relative size of WIC if noncontract brand* on retail prices. The regression results show that the greater the *relative size of WIC*, the greater the price of noncontract formula (figs. 9-2 to 9-13). Once again using Mead Johnson's milk-based powdered formula as an example, having *a relative size of WIC* of 0.42 results in a retail price of $2.36 (26 ounces reconstituted) compared with a price of $2.43 for an area that had a *relative size of WIC* value at the mean of 1.14, and a price of $2.74 for an area with *relative size of WIC* of 4.20, while controlling for all other factors (fig. 9-2). In other words, increasing the *relative size of WIC* from 1.0 (where the number of WIC formula-fed infants equals the number of non-WIC formula-fed infants in an area) to 2.0 (where the number of WIC formula-fed infants is twice the number of non-WIC formula-fed infants in an area) results in a 10.04-cent increase in the retail price of Mead Johnson formula (per 26 reconstituted ounces) in a market area in which it does not have the WIC contract. This finding of a positive, statistically significant coefficient was consistent across all brands, product bases, and forms, with the exception of the two Carnation soy-based formulas.[15]

Contract brand status effect on retail prices. As discussed above, an increase in the *relative size of WIC* variable on the noncontract brand usually resulted in increased prices for both the contract and noncontract brands of formula. However, in general, the effect of *relative size of WIC* on the noncontract brand was less than its effect on the contract-brands. That is, holding all other factors constant, being the contract brand of formula results in higher retail prices compared with the noncontract brand of formula for most of the different types/brands of formula. An implication of this result is that, holding other factors constant, at any given level of *relative size of WIC*, a manufacturer's brand of formula has a higher retail price when it is the contract brand than when it is the noncontract brand. This price difference is referred to as the contract brand effect.

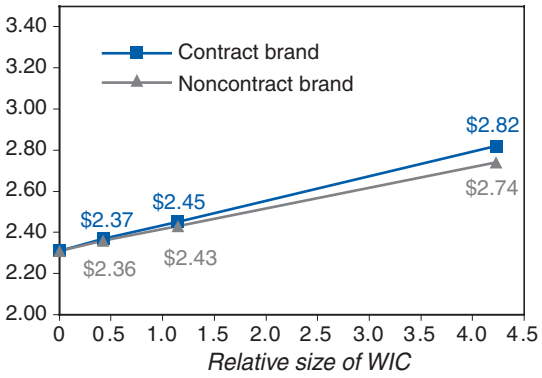
[14] While the regression results indicate that *relative size of WIC* affects the retail price of infant formula, so do other variables. As a result, one should not conclude that, since *relative size of WIC* increases retail price, the retail price in an area where *relative size of WIC* is high (e.g., Nashville, TN) will necessarily be higher than an area where relative size of WIC is low (e.g., Denver, CO). Any price difference between the two areas is affected by *relative size of WIC* along with other independent variables (for example, *median household income* and *poverty rate*) that jointly influence price.

[15] The effect of the *relative size of WIC variable if noncontract brand* on the retail price of Carnation's soy-based powder and liquid concentrate formulas was not statistically different from zero.

Figure 9-2

Retail price of infant formula by relative size of WIC and contract brand status: Mead Johnson, milk-based, powder

Dollars per 26 reconstituted ounces

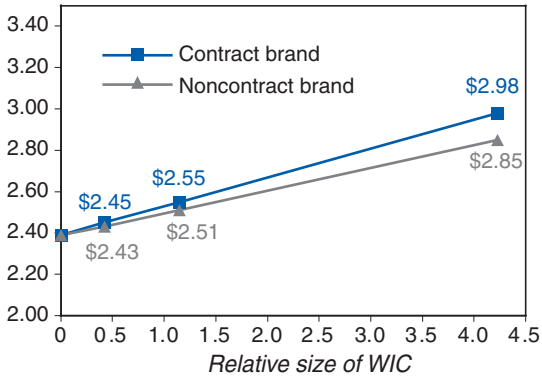


Source: ERS analysis of InfoScan supermarket data.

Figure 9-3

Retail price of infant formula by relative size of WIC and contract brand status: Ross, milk-based, powder

Dollars per 26 reconstituted ounces

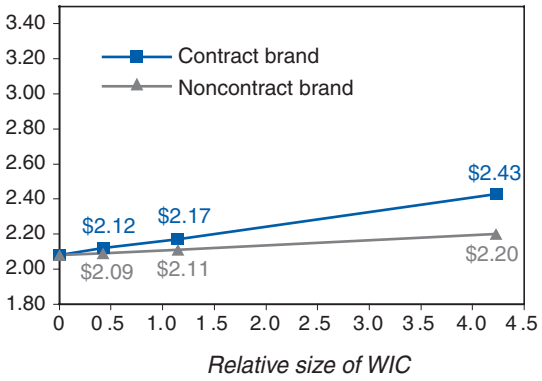


Source: ERS analysis of InfoScan supermarket data.

Figure 9-4

Retail price of infant formula by relative size of WIC and contract brand status: Carnation, milk-based, powder

Dollars per 26 reconstituted ounces

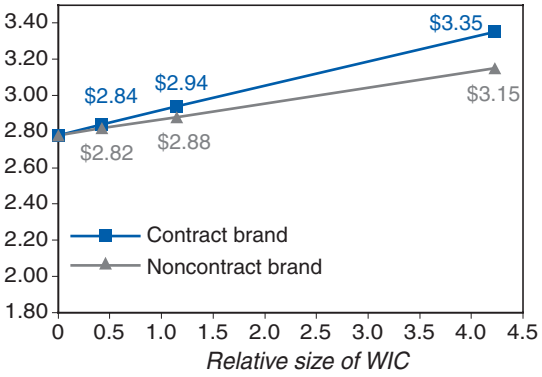


Source: ERS analysis of InfoScan supermarket data.

Figure 9-5

Retail price of infant formula by relative size of WIC and contract brand status: Mead Johnson, milk-based, liquid concentrate

Dollars per 26 reconstituted ounces

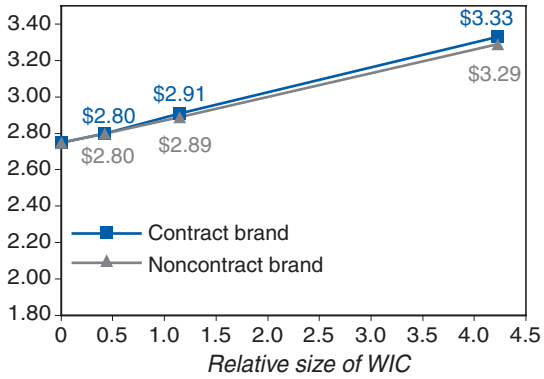


Source: ERS analysis of InfoScan supermarket data.

Figure 9-6

Retail price of infant formula by relative size of WIC and contract brand status: Ross, milk-based, liquid concentrate

Dollars per 26 reconstituted ounces

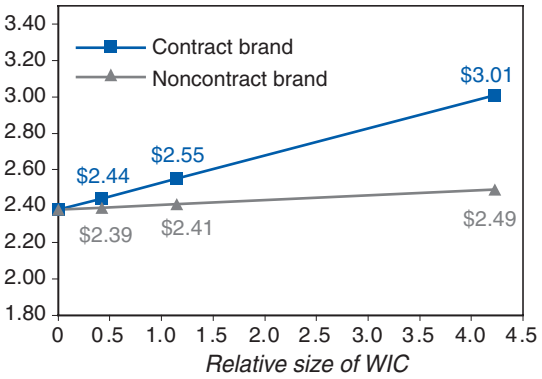


Source: ERS analysis of InfoScan supermarket data.

Figure 9-7

Retail price of infant formula by relative size of WIC and contract brand status: Carnation, milk-based, liquid concentrate

Dollars per 26 reconstituted ounces

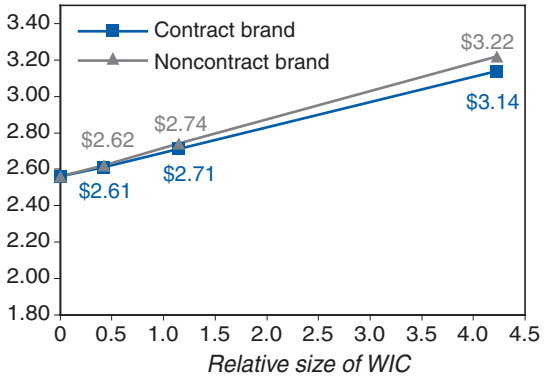


Source: ERS analysis of InfoScan supermarket data.

Figure 9-8

Retail price of infant formula by relative size of WIC and contract brand status: Mead Johnson, soy-based, powder

Dollars per 26 reconstituted ounces

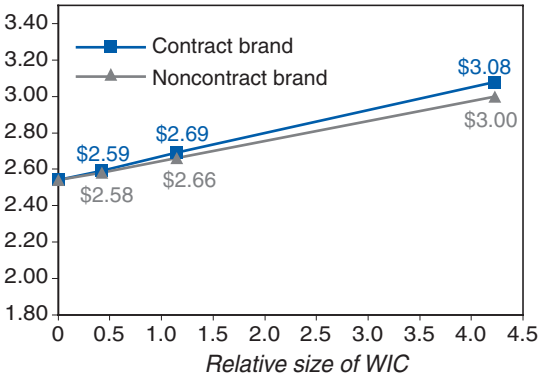


Source: ERS analysis of InfoScan supermarket data.

Figure 9-9

Retail price of infant formula by relative size of WIC and contract brand status: Ross, soy-based, powder

Dollars per 26 reconstituted ounces

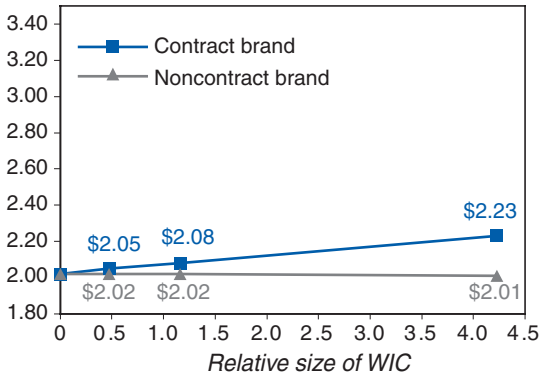


Source: ERS analysis of InfoScan supermarket data.

Figure 9-10

Retail price of infant formula by relative size of WIC and contract brand status: Carnation, soy-based, powder

Dollars per 26 reconstituted ounces

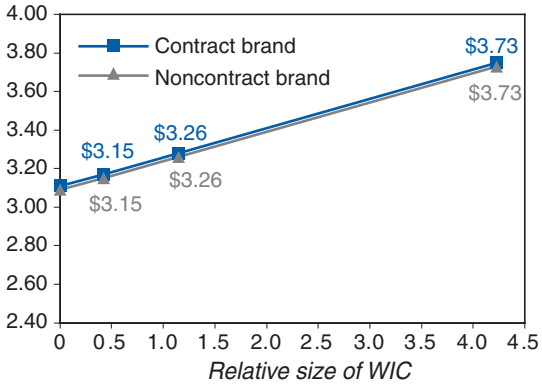


Source: ERS analysis of InfoScan supermarket data.

Figure 9-11

Retail price of infant formula by relative size of WIC and contract brand status: Mead Johnson, soy-based, liquid concentrate

Dollars per 26 reconstituted ounces

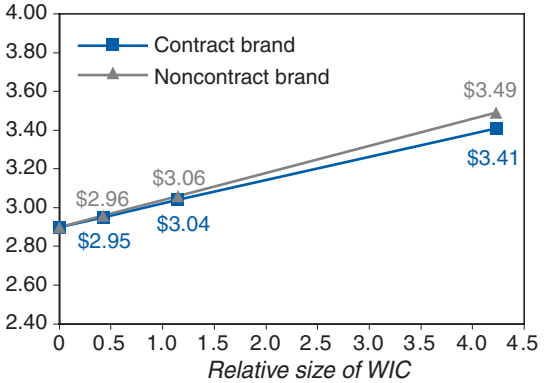


Source: ERS analysis of InfoScan supermarket data.

Figure 9-12

Retail price of infant formula by relative size of WIC and contract brand status: Ross, soy-based, liquid concentrate

Dollars per 26 reconstituted ounces

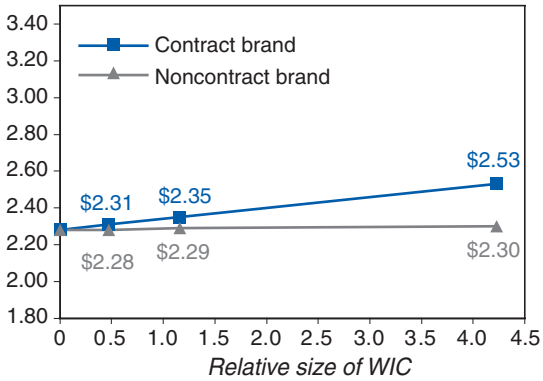


Source: ERS analysis of InfoScan supermarket data.

Figure 9-13

Retail price of infant formula by relative size of WIC and contract brand status: Carnation, soy-based, liquid concentrate

Dollars per 26 reconstituted ounces



Source: ERS analysis of InfoScan supermarket data.

This contract brand effect is shown in figures 9-2 to 9-13 as the difference between the line representing the contract brand and the line representing the noncontract brands. For example, the effect of being the contract brand of formula on Mead Johnson's milk-based powdered formula, evaluated at the mean size of WIC of 1.14 is the difference between $2.45 (for the contract brand) and $2.43 (for the noncontract brand) or 2 cents (shown in fig. 9-2). For five of the six types of milk-based formulas, being the contract brand was associated with statistically significant higher retail prices (the difference in the retail price of Ross' liquid concentrate formula when it was the contract brand was not significantly different from the price when it was the noncontract brand). This contract brand effect was especially noticeable for the Carnation brands (e.g., being the contract brand increased the retail price of Carnation's milk-based liquid concentrate, evaluated at the mean size of WIC of 1.14, by 14 cents per 26 reconstituted ounces). In total for milk-based formula, these results support the findings from the event-study analysis of prices—winning the WIC contract brand of formula leads to higher retail prices relative to the noncontract brands of formula.

The effect of contract brand status on retail prices was less clear among soy-based formulas than among milk-based formulas. For three of the six types of soy-based formula—Ross' powdered formula and Carnation's powdered and liquid concentrate formula—being the contract brand was associated with significantly higher retail prices. Similar to the results for the milk-based formulas, the greatest effect of being the contract brand was on the Carnation brands of formula (about 6 cents for both the powdered and liquid concentrate evaluated at the mean 1.14 size of WIC). For one type of formula—Mead Johnson's soy-based powder—the effect of being the WIC contract brand was to lower the retail price, a result that is unexplained. The contract brand effect for the Mead Johnson and Ross liquid concentrate brands was not statistically significant.

The average contract brand effect across the three manufacturer's brands, two product bases, and two product forms was estimated for summary purposes. When measured at the mean 1.14 *relative size of WIC*, the average contract brand effect was 2.5 cents.

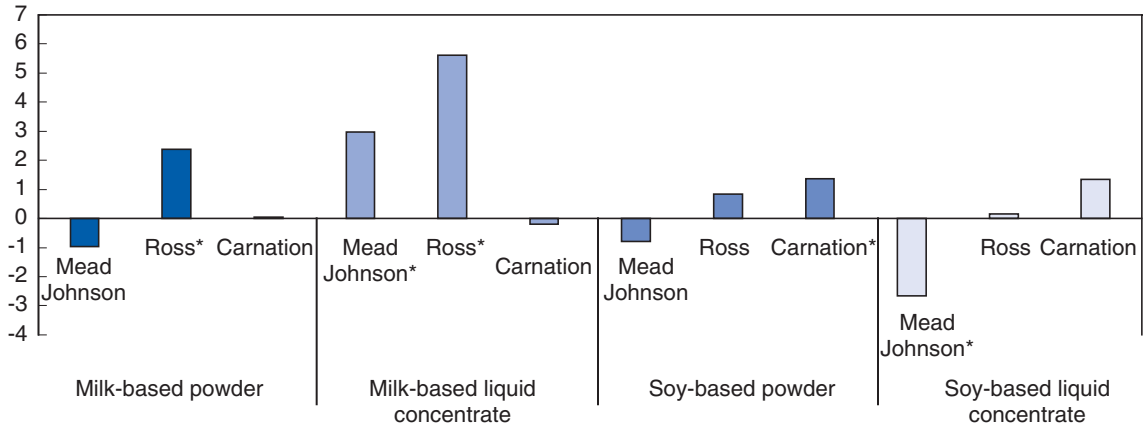
Effect of *change in contract brand* on retail prices. The regression model included the variable *change in contract brand* that represented a count, by quarter, of the number of times the WIC contract brand changed in a market area over the course of the 1994-2000 study period. This "trigger event" variable was found to have a statistically significant effect on retail prices for some but not all of the formulas (fig. 9-14). A change in the contract brand, holding other factors constant, was associated with an increase in the price of Ross milk-based powder (by 2.37 cents per change), and the milk-based liquid concentrate brands of Mead Johnson (2.98 cents per change) and Ross (5.61 cents per change) formulas. A change in the contract brand was also associated with an increase in the retail price of Carnation soy-based brand powder (1.36 cents per change). For unknown reasons, a change in the WIC contract brand was also associated with a decrease in the price of Mead Johnson's soy-based liquid concentrate formula of 2.67 cents. The effect of a change in the contract brand for the other types of infant formulas was not statistically significant.

Despite the statistically significant results associated with this variable for some of the formulas, it does not necessarily mean that consumers in market areas with many contract brand changes pay more for infant formula *in the long run* than consumers in market areas with few or no contract brand changes, even after controlling for other factors. Retailers may be using a change in the WIC contract brand as an occasion to re-evaluate their pricing of formula, and introduce price increases (for both the contract and noncontract brands) that otherwise would have occurred anyway (i.e., even in the absence of a change in the WIC contract brand) over a longer period, in smaller increments, and at different times by different retailers. A change in the contract brand in an area may concentrate price changes by the different retailers into the same short period. The difference in the pricing patterns between market areas that experienced changes in contract brand and those that did not experience a change may be only a difference in the timing of the increments in retail price.

Figure 9-14

Change in retail price of infant formula due to a change in the WIC contract brand

Cents per can



* = statistically significant.

Source: ERS analysis of InfoScan supermarket data.

Chapter 10

Discussion

The empirical study examined price effects associated with contract and noncontract brands of infant formula and changes in the relative size of WIC, given that WIC and its rebate program are both in effect. It did not consider issues related to the existence versus absence of the rebate or WIC programs. More specifically, the empirical study did not consider what infant formula prices are under WIC compared with what infant formula prices would be in the absence of WIC. Neither did it consider how infant formula prices under the rebate program would compare with infant formula prices if the rebate program were not in effect. These comparisons were not considered because the 1994-2000 dataset used in the analysis covers the period after WIC and its rebate program were instituted.

Results of the regression analysis indicate that WIC and its infant formula rebate program (with its designation of one manufacturer as the WIC contract brand) affect the retail price of infant formula in several ways:

(1) Compared with being the noncontract brand, being the WIC contract brand of infant formula was typically associated with higher retail prices for most types of formula—especially the milk-based brands of formulas (holding other factors constant). The results of the event study analysis that compared prices in the calendar quarter before and the calendar quarter after a change in the WIC contract holder support these findings that the WIC infant formula rebate program leads to higher prices of the contract brand of formula compared with what the price would be if the brand were not the contract brand. For example, for milk-based powder formula (the highest volume type of formula), the pre/postprice increase averaged 10 cents for new contract holders compared with 3 cents for old contract brands that had lost the WIC contract.

(2) The regression analysis found that the larger the relative size of the WIC program, the greater the retail price of the contract brand of formula, ranging from 8 to 14 cents across brands of milk-based powder formula (per 26 ounces of reconstituted formula) for a one-unit change in *relative size of WIC* (e.g., WIC's share of all formula infants increases from one-half to two-thirds).

(3) The analysis found that the relative size of the WIC program also affects the retail price of noncontract formula by amounts ranging (for milk-based power formula) from 3 cents to 11 cents. That is, larger WIC programs result in higher retail prices of the noncontract brands of formula although the increase is less than that of the contract brand.

(4) A change in the WIC contract brand within a market area regardless of who won or lost the contract, was also associated with a small, but statistically significant, effect on the retail prices of some types of formula.

These results have implications for both WIC State agencies and non-WIC consumers. First, the larger the relative size of a State's WIC program (holding other factors constant), the smaller the State WIC agency's savings per can from the rebate program for a given negotiated rebate level.[1] This is because, for each can of the contract brand of infant formula sold through WIC, the WIC

[1] It should be noted that larger WIC States (i.e., States with large numbers of WIC infants in absolute terms) may be able to negotiate larger rebate savings from the infant formula manufacturers.

State agency pays the retail price minus the amount of the manufacturer's rebate, and the larger the relative size of the WIC program, the greater the retail price of the contract brand of formula. While increases in infant formula retail prices due to an increase in the relative size of WIC may be considered small relative to the retail prices of formula, such price increases are larger compared with the actual cost of infant formula (per 26 ounces reconstituted) to State WIC agencies. In market areas with changes in contract brand, the WIC rebate program may also lead to higher retail prices for some of the contract brands of formula independent of the effect of the *relative size of WIC* variable (i.e., through the "trigger event" effect associated with changes in the WIC contract brand). However, the increase in costs of the contract brand to the WIC State agencies due to either WIC-related effect is far outweighed by the effect of the rebate levels negotiated.[2] In fact, because the rebates are so large, in some areas, the retail markup accounts for most of the costs of infant formula to WIC.

A second implication is that the non-WIC consumers can be affected by WIC and its rebate program. WIC leads to higher retail prices for non-WIC consumers who purchase the contract brand of formula. Furthermore, non-WIC consumers purchasing the noncontract brand of formula may also be negatively affected by WIC and its rebate program. Results from the regression analysis show that, since the relative size of the WIC program affects the retail price of formula in general, an increase in the relative size of the WIC program not only increases the retail price of the contract brand but also the noncontract brand. Therefore, non-WIC consumers in States with large WIC programs pay statistically significant higher prices for noncontract brand infant formula relative to consumers in States with small WIC programs, controlling for other factors. Finally, non-WIC consumers may pay higher retail prices for some brands of formula to the extent that the brand's price responds to the trigger event effect associated with WIC contract brand changes.

Figures 10-1 and 10-2 show the hypothetical effect on a family's monthly expenditures for infant formula when they move from a State where *relative size of WIC* equals 1 (i.e., WIC infants account for one-half of all formula-fed infants) to a State where *relative size of WIC* equals 2 (i.e., WIC infants account for two-thirds of all formula-fed infants) holding other factors constant.[3] Since the formula needs of infants depend on a number of factors, including age, weight, and diet, a number of assumptions are necessary to assess costs. The example reported here is based on the average formula needs of a 12-pound infant (i.e., the average weight of a 3-month-old infant girl) who is consuming only formula (i.e., no breast milk or solids).[4] The increase in monthly expenditures varies by brand of formula, ranging from less than $3 per month to over $5 per month for milk-based contract brands and from less than $1 to over $4 per month for the noncontract brand of milk-based formula. The results for the soy-based infant formulas in general showed similar results. The estimates in figures 10-1 and 10-2 would double if the comparison instead was what happens to a family's monthly expenditures for infant formula when they move from a State where *relative size of WIC* equals 1 to a State where *relative size of WIC* equals 3 (i.e., WIC infants account for three-quarters of all formula-fed infants). It bears repeating that although the regression results indicate that *relative size of WIC* affects the retail price of infant formula, so do other

[2] For example, the size of the rebate provided by infant formula manufacturers in September 2000 ranged from $2.06 per can of milk-based liquid concentrate in New Jersey to $2.84 per can in South Carolina (see fig. 3-2). In contrast, an increase in the *relative size of WIC* from 1 (where one-half of all formula-fed infants are on WIC) to 3 (where three-fourths of all formula-fed infants are on WIC) results in only a $0.27 increase per can in the retail price of Mead Johnson milk-based liquid concentrate when it is the contract brand. Similarly, if a market area experienced two contract changes during the 1994-2000 period, the price of this formula product would increase by a total of only $0.06.

[3] The average value of size of WIC in the market areas included in the regression analysis during the study period was 1.14.

[4] The example reported here assumes that infants consume about 2.5 ounces of infant formula per pound of body weight per day.

Figure 10-1

Example of the effect of a one-unit increase in *relative size of WIC* on monthly expenditures for milk-based infant formula

Dollars per month

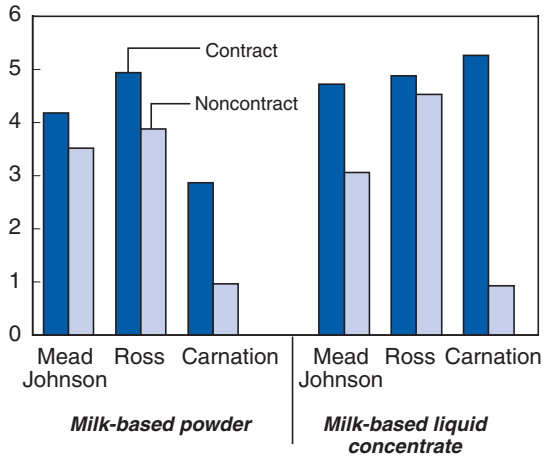
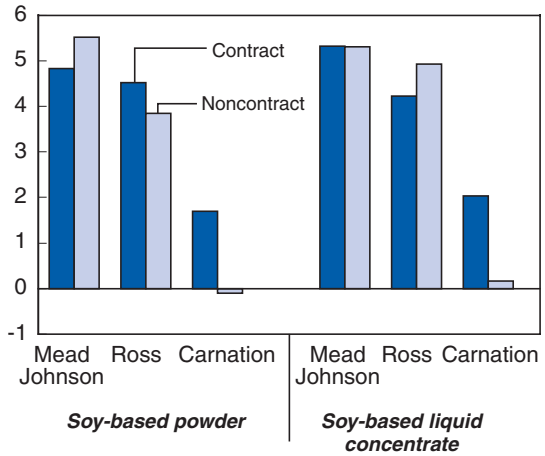


Figure 10-2

Example of the effect of a one-unit increase in *relative size of WIC* on monthly expenditures for soy-based infant formula

Dollars per month



Note: These examples are based on the hypothetical formula needs of a 12-lb, formula-fed-only infant. Actual formula needs depend on an infant's age, weight, and whether the infant is also consuming breast milk or solids.

variables. Areas in which *relative size of WIC* is large, are more likely to have high *poverty rates* and low *household income*, variables associated with lower infant formula prices.

A full discussion of the adverse price effects associated with WIC and its infant formula rebate program must acknowledge that over one out of every four participants in the WIC program (i.e., almost 2 million people per month in fiscal 2000) is served with rebate money. It may also be possible to lessen the negative impacts of the rebates on non-WIC consumers. Although States have no direct control over the retail price of the noncontract brand of infant formula, as a result of recent legislative changes, they do have authority to limit the price of the WIC contract brand of infant formula (65 FR 83253, December 29, 2000). WIC State agencies are now required to consider the prices a vendor applicant charges for WIC foods compared with the prices charged by other vendor applicants and authorized vendors. The State agencies must also establish price limitations on the amount they will pay vendors. These price limitations must be designed to ensure that the State agency does not pay authorized vendors at levels that would otherwise make the vendor ineligible for authorization (7 CFR 246.12). As a result, WIC vendors are discouraged from charging exorbitant prices for infant formula. In addition, several States, such as Texas and Rhode Island, have included provisions in their vendor contracts that prohibit vendors from marking up the retail price of WIC brand formula more than non-WIC brands, while Delaware awards the WIC contract to those vendors offering the lowest prices for WIC foods (Larin, 1996). Setting more stringent maximum prices for infant formula may help lower costs for WIC State agencies. However, if maximum price limits are too stringent, it might discourage participation by some retailers, thereby reducing participant access to WIC foods, which in turn, could discourage mothers of eligible infants from participating in WIC. WIC regulations require that States authorize an appropriate number and distribution of WIC vendors to ensure adequate participant access (7 CFR 246.12).

Limiting the retail price of the contract brand of formula may also indirectly affect the retail price of the noncontract brand of formula as well. The prices of substitute infant formulas may affect the demand for the noncontract brand of formula. That is, since the rebate program increases the price of the contract brand of formula, some non-WIC consumers who purchased a particular

brand of formula before it was the contract brand may have switched brands after it became the contract brand rather than pay higher prices.

The results of this analysis indicate that increasing the prevalence of breastfeeding among WIC infants would decrease the retail price of both the contract and noncontract brands of infant formula. Since *relative size of WIC* measures the number of WIC formula-fed infants relative to the number of non-WIC formula-fed infants, increasing the breastfeeding rate among WIC participants would reduce the number of WIC formula-fed infants, thereby reducing *relative size of WIC* (and WIC's influence in the infant formula market), resulting in lower retail prices for both contract and noncontract brands of infant formula. Although the breastfeeding rate for infants participating in WIC (20 percent at 6 months of age in 2000) has been increasing in recent years, it remains far below the rate for non-WIC infants (41 percent).

While this analysis indicates that the WIC program and its infant formula rebate program were generally found to result in modestly higher retail prices of infant formula in supermarkets, lower priced infant formulas are available to non-WIC consumers in most areas of the country, and furthermore, the number of these lower priced alternatives is increasing over time.[5] For example, Carnation brand formula, which is available in supermarkets throughout the country, is nearly always priced below that of comparable Mead Johnson and Ross products, even when Carnation is the WIC contract brand of formula. Infant formula marketed by PBM Products (which began operations in 1997) is available in supermarkets in most areas of the country and is priced significantly below formula produced by the other three manufacturers of infant formula. In 2001, Abbott Labs, the parent company of Ross, began producing a low-priced private-label infant formula for sale in Costco stores.[6]

Furthermore, the results from this analysis apply only to supermarkets (where WIC foods are predominantly sold). Increasingly non-WIC consumers are purchasing infant formula sold by mass merchandisers, who cater to the non-WIC consumer, at prices below that of supermarkets. (Since many of these mass merchandisers sell a limited variety of food products, they are not authorized WIC vendors and cannot participate in the infant formula rebate program.)

The increase in the range of alternatives available in the market place may be in response to infant formula consumers becoming more price conscious.[7] In addition to the increased purchase of lower priced brands and purchases from mass merchandisers, the purchase of powdered formula (the least expensive form of formula) and powdered formula in large-sized containers (with lower per unit prices) has increased dramatically in recent years.[8] As consumers become more price conscious, the role of medical detailing, which attempts to make consumers less price responsive by fostering brand loyalty, may be declining.

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[5] Other brands of infant formula may provide close substitutes for consumers wishing to switch brands. Since the content and quality of infant formula is strictly regulated, all brands of infant formula must meet the same nutritional standards.

[6] Because all infant formulas sold in the United States are required to meet the nutritional requirements of the Federal Food, Drug and Cosmetic Act for infant formula, private-label brands are as nutritionally complete as the national brands.

[7] In addition to a range of price alternatives, consumer choice in other areas has also widened in recent years as new types of infant formulas and new types of packaging have emerged.

[8] The increase in the prevalence of breastfeeding in recent years may also reflect greater sensitivity to infant formula prices by mothers.

Chapter 11

Conclusions

Since 1989, Federal law has required that WIC State agencies enter into cost-containment contracts for the purchase of infant formula used in WIC. Typically, WIC State agencies obtain significant discounts in the form of rebates from the manufacturers for each can of infant formula purchased by WIC participants. In exchange for rebates, a manufacturer is given the exclusive right to provide its products to WIC participants in the State.

Concerned about the rise in the price of infant formula since the WIC rebate program began, Congress in 2000 directed ERS to report on the several aspects of the infant formula market. While the resulting *Report to Congress* answered the specific questions posed by Congress, this report extends the original analyses and provides a more indepth examination of the effects of WIC and its infant formula rebate program on the retail prices of infant formula. Although wholesale prices can indirectly affect retail prices, this report focused on the pricing behavior of retailers for a given set of wholesale prices.[1] Specifically, this report provides answers to the following questions:

What are the recent trends in the infant formula market?

Since 1997, the volume of infant formula sold in the United States has remained relatively stable at about 27-28 billion ounces (reconstituted) per year. Over three-quarters of all infant formula sold in 2000 was milk-based, while soy-based infant formula accounted for another 20 percent. While most infant formula is sold in supermarkets (69 percent in 2000), the proportion of infant formula sold by mass merchandisers (at prices typically below those in supermarkets) has increased slightly in recent years, accounting for about 28 percent of total volume sold. One of the more dramatic trends in the infant formula market in recent years has been the increase of formula sold in powdered form (generally, the least expensive form of formula)—from 44 percent of all formula sold in 1994 to 62 percent in 2000. The volume of powdered infant formula that is sold in large—24 or more ounces—containers (at lower per unit prices) is also on the rise, increasing from only 4 percent in 1994 to 19 percent in 2000. Specialized formula (which is generally more expensive than standard formula) has made significant inroads in the market in recent years and accounted for 8 percent of all formula sold in 2000. Total dollars sales of infant formula has increased in recent years, much of it attributed to the increased sales of specialized formula. The average retail price of infant formula continues to increase over time, across the different physical forms, product bases, and outlets.

Has the number of infant formula suppliers decreased since WIC's infant formula rebate program began?

In both 1987, before WIC's infant formula rebate programs were widely implemented, and in 2000, three manufacturers accounted for about 99 percent of the infant formula market. Furthermore, in both years, two companies—Ross and Mead Johnson—accounted for between 87 percent and 90 percent of all infant formula sold. However, the third-largest producer in 2000—Carnation—entered the U.S. market after the rebate program began. Carnation continues to make inroads into the infant formula market; they accounted for 12 percent of all formula sold in 2000. In addition, a fourth company—PBM Products—entered the infant formula market in the late 1990s. Starting in 1997, PBM began marketing formula produced by Wyeth (which withdrew from the U.S. retail market in 1996). Thus, there is no

[1] To the extent that WIC and the rebate program affect wholesale prices in addition to the retail markup, this report's analysis does not capture all effects of WIC and the rebate program.

evidence that WIC's infant formula rebate program has resulted in a reduction of the number of infant formula manufacturers, thereby lessening competition.

Have infant formula prices increased faster than inflation in recent years?

Although the increase in the retail price of infant formula over the 1994-2000 period varied by manufacturer and type of formula, in nearly all cases, the average annual increase in the retail price of infant formula exceeded inflation regardless of which of three Consumer Price Indices (CPI) were used to represent inflation—*All Items, Food at Home,* or *Nonprescription Drugs and Medical Supplies*. In addition, in every case the annual rate of increase in retail prices exceeded the annual rate of increase in wholesale prices. Since little information is available on the operating costs associated with retailing infant formula, it is not possible to determine the extent to which the increase in retail infant formula prices above the rate of inflation are attributable to increased costs of retailing. It also should be noted that infant formula prices were increasing faster than inflation even before the rebate program was implemented.

Does the percentage retail markup of infant formula differ by brand or type of formula?

The size of the retail markups in percentage terms varied by type and manufacturer. Carnation brands of infant formula had a higher retail markup than did Mead Johnson and Ross brands. Since the wholesale prices of Carnation are generally lower than the two other brands, retailers can mark Carnation products up more and still price them lower than the Ross and Mead Johnson brands. In addition, liquid concentrate forms of formula (both milk- and soy-based) had higher markups than powdered forms of formula across manufacturers. All categories of formula had positive average annual retail markups at the national level. However, in many individual market areas, the retail prices of some infant formula products were priced below the listed wholesale price suggesting that many retailers may use infant formula as loss leaders to attract customers into their stores.

What is the availability of infant formula products from the major manufacturers by market area?

Infant formula manufactured by Mead Johnson, Ross, and Carnation are widely available in supermarkets throughout the United States. Formula manufactured by Wyeth and marketed by PBM Products, usually at relatively low retail prices, is available in some supermarkets in most areas of the country.

Is the retail price of formula that is included in the WIC rebate program greater than formula that is not included in the WIC rebate program?

Retail prices of infant formula vary widely across geographic areas. Within market areas there is not a clear and consistent relationship between a formula's being the WIC contract brand and having the highest average retail price.

What effect does being the WIC contract brand have on the retail price of infant formula?

The results from the event study analysis clearly showed that after a change in the WIC contract holder, the retail price of the new contract brand of formula increased more than that of the old contract holder and the other brands of formula. This finding suggests that being the contract brand of formula results in higher retail prices. This general result of higher, but not necessarily the highest price, was robust across all product bases and physical forms. A multivariate regression analysis examined retail prices while controlling for a variety of economic, demographic, and WIC program factors. Results showed that a manufacturer's brand of formula had a higher retail price—for a given wholesale price—if that brand is the WIC contract brand. The use of two different analytical approaches with comparable findings provides stronger, more credible results.

Does the size of the WIC program affect the retail price of infant formula?

The multivariate regression analysis showed that the greater the relative size of the WIC program in the State, as measured by the ratio of WIC formula feeders to non-WIC formula feeders, the greater the retail price of both the contract and noncontract brands of formula, holding other factors constant. This result held across nearly all brands and types of infant formula. Increasing the prevalence of breastfeeding among WIC mothers would decrease the relative size of the WIC program, thereby resulting in lower retail prices of infant formula.

In conclusion, supermarket prices of infant formula in a market area depend on a number of economic, demographic, and WIC program factors. WIC and its infant formula rebate program each tend to modestly increase the supermarket price of infant formula for non-WIC consumers, for given wholesale prices. The infant formula rebate program affects retail prices due to the designation of a single brand of formula as the contract brand (i.e., sole sourcing). The WIC program also affects retail infant formula prices through changes in WIC's size as measured by the number of formula-fed WIC infants relative to the number of formula-fed non-WIC infants. An increase in the relative size of the WIC program tends to result in higher retail prices. Accordingly, States with a high percentage of formula-fed infants in WIC had higher prices (other factors equal) with the amount of the increase depending on type and brand of formula consumed. For example, when moving from an area where WIC infants account for half of all formula-fed infants to an area where they account for two-thirds, a family with a typical 12-pound formula-fed infant has monthly expenditures (for milk-based formula) that increase by about $3 to $5 for contract brands of formula and about $1 to $4 for noncontract brands. No evidence was found that suggests that rebate levels affect retail markups. A full discussion of the price effects on non-WIC consumers due to WIC and its infant formula rebate program should consider that over one out of every four participants in the WIC program (i.e., almost 2 million people per month in fiscal 2000) is served with rebate money. Furthermore, recent legislative changes provide USDA with enhanced control of the prices WIC vendors charge for the contract brand of infant formula.

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Appendix A—History of the WIC Infant Formula Rebate Program

Several States have engaged in infant formula cost-containment practices since WIC's establishment in the early 1970s (Harvey et al., 1988). For example, Vermont, which uses a home delivery system to distribute WIC foods, has always used competitive bidding to purchase infant formula for its WIC program. Mississippi, which uses a direct distribution system for WIC foods, purchased infant formula in bulk in order to take advantage of available discounts.[1] However, the other States, all of which use retail purchase systems to distribute WIC foods, purchased infant formula at full retail prices prior to 1987.[2]

In the mid-1980s several factors prompted the States with retail purchase systems to look into alternative ways to reduce infant formula costs: (1) nearly 40 percent of total WIC food costs were attributed to infant formula; (2) formula prices grew faster than overall food prices; and (3) the infant formula industry structure suggested that cost-containment initiatives could be successful (U.S. General Accounting Office, 1990). Tennessee became the first State with a retail purchase food delivery system to implement a rebate system to control costs associated with infant formula when it awarded a competitively bid single-source exclusive contract in June 1987. Significantly, the contract was awarded to Wyeth Laboratories (the only company to submit a bid), who—since it accounted for only a small portion of the infant formula market—had the most to gain from winning a sole-source contract (Post and Wubberhorst, 1989). In December 1987, Oregon became the second State to implement a competitively bid single-source exclusive contract. The contract was awarded to Wyeth Laboratories, which was once again the only company to submit a bid (U.S. GAO, 1990).

In late 1987 and early 1988, Florida, Michigan, and Wyoming instituted an alternative infant formula cost-containment strategy, known as the "open market" system. Under this system, there were no sealed bids or exclusive contracts. Rather, infant formula manufacturers voluntarily agreed to provide a rebate to the State for their share of infant formula purchased through WIC (Center on Budget and Policy Priorities, 1995). However, WIC participants could still choose formula of manufacturers that chose not to provide a rebate. In spring of 1988, Texas awarded a competitive bid single-source exclusive contract, which was the first to be bid on by more than one manufacturer (U.S. GAO, 1990).

On October 1, 1988, P.L. 100-460 required that all State WIC agencies explore the feasibility of implementing cost-containment procedures for acquiring infant formula, and if the procedures were determined to lower costs, begin implementing the cost-containment system within a year. Although States had the option of using a home delivery system (Vermont) or direct distribution system (Mississippi) to reduce costs, most found these to be infeasible due to the costs associated with administering the systems or because of their impact on participants (U.S. Department of Agriculture, 1991). By late 1989, 57 State WIC agencies had implemented infant formula rebate contracts, 35 used the open market system, 19 used the competitive sole-source system, and 3 used a competitive multisource rebate approach (U.S. GAO, 1990).[3] Savings under the open market

[1] In 1984, Mississippi began using competitive bidding (with the low bidder winning the contract) to purchase its infant formula for WIC (Harvey et. al., 1988).

[2] In the past, parts of Ohio and Maryland also used the home delivery system to distribute WIC foods. These areas used competitive bidding to award delivery contracts to the WIC vendors. These vendors in turn, tried to purchase the infant formula at the lowest cost (Harvey et al., 1988).

[3] Under the competitive multisource rebate system, contracts were awarded to the best bidder and any other bidders who met specified minimum bid criteria (U.S. GAO, 1990).

system, in which no sealed bids were submitted and the low bidder did not win an exclusive contract, resulted in lower savings than under competitive bidding.[4] The greater savings realized under the competitive bidding system were attributed to the lack of strong inherent pressure for price competition in the infant formula industry (U.S. GAO, 1990).[5]

On November 10, 1989, P.L. 101-147 required States to use competitive bidding or an alternate method that yielded savings equal to or greater than that produced by competitive bidding to procure infant formula (Indian State agencies with 1,000 or fewer WIC participants are exempted from this requirement). Competitive bidding was defined as a procurement process in which the State WIC agency selects the single source (i.e., infant formula manufacturer) offering the lowest price for the infant formula, as determined by the submission of sealed bids.[6]

Since the infant formula market was dominated by a small number of manufacturers, there was concern that coordination of pricing strategies between the manufacturers was leading to high infant formula prices and large profits for the producers. In May 1990, the Senate Subcommittee on Antitrust, Monopolies, and Business Rights held a hearing on the pricing behavior of infant formula companies. At the hearing, the Chairman, Senator Howard Metzenbaum, referred to the formula companies' "campaign to undermine cost-containment efforts" in the WIC program as an example of the attempts of producers to "push prices higher" (U.S. Senate, 1990). At about that time, the Federal Trade Commission (FTC) began investigating potential anticompetitive practices in the infant formula industry. In June 1992, the FTC brought charges against the three largest domestic manufacturers of infant formula—Abbott Laboratories (parent company of Ross), Mead Johnson, and American Home Products (parent company of Wyeth)—alleging bid-rigging in connection with a WIC contract to provide infant formula in Puerto Rico (Federal Trade Commission, 1993). Mead Johnson and American Home Products agreed to settle charges by providing 3.6 million pounds of free infant formula to the WIC program (Mauskopf and Dean, 1990). In May 1994, the court ruled in favor of Abbott Laboratories (853 Federal Supplement 526, May 27, 1994).

The original cost-containment regulations published in 1989 required States to use competitive bidding to obtain infant formula, with the manufacturer offering the "lowest price" being awarded the contract. Historically, States awarded infant formula contracts to the bidder offering the lowest net costs (that is, the difference between the manufacturer's wholesale price for infant formula and the rebate offered to the State).[7] However, in the mid-1990s, several States began awarding their contracts to the bidder offering the highest total rebate (Larin, 1996).[8] Contracts awarded on the basis of highest total rebate favor manufacturers with high wholesale prices over those with low wholesale prices. P.L. 105-86, enacted in November 1997, requires that contracts be awarded to the bidder offering the lowest net price unless the average retail price for different brands of infant formula do not vary by more than 5 percent.

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[4] An analysis by GAO found that after statistically controlling for other factors, competitive sole-source contracts resulted in prices (for a 13-ounce can of milk-based infant formula) that were $0.36 lower than that of open market contracts (U.S. GAO, 1990).

[5] GAO states that the natural pressures for price competition between infant formula manufacturers are limited in the absence of competitively bid contracts due to: (1) the small number of infant formula producers; (2) the difficulty new competitors face in entering the domestic market; and (3) consumer selection of infant formula brands that may be relatively unresponsive to price differences among the brands (U.S. GAO, 1990).

[6] The best bid was determined by either the lowest net cost of infant formula or the highest rebate.

[7] At the time the regulations were published in 1998, there were only relatively small differences in the wholesale price of formula across the different brands.

[8] The States contended that retail prices were not related to wholesale prices, and if retail prices for the different brands of infant formula were similar, then the State would realize the greatest cost savings by awarding the contract to the bidder offering the largest rebate (Larin, 1996).

The two largest infant formula companies, Ross and Mead Johnson, have long dominated the WIC infant formula market. In fact, only two other infant formula manufacturers, Wyeth and Carnation, have ever won WIC sole-source competitive infant formula rebate contracts, and Wyeth stopped producing infant formula under its own name in 1996.[9] Since 1994, when most WIC State agencies switched to sole-source competitive rebate systems (excluding Indian State agencies with 1,000 or fewer WIC participants), Carnation has accounted for between 1 percent and 6 percent annually of the formula purchased in WIC (appendix table A-1). Mead Johnson has gained in market share over Ross in recent years and now accounts for over two-thirds of the WIC market.

[9] Two small infant formula manufacturers, Loma Linda and Rimaco, participated in several open market contracts in the early 1990s. These companies have since exited the infant formula market.

Appendix table A-1—Share of the WIC infant formula market by manufacturer, 1994-2000

Fiscal year	Ross	Mead Johnson	Wyeth	Carnation
		Percent		
1994	54.2	23.0	17.8	5.0
1995	48.5	32.8	13.7	5.1
1996	22.3	62.4	13.2	2.0
1997	31.0	67.4	0	1.4
1998	31.6	65.5	0	2.9
1999	25.8	70.1	0	4.2
2000	26.8	67.6	0	5.6

Source: Food and Nutrition Service, USDA.

Appendix B—Change in the Price of Infant Formula After a Change in the Holder of the WIC Contract by Market Area

Tables:

Appendix table B-1—Average retail price of milk-based powdered infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Albany	5	Ross	1.57	1.61	0.04	Mead Johnson	1.64	1.67	0.02
Atlanta	4	Ross	1.86	1.83	-0.03	Mead Johnson	1.89	1.93	0.04
Atlanta	19	Mead Johnson	2.31	2.32	0.02	Ross	2.44	2.50	0.06
Boise	8	Carnation	1.76	1.88	0.12	Mead Johnson	1.97	2.19	0.22
Boston	4	Mead Johnson	2.03	2.06	0.03	Wyeth	1.99	1.99	0.00
Boston	10	Wyeth	2.02	2.09	0.07	Mead Johnson	2.05	2.08	0.03
Buffalo/Rochester	5	Ross	1.87	1.87	0.00	Mead Johnson	1.90	1.92	0.03
Charlotte	4	Wyeth	1.99	1.96	-0.03	Mead Johnson	2.12	2.14	0.02
Chicago	9	Wyeth	2.33	2.35	0.02	Ross	2.40	2.61	0.21
Dallas/Ft Worth	20	Ross	2.50	2.53	0.03	Mead Johnson	2.52	2.56	0.04
Des Moines	20	Ross	2.49	2.63	0.14	Mead Johnson	2.37	2.55	0.19
Detroit	10	Wyeth	2.11	2.23	0.12	Ross	2.36	2.42	0.06
Grand Rapids	10	Wyeth	1.99	1.97	-0.01	Ross	1.93	2.07	0.14
Green Bay	10	Wyeth	2.37	2.31	-0.06	Ross	2.50	2.60	0.10
Harrisburg/Scranton	20	Mead Johnson	2.34	2.36	0.02	Ross	2.45	2.48	0.03
Hartford/Springfield	4	Mead Johnson	2.13	2.16	0.03	Wyeth	2.05	2.10	0.05
Hartford/Springfield	10	Wyeth	2.14	2.16	0.02	Mead Johnson	2.20	2.23	0.03
Houston	20	Ross	2.49	2.46	-0.03	Mead Johnson	2.27	2.34	0.07
Indianapolis	10	Wyeth	2.13	2.38	0.25	Ross	2.27	2.36	0.08
Indianapolis	24	Ross	2.31	2.33	0.02	Mead Johnson	2.10	2.37	0.28
Jacksonville	5	Ross	2.11	2.18	0.07	Mead Johnson	2.12	2.20	0.09
Jacksonville	21	Mead Johnson	2.49	2.51	0.02	Carnation	2.04	2.14	0.10
Knoxville	23	Mead Johnson	2.39	2.42	0.04	Ross	2.48	2.52	0.04
Little Rock	4	Ross	2.12	2.14	0.02	Mead Johnson	2.08	2.18	0.09
Los Angeles	7	Ross	2.39	2.23	-0.17	Mead Johnson	2.25	2.42	0.17
Miami/Ft Lauderdale	5	Ross	2.15	2.18	0.03	Mead Johnson	2.11	2.21	0.10
Miami/Ft Lauderdale	21	Mead Johnson	2.44	2.52	0.08	Carnation	2.06	2.24	0.19
Milwaukee,	10	Wyeth	2.26	2.28	0.01	Ross	2.48	2.57	0.09
Minneapolis/St Paul	20	Ross	2.44	2.29	-0.15	Mead Johnson	2.33	2.31	-0.02
Nashville	23	Mead Johnson	2.48	2.49	0.01	Ross	2.47	2.62	0.16
Oklahoma City	10	Wyeth	2.16	2.19	0.04	Mead Johnson	2.29	2.28	-0.01
Omaha	24	Ross	2.49	2.58	0.09	Mead Johnson	2.09	2.44	0.35
Orlando	5	Ross	2.10	2.18	0.08	Mead Johnson	2.12	2.21	0.10
Orlando	21	Mead Johnson	2.42	2.52	0.10	Carnation	2.07	2.20	0.13
Peoria/Springfield	9	Wyeth	2.10	2.06	-0.04	Ross	2.13	2.36	0.23
Pittsburgh	20	Mead Johnson	2.19	2.22	0.03	Ross	2.42	2.42	0.00
Portland	8	Carnation	1.84	1.94	0.09	Mead Johnson	1.86	2.16	0.30
Providence	4	Mead Johnson	2.05	2.07	0.03	Wyeth	2.05	2.13	0.08
Providence	10	Wyeth	2.11	2.22	0.11	Mead Johnson	2.13	2.16	0.03

See notes at end of table.

Continued—

Appendix table B-1—Average retail price of milk-based powdered infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000—Continued

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Raleigh/Greensboro	4	Wyeth	1.99	2.06	0.07	Mead Johnson	2.12	2.15	0.03
Sacramento	7	Ross	2.19	2.19	0.00	Mead Johnson	2.20	2.26	0.06
Salt Lake City	8	Carnation	1.67	1.86	0.18	Mead Johnson	1.98	2.24	0.26
San Antonio/ Corpus Christi	20	Ross	2.50	2.34	-0.16	Mead Johnson	2.23	2.16	-0.07
San Diego	7	Ross	2.19	2.18	0.00	Mead Johnson	2.23	2.25	0.02
San Francisco/Oakland	7	Ross	2.17	2.18	0.01	Mead Johnson	2.11	2.25	0.14
Seattle/Tacoma	8	Carnation	1.90	1.91	0.01	Mead Johnson	2.07	2.26	0.19
Spokane	8	Carnation	1.80	1.79	-0.01	Mead Johnson	2.10	2.07	-0.04
Syracuse	5	Ross	1.84	1.86	0.02	Mead Johnson	1.87	1.90	0.03
Tampa/St Petersburg	5	Ross	2.09	2.15	0.06	Mead Johnson	2.12	2.18	0.06
Tampa/St Petersburg	21	Mead Johnson	2.45	2.53	0.08	Carnation	2.04	2.17	0.13
Tulsa	10	Wyeth	2.27	2.21	-0.06	Mead Johnson	2.35	2.42	0.07
Average (39 market areas— excludes shaded areas)			2.17	2.19	0.03		2.14	2.23	0.10
Average (all 51 market areas)			2.17	2.20	0.03		2.16	2.26	0.09

Note: shaded lines represent market areas in which Wyeth lost the WIC contract in 1996. Averages are based on unweighted data.

[1]Calender year quarter since 1st quarter 1994.

Appendix table B-2—Average retail price of milk-based liquid concentrate infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Albany	5	Ross	1.92	2.05	0.14	Mead Johnson	1.90	2.08	0.18
Atlanta	4	Ross	2.30	2.33	0.03	Mead Johnson	2.27	2.36	0.09
Atlanta	19	Mead Johnson	2.84	2.85	0.01	Ross	2.82	2.89	0.07
Boise	8	Carnation	1.98	2.22	0.24	Mead Johnson	2.09	2.74	0.65
Boston	4	Mead Johnson	2.38	2.37	-0.01	Wyeth	2.27	2.31	0.03
Boston	10	Wyeth	2.35	2.39	0.04	Mead Johnson	2.34	2.53	0.19
Buffalo/Rochester	5	Ross	2.31	2.39	0.08	Mead Johnson	2.30	2.41	0.12
Charlotte	4	Wyeth	2.27	2.32	0.05	Mead Johnson	2.41	2.42	0.02
Chicago	9	Wyeth	2.78	2.76	-0.03	Ross	2.72	3.00	0.28
Dallas/Ft Worth	20	Ross	2.92	3.06	0.14	Mead Johnson	2.71	2.87	0.16
Des Moines	20	Ross	2.68	2.64	-0.03	Mead Johnson	2.62	3.09	0.46
Detroit	10	Wyeth	2.53	2.68	0.15	Ross	2.54	2.61	0.07
Grand Rapids	10	Wyeth	2.45	2.49	0.04	Ross	2.22	2.36	0.13
Green Bay	10	Wyeth	2.63	2.64	0.02	Ross	2.80	2.85	0.06
Harrisburg/Scranton	20	Mead Johnson	2.79	2.82	0.03	Ross	2.75	2.80	0.04
Hartford/Springfield	4	Mead Johnson	2.45	2.45	0.00	Wyeth	2.38	2.44	0.06
Hartford/Springfield	10	Wyeth	2.50	2.50	0.00	Mead Johnson	2.53	2.65	0.12
Houston	20	Ross	2.72	2.75	0.03	Mead Johnson	2.74	2.81	0.07
Indianapolis	10	Wyeth	2.48	2.65	0.17	Ross	2.50	2.60	0.10
Indianapolis	24	Ross	2.73	2.92	0.19	Mead Johnson	2.45	2.83	0.39
Jacksonville	5	Ross	2.41	2.49	0.08	Mead Johnson	2.41	2.50	0.10
Jacksonville	21	Mead Johnson	2.94	2.99	0.05	Carnation	2.28	2.40	0.12
Knoxville	23	Mead Johnson	2.90	2.93	0.03	Ross	2.78	2.85	0.07
Little Rock	4	Ross	2.41	2.33	-0.08	Mead Johnson	2.57	2.68	0.11
Los Angeles	7	Ross	2.70	2.53	-0.17	Mead Johnson	2.62	2.83	0.21
Miami/Ft Lauderdale	5	Ross	2.43	2.49	0.07	Mead Johnson	2.40	2.49	0.09
Miami/Ft Lauderdale	21	Mead Johnson	2.96	3.06	0.10	Carnation	2.30	2.51	0.21
Milwaukee	10	Wyeth	2.56	2.61	0.04	Ross	2.79	2.76	-0.03
Minneapolis/St Paul	20	Ross	2.81	2.74	-0.07	Mead Johnson	2.84	3.01	0.17
Nashville	23	Mead Johnson	3.03	3.01	-0.02	Ross	2.87	3.05	0.18
Oklahoma City	10	Wyeth	2.54	2.62	0.07	Mead Johnson	2.62	2.65	0.03
Omaha	24	Ross	2.84	2.74	-0.10	Mead Johnson	2.46	2.89	0.44
Orlando	5	Ross	2.42	2.50	0.08	Mead Johnson	2.40	2.50	0.10
Orlando	21	Mead Johnson	2.95	3.09	0.14	Carnation	2.34	2.52	0.18
Peoria/Springfield	9	Wyeth	2.51	2.52	0.01	Ross	2.24	2.55	0.32
Pittsburgh	20	Mead Johnson	2.57	2.61	0.04	Ross	2.54	2.59	0.04
Portland	8	Carnation	2.04	2.13	0.10	Mead Johnson	2.24	2.61	0.37
Providence	4	Mead Johnson	2.29	2.37	0.08	Wyeth	2.26	2.41	0.16
Providence	10	Wyeth	2.27	2.47	0.20	Mead Johnson	2.46	2.64	0.18

See notes at end of table.

Continued—

Appendix table B-2—Average retail price of milk-based liquid concentrate infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000—Continued

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Raleigh/Greensboro	4	Wyeth	2.28	2.37	0.10	Mead Johnson	2.41	2.45	0.03
Sacramento	7	Ross	2.59	2.60	0.00	Mead Johnson	2.58	2.66	0.08
Salt Lake City	8	Carnation	1.98	2.27	0.28	Mead Johnson	2.78	3.17	0.40
San Antonio/ Corpus Christi	20	Ross	2.77	2.75	-0.02	Mead Johnson	2.75	2.73	-0.03
San Diego	7	Ross	2.52	2.47	-0.05	Mead Johnson	2.57	2.69	0.11
San Francisco/Oakland	7	Ross	2.61	2.59	-0.02	Mead Johnson	2.49	2.63	0.14
Seattle/Tacoma	8	Carnation	2.38	2.31	-0.07	Mead Johnson	2.51	2.65	0.14
Spokane	8	Carnation	2.02	2.00	-0.02	Mead Johnson	2.39	2.40	0.01
Syracuse	5	Ross	2.22	2.25	0.03	Mead Johnson	2.22	2.30	0.09
Tampa/St Petersburg	5	Ross	2.39	2.49	0.10	Mead Johnson	2.40	2.49	0.09
Tampa/St Petersburg	21	Mead Johnson	3.00	3.02	0.01	Carnation	2.35	2.49	0.14
Tulsa	10	Wyeth	2.64	2.50	-0.14	Mead Johnson	2.81	2.92	0.11
Average (39 market areas— excludes shaded areas)			2.53	2.57	0.04		2.47	2.63	0.16
Average (all 51 market areas)			2.53	2.57	0.04		2.49	2.64	0.15

Note: shaded lines represent market areas in which Wyeth lost the WIC contract in 1996. Averages are based on unweighted data.

[1]Calender year quarter since 1st quarter 1994.

Appendix table B-3—Average retail price of soy-based powdered infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Albany	5	Ross	1.80	1.86	0.06	Mead Johnson	1.88	1.95	0.07
Atlanta	4	Ross	1.97	1.98	0.01	Mead Johnson	1.88	1.97	0.08
Atlanta	19	Mead Johnson	2.64	2.65	0.02	Ross	2.56	2.59	0.03
Boston	4	Mead Johnson	2.20	2.24	0.05	Wyeth	1.98	1.94	-0.04
Boston	10	Wyeth	1.94	1.96	0.01	Mead Johnson	2.28	2.32	0.04
Buffalo/Rochester	5	Ross	2.08	2.10	0.02	Mead Johnson	1.98	2.07	0.08
Charlotte	4	Wyeth	1.85	1.91	0.06	Mead Johnson	2.26	2.29	0.02
Chicago	9	Wyeth	2.28	2.31	0.03	Ross	2.60	2.75	0.15
Dallas/Ft Worth	20	Ross	2.73	2.76	0.03	Mead Johnson	2.91	2.96	0.06
Denver	8	Ross	2.18	2.20	0.02	Mead Johnson	2.26	2.27	0.01
Des Moines	20	Ross	2.61	2.77	0.16	Mead Johnson	2.74	2.97	0.23
Detroit	10	Wyeth	2.00	2.21	0.21	Ross	2.39	2.42	0.04
Grand Rapids	10	Wyeth	1.90	1.86	-0.04	Ross	2.02	2.05	0.03
Green Bay	10	Wyeth	2.18	2.17	-0.01	Ross	2.68	2.74	0.07
Harrisburg/Scranton	20	Mead Johnson	2.67	2.67	0.01	Ross	2.53	2.57	0.04
Hartford/Springfield	4	Mead Johnson	2.29	2.32	0.02	Wyeth	2.03	2.09	0.05
Hartford/Springfield	10	Wyeth	2.14	2.15	0.01	Mead Johnson	2.38	2.45	0.07
Houston	20	Ross	2.55	2.55	0.00	Mead Johnson	2.50	2.59	0.09
Indianapolis	10	Wyeth	2.05	2.22	0.17	Ross	2.32	2.35	0.04
Indianapolis	24	Ross	2.38	2.44	0.06	Mead Johnson	2.58	2.73	0.15
Jacksonville	5	Ross	2.26	2.34	0.08	Mead Johnson	2.26	2.36	0.10
Jacksonville	21	Mead Johnson	2.69	2.80	0.12	Carnation	1.91	2.01	0.09
Knoxville	23	Mead Johnson	2.71	2.76	0.05	Ross	2.52	2.56	0.03
Little Rock	4	Ross	2.41	2.48	0.07	Mead Johnson	2.45	2.48	0.03
Los Angeles	7	Ross	2.45	2.36	-0.09	Mead Johnson	2.37	2.48	0.11
Miami/Ft Lauderdale	5	Ross	2.28	2.35	0.07	Mead Johnson	2.26	2.34	0.08
Miami/Ft Lauderdale	21	Mead Johnson	2.72	2.81	0.09	Carnation	1.92	2.04	0.12
Milwaukee	10	Wyeth	2.15	2.17	0.01	Ross	2.75	2.76	0.01
Minneapolis/St Paul	20	Ross	2.58	2.46	-0.12	Mead Johnson	2.69	2.65	-0.04
Nashville	23	Mead Johnson	2.76	2.73	-0.03	Ross	2.55	2.75	0.20
Oklahoma City	10	Wyeth	2.06	2.17	0.12	Mead Johnson	2.53	2.55	0.02
Omaha	24	Ross	2.67	2.67	0.00	Mead Johnson	2.61	2.73	0.12
Orlando	5	Ross	2.26	2.35	0.09	Mead Johnson	2.26	2.35	0.09
Orlando	21	Mead Johnson	2.71	2.87	0.16	Carnation	1.93	2.03	0.10
Peoria/Springfield	9	Wyeth	2.00	2.01	0.00	Ross	2.36	2.48	0.12
Pittsburgh	20	Mead Johnson	2.64	2.71	0.07	Ross	2.50	2.49	-0.01
Providence	4	Mead Johnson	2.21	2.23	0.02	Wyeth	2.06	2.06	0.00
Providence	10	Wyeth	2.07	2.13	0.06	Mead Johnson	2.23	2.32	0.09
Raleigh/Greensboro	4	Wyeth	1.85	1.94	0.08	Mead Johnson	2.26	2.29	0.03

See notes at end of table.

Continued—

Appendix table B-3—Average retail price of soy-based powdered infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000—Continued

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Sacramento	7	Ross	2.39	2.37	-0.02	Mead Johnson	2.44	2.46	0.02
San Antonio/ Corpus Christi	20	Ross	2.59	2.60	0.01	Mead Johnson	2.59	2.58	-0.01
San Diego	7	Ross	2.37	2.36	-0.01	Mead Johnson	2.35	2.42	0.07
San Francisco/Oakland	7	Ross	2.36	2.37	0.01	Mead Johnson	2.38	2.40	0.03
Syracuse	5	Ross	2.04	2.08	0.04	Mead Johnson	2.02	2.10	0.07
Tampa/St Petersburg	5	Ross	2.25	2.31	0.06	Mead Johnson	2.26	2.34	0.08
Tampa/St Petersburg	21	Mead Johnson	2.77	2.84	0.06	Carnation	1.90	2.00	0.09
Tulsa	10	Wyeth	2.15	2.10	-0.05	Mead Johnson	2.65	2.67	0.03
Average (35 market areas— excludes shaded areas)			2.40	2.44	0.04		2.30	2.37	0.06
Average (all 47 market areas)			2.32	2.35	0.04		2.34	2.40	0.06

Note: shaded lines represent market areas in which Wyeth lost the WIC contract in 1996. Averages are based on unweighted data.

[1]Calender year quarter since 1st quarter 1994.

Appendix table B-4—Average retail price of soy-based liquid concentrate infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Albany	5	Ross	1.95	1.99	0.04	Mead Johnson	1.90	2.13	0.23
Atlanta	4	Ross	2.37	2.45	0.08	Mead Johnson	2.36	2.46	0.10
Atlanta	19	Mead Johnson	3.06	3.06	0.01	Ross	2.95	3.00	0.04
Boston	4	Mead Johnson	2.41	2.44	0.03	Wyeth	2.43	2.46	0.03
Boston	10	Wyeth	2.45	2.50	0.04	Mead Johnson	2.47	2.50	0.03
Buffalo/Rochester	5	Ross	2.34	2.42	0.07	Mead Johnson	2.42	2.48	0.06
Charlotte	4	Wyeth	2.40	2.48	0.08	Mead Johnson	2.55	2.57	0.02
Chicago	9	Wyeth	2.85	2.85	0.00	Ross	2.72	3.07	0.35
Dallas/Ft Worth	20	Ross	2.85	3.03	0.18	Mead Johnson	3.34	3.45	0.11
Denver	8	Ross	2.56	2.56	0.00	Mead Johnson	2.57	2.57	0.00
Des Moines	20	Ross	2.85	3.01	0.15	Mead Johnson	3.28	3.29	0.01
Detroit	10	Wyeth	2.64	2.74	0.10	Ross	2.74	2.80	0.05
Grand Rapids	10	Wyeth	2.50	2.44	-0.06	Ross	2.29	2.36	0.07
Green Bay	10	Wyeth	2.80	2.85	0.04	Ross	2.96	3.08	0.13
Harrisburg/Scranton	20	Mead Johnson	3.04	3.02	-0.02	Ross	2.93	2.97	0.04
Hartford/Springfield	4	Mead Johnson	2.57	2.57	0.01	Wyeth	2.46	2.54	0.08
Hartford/Springfield	10	Wyeth	2.64	2.66	0.02	Mead Johnson	2.70	2.79	0.09
Houston	20	Ross	2.86	2.94	0.08	Mead Johnson	2.86	2.95	0.09
Indianapolis	10	Wyeth	2.64	2.99	0.35	Ross	2.51	2.60	0.09
Indianapolis	24	Ross	2.70	2.96	0.26	Mead Johnson	2.48	2.86	0.38
Jacksonville	5	Ross	2.59	2.65	0.05	Mead Johnson	2.56	2.66	0.11
Jacksonville	21	Mead Johnson	3.21	3.28	0.08	Carnation	2.12	2.22	0.10
Knoxville	23	Mead Johnson	3.12	3.18	0.06	Ross	2.96	3.04	0.07
Little Rock	4	Ross	2.56	2.49	-0.06	Mead Johnson	2.58	2.54	-0.04
Los Angeles	7	Ross	2.80	2.73	-0.07	Mead Johnson	2.78	2.82	0.04
Miami/Ft Lauderdale	5	Ross	2.57	2.69	0.12	Mead Johnson	2.54	2.69	0.15
Miami/Ft Lauderdale	21	Mead Johnson	3.32	3.35	0.03	Carnation	2.10	2.30	0.21
Milwaukee	10	Wyeth	2.78	2.77	0.00	Ross	3.07	3.08	0.01
Minneapolis/St Paul	20	Ross	2.97	2.88	-0.10	Mead Johnson	3.06	3.14	0.07
Nashville	23	Mead Johnson	3.24	3.22	-0.02	Ross	3.03	3.29	0.26
Oklahoma City	10	Wyeth	2.65	2.65	0.01	Mead Johnson	2.70	2.82	0.12
Omaha	24	Ross	3.15	2.98	-0.17	Mead Johnson	2.97	3.16	0.19
Orlando	5	Ross	2.59	2.69	0.10	Mead Johnson	2.54	2.70	0.16
Orlando	21	Mead Johnson	3.19	3.30	0.11	Carnation	2.17	2.32	0.15
Peoria/Springfield	9	Wyeth	2.72	2.54	-0.18	Ross	2.37	2.66	0.29
Pittsburgh	20	Mead Johnson	2.80	2.87	0.07	Ross	2.79	2.84	0.04
Providence	4	Mead Johnson	2.39	2.36	-0.03	Wyeth	2.49	2.54	0.05
Providence	10	Wyeth	2.58	2.63	0.06	Mead Johnson	2.53	2.67	0.14
Raleigh/Greensboro	4	Wyeth	2.40	2.50	0.09	Mead Johnson	2.56	2.61	0.05

See notes at end of table.

Continued—

Appendix table B-4—Average retail price of soy-based liquid concentrate infant formula by market area, pre- and postchange in WIC contract holder, 1994-2000—Continued

Market area	Time of change[1]	Old contract holder	Pre-change price	Post-change price	Dollar change in price	New contract holder	Pre-change price	Post-change price	Dollar change in price
			Dollars	*Dollars*			*Dollars*	*Dollars*	
Sacramento	7	Ross	2.75	2.72	-0.03	Mead Johnson	2.71	2.74	0.03
San Antonio/ Corpus Christi	20	Ross	2.87	2.86	-0.02	Mead Johnson	3.03	2.95	-0.08
San Diego	7	Ross	2.72	2.66	-0.06	Mead Johnson	2.73	2.79	0.06
San Francisco/Oakland	7	Ross	2.70	2.70	0.00	Mead Johnson	2.68	2.73	0.04
Syracuse	5	Ross	2.27	2.28	0.01	Mead Johnson	2.31	2.39	0.08
Tampa/St Petersburg	5	Ross	2.54	2.66	0.12	Mead Johnson	2.55	2.69	0.13
Tampa/St Petersburg	21	Mead Johnson	3.23	3.31	0.08	Carnation	2.14	2.25	0.11
Tulsa	10	Wyeth	2.77	2.71	-0.06	Mead Johnson	2.94	3.06	0.12
Average (35 market areas— excludes shaded areas)			2.74	2.78	0.04		2.63	2.72	0.09
Average (all 47 market areas)			2.72	2.76	0.04		2.64	2.74	0.10

Note: shaded lines represent market areas in which Wyeth lost the WIC contract in 1996. Averages are based on unweighted data.

[1]Calender year quarter since 1st quarter 1994.

Appendix C—The Economic Model of the Retail Infant Formula Market

This appendix summarizes the results of an economic model (hereafter, "WIC model") of the factors that influence the supermarket retail prices of infant formula, with special attention devoted to the role of WIC and its infant formula rebate program. The WIC model generalizes the standard multi-firm Cournot oligopoly model to a new setting that features two differentiated products, heterogeneous consumers who are segmented by income, and the presence of WIC and its rebate program. A forthcoming companion report, *An Economic Model of WIC, the Infant Formula Rebate Program, and the Retail Price of Infant Formula*, provides the formal mathematical development of the WIC model and examines the model's results more fully.

Under sole-source procurement, the formula provided by the contract-winning manufacturer receives *all* of the infant formula demand of WIC households (hereafter, "WIC demand") and all other manufacturers' brands receive *none* of the WIC demand.[1] In September 2000, each of the WIC State agencies of the 50 States was using sole-source procurement. A critical feature of the WIC model's specification is its inclusion of not one but two formula brands (two "products"), a feature that is required to identify the simultaneous *interactions* between the prices of contract and noncontract brands of formula.

The WIC model constitutes the theoretical framework for the specification and interpretation of the regression models presented in this report. Of the various factors that may affect supermarket retail prices of infant formula, two WIC-related factors receive particular attention:

- the effects on the prices of the contract and noncontract brands of formula of an increase in the *relative size of WIC* (as measured by the number of formula-fed WIC infants relative to the number of formula-fed non-WIC infants)
- the effects on the price of a manufacturer's infant formula product of a change in the product's contract brand status between being the contract brand and being a noncontract brand.

The WIC model focuses on the retail markup in supermarkets.[2] It treats the wholesale price as an exogenous variable independent of a manufacturer's contract brand status in any one market area. The model assumes a manufacturer's wholesale price of formula is the same across supermarkets, but does not restrict the manufacturers' wholesale prices to equal one another.

The WIC model assumes that there are three distinct formula-buying groups or market segments:

H - high-income households;
L - low-income non-WIC households; or
W - low-income households that receive vouchers in the WIC program.[3]

[1] An exception to this general statement is that the WIC State agency can issue formula provided by a different manufacturer to accommodate religious eating patterns or when medical documentation supports the use of another infant formula product.

[2] Because the behavior of supermarket retail prices can be expected to differ systematically based on the distribution system used by a State, the discussion in this appendix and the report's regression analysis both consider only those market areas in which the retail food delivery system is used (as opposed to the Direct Distribution system, used in Mississippi, or the Home Distribution system, used in Vermont).

[3] The model sets the income "cutoff" that divides *low-income* from *high-income* households above the income threshold for WIC income eligibility (185 percent of poverty) instead of equal to or below that threshold. Thus, by definition of the term *low-income*, there is some positive number of low-income non-WIC households ($\boldsymbol{L} > 0$) even if all households (with infants) with income below 185 percent of poverty participate in WIC.

Two fundamental aspects of the model's structure pertain to the price responsiveness of these three groups: (1) The model assumes a low-income non-WIC household is relatively more responsive to an increase in the price of an infant formula product, switching to substitutes (perhaps especially discount store formula) more readily than do high-income non-WIC households; and (2) It assumes that a WIC household does not respond at all to an increase in price—i.e., that WIC demand is completely insensitive to price (perfectly inelastic)—because WIC households receive food instruments ("vouchers") for a fixed amount of formula rather than paying out of pocket as low-income non-WIC and higher income households do. Salant (1999) and Post and Wubbenhorst (1989) each adopted one of these assumptions about price sensitivities. Their two arguments regarding the effects of WIC, relative to the absence of WIC, are compatible and both are adapted here to consider the price effects of an increase in the relative size of WIC.

Salant considered the behavior of a monopolistic infant formula manufacturer and examined major manufacturers' wholesale price series. Based on a "reservation price" monopoly model, Salant argued: "by removing the portion of the population with the lowest reservation price for infant formula from the general market, the WIC program inevitably raised the profit-maximizing monopoly price … What previously restrained [the monopolist] was the recognition that a price increase would drive away the poorer customers; but once the WIC program absorbs these customers, the monopolist has nothing further to lose if he raises the price … As more infants are added to the WIC program, the model predicts that the [monopolist] will continue to raise the price to non-WIC customers."[4] The pricing behavior identified by Salant does not require that the firm be a monopolist or a manufacturer: his economic reasoning also applies to the WIC model in which multiple supermarkets engage in (imperfect) competition in the establishment of a retail price.

Salant's argument that WIC "removes" from the general market the (low-income) households with the *lowest reservation price* is recast by the WIC model as the argument that WIC "removes" from the general market the (low-income) households that are relatively *more price sensitive*. When the relative size of WIC increases, some additional low-income non-WIC households leave the out-of-pocket segment of the market and enter the WIC segment, changing the mix of out-of-pocket households towards relatively more ***H*** and less ***L***. This change in the mix lowers the overall price-sensitivity of the out-of-pocket households, which is a weighted average of their segment-specific price sensitivities. As a result of the increase in the relative size of WIC, each of the supermarket chains will find it profit-maximizing to increase retail price (of the contract brand), holding other factors constant. The WIC model calls this price-increasing effect of WIC the *out-of-pocket composition effect* because the effect depends on whether out-of-pocket demand is composed of relatively few or many low-income households.

The second mechanism by which WIC decreases the price sensitivity of demand was identified by Post and Wubbenhorst (1989). They argued that by providing WIC households with vouchers, the WIC program produces a "customer that is essentially unconcerned with the price she or he is paying." When the relative size of WIC increases, the mix of demands in total market demand is changed, with relatively fewer *price-sensitive* out-of-pocket households and relatively more *price-insensitive* WIC households resulting in a decrease in overall price sensitivity. As a result of the increase in the relative size of WIC, each of the supermarket chains will find it profit-maximizing

[4] Salant noted that this effect is analogous to pricing effects that seem to be found in the markets for certain pharmaceutical products. In some instances, the price of a brand-name drug *increased* after entry into the market by generic drugs. One explanation is that consumers who were most price sensitive switched to the generic drug, leaving the less price-sensitive customers in the market for the brand-name product and prompting an increase in the brand-name product's price. Similar pricing behavior was found in a broad study of thirty-two processed food and beverages industries by Ward et al. (2002), who found that brand-name firms' prices tend to rise when the share of private-label firms increase.

to increase retail price (of the contract brand), holding other factors constant. The WIC model calls this price-increasing effect of WIC the *voucher effect*.

While WIC does "remove" a set of low-income households from the out-of-pocket segment of the retail food system, as Salant emphasized, WIC also provides vouchers that make the WIC households price insensitive, as Post and Wubbenhorst emphasized, which "adds" those *same* households *back into* the retail food system. Supermarket retail price (of the contract brand) is positively related to the relative to size of WIC due to both mechanisms. Although the out-of-pocket composition effect and the voucher effect both affect the mix of households in the infant formula market, the two effects are different: the former changes the mix within the group of out-of-pocket households, while the latter changes the mix between the out-of-pocket households and the WIC households. A way of describing both effects at once is to state that WIC *converts* out-of-pocket low income households (whose price sensitivity is *greater* than for high-income households) into WIC households (whose price sensitivity—of zero—is *smaller* than for high-income households).[5]

The statistical analysis of the report is based on the retailer-behavior hypothesis, which states that supermarket infant formula prices (P) are determined, in part, by the *relative size of WIC* (S). An additional family-behavior hypothesis should be considered, which states that higher infant formula prices lead to increased participation in WIC since the value and attractiveness of the WIC benefit rises when infant formula prices are higher. Thus, the retailer-behavior hypothesis states that P depends on S while the family-behavior hypothesis states that S depends on P. If both hypotheses are valid—in the relevant price range found in the 1994-2000 sample—then observed data for P and S are generated by two simultaneous equations.[6] The report focuses exclusively on the retailer hypothesis, treating S as an exogenous factor, based in part on the belief that the vast majority of eligibles participated in WIC during the 1994-2000 period. While one can easily imagine that some, even many, WIC-eligible families are indeed attracted to WIC and apply for the program due (in part) to infant formula prices, that scenario by itself does not mean that the family-behavior hypothesis is pertinent statistically *in the relevant price range*. It is thought that those families who base WIC participation decisions on infant formula prices do so well before infant formula prices reach the levels observed in the data, so that—on the margin—variation in price does not affect participation decisions of the remaining eligible nonparticipants. Technically, the family-behavior function $S = g(P)$ is thought to be strictly concave with a slope $g'(P)$ approaching zero in the relevant price range.

The designation of a particular manufacturer as the contract brand may do more than bring WIC demand to its product. Non-WIC demand may be drawn to the contract brand for either of two reasons identified by the GAO (1998) and others. First, doctors or hospitals may tend to promote the State's contract brand, either through recommendations or the provision of formula samples, and such promotions may lead to a brand-inducement behavior by which some number of non-WIC households favor the contract brand when making their out-of-pocket formula purchase. Second, some number of non-WIC households may favor the brand that has a greater presence on the supermarket shelf.

[5] The concept of *converting* low-income households from non-WIC to WIC participation helps clarify how there are two answers to the seemingly simple question: "Are WIC households more sensitive or less sensitive to price than high-income households?" The answer depends on whether the price sensitivity of WIC households is considered *ex ante* or *ex post* to their participation in WIC.

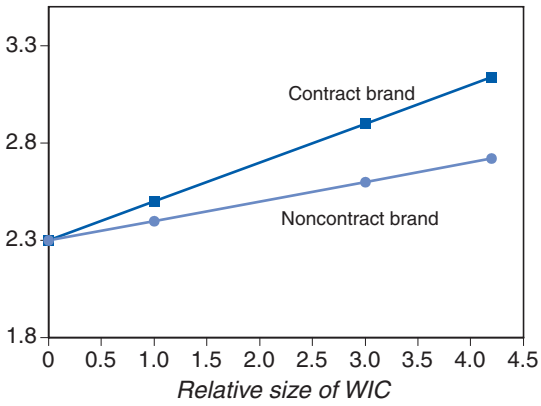
[6] It is believed that during 1994-2000, WIC funding was sufficient to support participation by all eligible households who chose to enroll their infants in the program. If WIC funding had been more limited, then it is possible that an increase in infant formula prices would have *decreased* WIC participation by (formula-fed) infants—even if it increased the number of applicants—because less formula can be purchased with a fixed limited budget when price increases.

While it may be intuitive that an increase in the relative size of WIC induces supermarkets to increase the retail price of the sole brand of formula for which WIC vouchers can be redeemed, it may at first seem unlikely that an increase in the relative size of WIC has any price effect on the noncontract brands. However, the WIC model identifies a possible connection between the prices of the contract and noncontract brands. Non-WIC households may consider various manufacturers' brands to be substitutes for one another. If so, then changes in the relative size of WIC (S) do not leave the price of the noncontract brand unaffected. Instead, as illustrated in appendix figure C-1, suppose the value for the relative size of WIC is 3 in market area B (meaning that three-fourths of the area's formula-fed infants are WIC participants) while the corresponding value for market area A is 1 (meaning that half of the area's formula-fed infants are WIC participants). Then supermarkets in B establish a price for the contract brand that is high compared with the price of the contract brand in A. This difference in turn results in a shift in demand by non-WIC households from the contract to the noncontract brand in B that is large compared with the corresponding shift in A. This in turn results in supermarkets in B establishing a price for the noncontract brand that is higher than the price of the noncontract brand in A. The three main results exhibited by the figure are:

Appendix figure C-1

Theoretical relationship between retail infant formula prices and *relative size of WIC*, contract brand vs. noncontract brand

Dollars per 26 ounces reconstituted



Note: *Relative size of WIC* equals the ratio of the number of formula-fed WIC infants and the number of formula-fed non-WIC infants.

- For a market area's contract brand, an increase in the relative size of WIC increases supermarket retail price, holding other factors constant; this change corresponds to a movement along the price line for the contract brand.

- For a market area's noncontract brand, an increase in the relative size of WIC increases supermarket retail price, holding other factors constant; this change corresponds to a movement along the price line for the noncontract brand.

- For a given manufacturer in a given market area, if its product is the contract brand, then its retail price is higher than the manufacturer's price would be in that area if its product were a noncontract brand, holding other factors constant; this change corresponds to a vertical movement between the noncontract and contract brand price lines at a given value of the relative size of WIC variable.[7]

Supermarkets take consumer substitution behaviors into account when establishing the prices of the interrelated brands. If households do not consider various manufacturers' brands to be substitutes, then an increase in the relative size of WIC increases only the price of the contract brand:

[7] Strictly speaking, appendix figure C-1 is most accurate for this scenario in which the effect of changing a single manufacturer's status between contract brand and noncontract brand is considered. If instead a comparison is made for a given market area between the contract and noncontract brand prices for two different manufacturers, the intercepts of the contract and noncontract brand price lines would not necessarily coincide.

the noncontract brand price line would be horizontal (not shown). The regression analysis reveals what the retail price data show about the slope of noncontract brand price lines, by manufacturer and product type.

As noted, the WIC model assumes that the price sensitivities of high-income non-WIC consumers are lower than those of low-income non-WIC consumers. The regression analysis includes median household income as an independent variable with the expectation that an increase in a market area's household income results in an increase in the retail price established by supermarkets.

The role played by the mix or composition of out-of-pocket households ***H*** and ***L*** was also explained by the model. No readily available data compare the middle and upper reaches of the income distribution for these two household segments. Instead, a market area's Poverty Rate is assumed to capture the general location of the area's income distribution, and the Poverty Rate is included in the price regressions to proxy for the presence of the low-income non-WIC households (whose incomes in fact exceed the poverty line) relative to the high-income non-WIC households at the high end of the income distribution. An increase in the poverty rate is expected to increase the overall price sensitivity of the out-of-pocket segment of the market, and thereby result in a decrease in the supermarket retail price.[8]

According to the WIC model, another factor that affects supermarket price is the ease (of the out-of-pocket households) of switching to lower priced formula sold in the discount store sector in response to an increase in the supermarket retail price. The price sensitivity of demand for *supermarket* formula increases due to an increase in the number of *discount* stores (which compete with supermarkets for infant formula consumers), holding other factors constant, which in turn would induce supermarkets to establish a lower supermarket retail price. In order to adjust for the scale of population in a market area, the regression analysis uses the number of discount stores per 100,000 people as its measure of the presence of discount stores.

An increase in the number of (equally sized) supermarkets lowers supermarket *concentration*, whether concentration is measured by the Herfindahl-Hirschman Index, the four-firm concentration ratio, or any other measure of concentration. Typically, economic theory predicts a positive relationship between concentration and price, reflecting some combination of market power influences and tacit (or explicit) collusion. Indeed, the formal WIC model discussed so far in this appendix predicts a positive price-concentration relationship due to its underlying Cournot model structure. However, formula (and, possibly, a select number of other supermarket products) may exhibit a negative price-concentration relationship—contrary to the Cournot and WIC models—if two conditions are both met.

Suppose that the Cournot model is correct for most supermarket products—i.e., a typical supermarket item has a positive price-concentration relationship. If so, then in a highly concentrated market area a typical item will have a high price-cost margin (relative to the margin in a less concentrated area)—making a marginal customer especially valuable to the supermarket in the highly concentrated area. In addition, suppose that infant formula exhibits what may be called "attractor" characteristics that lead (at least some) customers to change shopping location in pursuit of a low-priced "attractor" item, draws them to the supermarket and results in joint purchases with other items. If both conditions are met, then supermarkets in a high-concentration area may establish a relatively low supermarket price for infant formula as they seek to lure customers to purchase the high-margin

[8] It would be more difficult to predict the expected sign for the poverty rate if the *relative size of WIC* were not included in the regression. In this case, the poverty rate could reflect two factors—the presence of WIC households (relative to non-WIC households) and the presence of low-income non-WIC households (relative to high-income non-WIC households)—that have price effects of opposite signs.

items (through joint sales). In this case, a *positive* price-concentration relationship for most supermarket items combined with "attractor" characteristics for infant formula result in a *negative* price-concentration relationship for infant formula. At an extremely high level of concentration, holding other factors constant, the supermarket retail price of infant formula could fall so low that it drops below the wholesale cost, making infant formula a loss-leader. While the concept of loss-leader pricing is familiar, the argument here is novel in that it attributes the practice to supermarket concentration (rather than, say, a temporary sales promotion).

As usual, the relationship between an infant formula product's price and its wholesale cost, paid by the retailer to the manufacturer, is expected to be a positive one.

$$(1)\quad P_{i,t}^{k} = \beta_0 + \beta_1(CB_{i,t}^{k})*(S_{i,t}) + \beta_2(1-CB_{i,t}^{k})*(S_{i,t}) + \beta_3(WC_t^{k}) + \beta_4(D_{i,t}) + \beta_5(HHI_i) + \beta_6(I_{i,t}) + \beta_7(R_{i,t}) + \varepsilon_{i,t}$$

In summary, an econometric specification that is consistent with the WIC model is given by:

where

- $P^{k}_{i,t}$ represents the retail price of brand *k* formula in market area *i* in time period *t*;
- $CB^{k}_{i,t}$ represents a dummy variable that equals 1 if brand *k* is the contract brand in market area *i* in time period *t* and equals zero otherwise;
- $S_{i,t}$ represents the relative size (ratio) of WIC to non-WIC formula-fed infants in market area *i* in time period *t*;
- WC^{k}_{t} represents the wholesale cost for brand *k* in time period *t*;
- $D_{i,t}$ represents the number of discount stores relative to population in market area *i* in time period *t*;
- HHI_{i} represents the Herfindahl-Hirschman Index for market area *i* in 2000, rescaled by a factor of 1,000 for ease of interpretation;
- $I_{i,t}$ represents median household income in market area *i* in time period *t*;
- $R_{i,t}$ represents the poverty rate for market area *i* in time period *t*;
- $\varepsilon_{i,t}$ represents an error term

An alternative, fixed-effects model could be specified to incorporate effects associated with specific market areas. However, a fixed-effects model would not be able to measure price effects associated with supermarket concentration inasmuch as the data available for concentration for this study were cross-sectional (HHI is measured only for 2000). The results of this study are based on the model outlined above.

It is expected that $\beta_1 > 0$, measuring the price effect on the contract brand of a change in S, the *relative size of WIC*, and that $\beta_2 > 0$, measuring the price effect on the noncontract brand of a change in S. It is also expected that $\beta_3 > 0$, $\beta_4 < 0$, $\beta_6 > 0$, and $\beta_7 < 0$. The sign on β_5, the coefficient associated with HHI, could be positive if infant formula pricing resembles the pattern predicted by the Cournot and WIC models or negative if supermarket instead adopt the pricing strategies outlined above for an "attractor" item.

The full empirical specification augments the specification outlined in the previous section by including a pair of additional variables to reflect that the number of alternative infant formula products that supermarkets carried varied in the sample by market area and period. The regressions included two dummy variables, *presence of Wyeth* and *presence of private label* to capture this variation. For either brand, Wyeth or private label, the dummy variable equals 1 if that brand is available in a given market area in a given quarter in the same product base and product form as the product modeled in the regression (e.g., if the regression's independent variable is the price of Mead-Johnson milk-based liquid concentrate then *presence of Wyeth* equals 1 for that regression if supermarkets carried Wyeth's milk-based liquid concentrate infant formula product, and equals 0 otherwise). Households may consider Wyeth brand formula or private label formula to be a substitute for one or more of the brands (Mead-Johnson, Ross, Carnation) whose price-determining factors are estimated by the regressions. If so, then the coefficient on the dummy variable for the presence of the alternative brand would be negative.

Appendix D—Detailed Regression Results

This appendix considers in detail the statistical results from regression models that examine the economic, demographic, and programmatic factors that affect the supermarket retail prices of infant formula. The quantity "unit" for which all price data are calculated is a 26-ounce reconstituted equivalent.[1]

The sample means, minimum values, and maximum values of the variables used in the regressions are presented in appendix tables D-1 and D-2 for milk-based and soy-based formula price regressions, respectively. Most of the price regressions contained a sample size of 1,261 observations.[2] The dependent mean values are averages across market areas and periods of inflation-adjusted supermarket retail prices, measured in cents. The variable *relative size of WIC if contract brand* is likewise an average across market areas and periods. The variable's low values of 0.04 or 0.03 for Carnation reflects the fact that Carnation was the contract brand for relatively few observations, which means many zeroes are averaged into the value. In contrast, the values for Ross and Mead-Johnson are higher than for Carnation, and show that these brands were the contract brand in more market areas in more periods. The *change in contract brand* variable averaged 0.59 or 0.55, reflecting that a substantial number of market areas had one or two changes in the manufacturer that held the contract brand, but that many market areas had no contract brand turnovers, bringing the cross-market average below 1. The means of the *presence of private label* and *presence of Wyeth* variables show the proportions of observations for which these variables equal 1. The sample average of *discount stores* is 2.54 stores (per 100,000), while the Herfindahl-Hirschman Index averages 1990 as conventionally measured, or 1.99 as used in the scale-adjusted specification (designated *supermarket concentration*) in the regressions. *Household income* and *poverty rate* values average $37,030 and 12.8 percent across observations. The means of *wholesale price* are, like the dependent variable, measured in (inflation-adjusted) cents.

The magnitudes and t-tests for the regression coefficients are reported in appendix tables D-3 and D-4 for regressions of milk-based formula prices and soy-based formula prices, respectively. Each table contains six regressions, distinguished by form (powdered vs. liquid concentrate) for each of the three major brands (Mead-Johnson, Ross, and Carnation) that were producing for the domestic market in September 2000, the close of this report's 1994-2000 study period.[3] To evaluate the effect of contract brand status, the differences between certain pairs of coefficients are measured and subjected to t-tests in appendix table D-5. In the following discussion, the 5 percent level of confidence is adopted for statistical significance.

The analysis that follows considers the magnitudes and interpretation of the numerical coefficients from the price regressions, and identifies which of the above effects have strong statistical support and which require greater qualification. Certain empirical results do depend somewhat on whether prices are examined for milk-based formula or soy-based formula. Inasmuch as milk is the product

[1] For example, the 26-ounce equivalent corresponds to a single 13-ounce can of liquid concentrate formula with the dilution ratio of 1 ounce of water for each ounce of concentrate.

[2] The reason for a smaller sample size for certain Carnation prices was that the not all Carnation soy-based products were available in each of the market areas in all 27 quarters of the study period.

[3] Statistical results for the Wyeth formula are not reported here. Wyeth is a formula manufacturer that no longer markets its own formula, exiting from the domestic market early in the 1994-2000 study period (during 1996). Preliminary analysis using the foreshortened price series available for Wyeth formula suggested that estimated coefficients for Wyeth were not well-behaved, sometimes taking on unexpected signs that differed from the signs predicted by economic theory and the signs exhibited by other companies. It is not known to what extent the unusual results for Wyeth are attributable to the short period for which Wyeth price information are available and how much to any other factors.

Appendix table D-1—Sample means of variables in milk-based formula price regressions

	Powder			Liquid Concentrate		
	Mead-Johnson	Ross	Carnation	Mead-Johnson	Ross	Carnation
Sample size	1,261	1,261	1,261	1,261	1,261	1,261
Dependent mean	245.39	252.47	211.37	291.54	289.76	241.62
Relative size of WIC, if contract brand	0.64	0.39	0.04	0.64	0.39	0.04
Relative size of WIC, if noncontract brand	0.50	0.75	1.11	0.50	0.76	1.11
Change in contract brand	0.59	0.59	0.59	0.59	0.59	0.59
Presence of private label	0.32	0.32	0.32	NA	NA	NA
Presence of Wyeth	0.50	0.50	0.50	0.44	0.44	0.44
Discount stores	2.54	2.54	2.54	2.54	2.54	2.54
Supermarket concentration	1.99	1.99	1.99	1.99	1.99	1.99
Household income	37.03	37.03	37.03	37.03	37.03	37.03
Poverty rate	12.83	12.83	12.83	12.83	12.83	12.83
Wholesale price	245.39	266.22	199.65	284.82	283.75	223.05
Trend	14.06	14.06	14.06	14.06	14.06	14.06

NA = not applicable.

Appendix table D-2—Sample means of variables in soy-based formula price regressions

	Powder			Liquid Concentrate		
	Mead-Johnson	Ross	Carnation	Mead-Johnson	Ross	Carnation
Sample size	1,261	1,261	1,021	1,261	1,261	1,026
Dependent mean	244.22	252.47	211.37	291.54	289.76	241.62
Relative size of WIC, if contract brand	0.66	0.39	0.03	0.66	0.39	0.03
Relative size of WIC, if noncontract brand	0.49	0.75	1.13	0.49	0.75	1.13
Change in contract brand	0.55	0.55	0.67	0.55	0.55	0.67
Presence of private label	0.40	0.40	0.49	NA	NA	NA
Presence of Wyeth	0.47	0.47	0.35	0.45	0.45	0.33
Discount stores	2.54	2.54	2.56	2.54	2.54	2.56
Supermarket concentration	1.99	1.99	1.99	1.99	1.99	1.99
Household income	37.03	37.03	37.49	37.03	37.03	37.48
Poverty rate	12.83	12.83	12.58	12.83	12.83	12.58
Wholesale price	272.48	266.22	187.55	307.28	302.65	204.51
Trend	14.06	14.06	16.63	14.06	14.06	16.58

NA = not applicable.

base that accounts for the greatest share by far of standard infant formula, our conclusions about the infant formula market "in general" are based primarily on those results.

The first coefficient listed in appendix tables D-3 and D-4 measures the effect on a brand's retail price associated with a one-unit change in the variable *relative size of WIC if contract brand*. In each of the twelve regressions, the price effect for the variable is positive and statistically significant.[4] When Mead Johnson or Ross hold the contract, an increase in a market area's relative size of WIC by one unit increases the retail prices of the two brands by, respectively, 11.92 cents to

[4] The t-scores range between 8.89 to 11.49 for the two major brands and no less than 2.57 for Carnation.

14.07 cents (per 26-oz equivalent). [5] In contrast, the price effect for Carnation is relatively low for powdered formula (at 8.19 cents) and relatively high for liquid concentrate (at 14.99 cents). For the soy-based formula of the two major brands, price effects range between 12.04 cents and 15.15 cents, with relatively low price effects for Carnation for both product forms (equaling 4.85 or 5.79 cents). The regression results strongly support the conclusion that, holding other factors constant, an increase in the relative size of WIC in a market area increases the retail price for that area's contract brand of infant formula.

The second coefficient listed in appendix tables D-3 and D-4 measures the effect on a brand's retail price associated with a one-unit change in the variable *relative size of WIC if noncontract brand*. For 11 of the 12 regressions, the price effect on a noncontract brand's retail price of an increase in the relative size of WIC is positive. The sole exception to this pattern was Carnation soy-based powdered formula, and its negative sign is not statistically significant from zero. Of the 11 positive coefficients, 10 are statistically significant (Carnation soy-based formula—this time the liquid concentrate—is the exception). In the milk-based formula price regressions, the pattern of coefficient matches the pattern already examined for the price effect of the variable *relative size of WIC if contract brand*: the price effects are relatively larger for Mead Johnson and Ross (ranging between 8.71 cents and 11.04 cents) compared with Carnation (at 2.62 and 2.73 cents). For the soy-based formula price regressions, the price effect is positive and statistically for the two major brands, although insignificant for Carnation. Given that Carnation's statistically insignificant coefficients were found only for soy-based formula, the product base that is relatively small, and that Carnation itself is a manufacturer that is relatively small, we conclude as a general result that an increase in the relative size of WIC in a market area increases retail price for that area's noncontract brands of infant formula.

In appendix table D-5, the two rows of figures and associated t-scores record the difference between the coefficients for the variables *relative size of WIC if contract brand* and *relative size of WIC if noncontract brand* for each given manufacturer's product (by base and form). For example, for milk-based powdered formula the price regression's two coefficients are 11.92 cents and 10.04 cents for Mead Johnson (shown in appendix table D-3) resulting in a 1.88-cent difference (shown in appendix table D-5). Thus, the figures in appendix table D-5 measure the "contract brand effect"—the difference in a product's retail price associated with the product's manufacturer changing its contract brand status between being a noncontract brand to being the contract brand in a market area. In the table, the contract brand effect is evaluated at a relative size of WIC of 1.0.[6] The contract brand effect is said to be a "positive" price effect if the product's retail price is higher when its manufacturer holds the WIC contract (holding other factors constant); the "positive" effect is a mathematical term, not a normative one meaning "desirable."

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[5] Because the relative size of WIC is constructed as the ratio of (formula-fed) WIC infants to (formula-fed) non-WIC infants, a one-unit change in the variable corresponds, for example, to a change from a local condition of one WIC infant for each non-WIC infant to a local condition of two WIC infants for each non-WIC infant.

[6] The figures and discussion in the body of this report differ slightly from the figures considered in this appendix. The figures in appendix table D-5 pertain to a relative size of WIC value of 1.0 because the coefficients in appendix table D-3 and D-4 are for one-unit changes in relative size of WIC. In contrast, in the body of the report the figures for the contract brand effect pertain to a relative size of WIC value of 1.14 because that value is the average in the sample of the relative size of WIC. The value of the contract brand effect for any given value of the relative size of WIC variable can be found by multiplying the figures in appendix table D-5 by the chosen value of the relative size of WIC. In the quarterly data, the relative size of WIC ranges from a low of 0.42 to a high of 4.2. Figure 9-1 in the text shows a range that is less broad because its figures are means across all quarters, by State, which average out the high and low values of the quarterly data. In either case, the contract brand effect in a given market area and period can be smaller than or several times larger than the figures reported in appendix table D-5.

Appendix table D-3—Regression coefficients and standard errors for supermarket infant formula prices: milk-based infant formula by product base and brand

	Powder			Liquid Concentrate		
	Mead-Johnson	Ross	Carnation	Mead-Johnson	Ross	Carnation
Relative size of WIC, if contract brand	**11.92** 9.86	**14.07** 10.12	**8.19** 5.79	**13.45** 10.36	**13.91** 8.89	**14.99** 8.84
Relative size of WIC, if noncontract brand	**10.04** 6.47	**11.04** 10.24	**2.73** 4.43	**8.71** 5.21	**12.87** 10.68	**2.62** 3.55
Change in contract brand	-0.97 0.91	**2.37** 2.46	0.05 0.10	**2.98** 2.60	**5.61** 5.24	-0.19 0.30
Presence of private label	1.56 1.06	**-2.85** 2.16	**-2.75** 3.71	NA	NA	NA
Presence of Wyeth	0.32 0.18	2.53 1.49	0.77 0.84	0.74 0.36	2.47 1.31	**-2.42** 2.10
Discount stores	**-9.17** 10.69	**-7.70** 10.09	-0.49 1.13	**-9.29** 10.26	**-9.99** 11.91	**-0.25** 4.77
Supermarket concentration	**-4.75** 8.29	**-4.93** 9.65	**-0.66** 2.26	**-2.44** 3.97	**-5.03** 8.82	0.34 0.96
Household income	0.11 0.63	0.09 0.56	**0.18** 2.08	**0.76** 4.15	**0.62** 3.60	**0.62** 5.93
Poverty rate	**-1.07** 4.60	**-0.90** 4.32	**-0.28** 2.35	***-0.47*** 1.87	**-0.55** 2.37	**-0.33** 2.30
Wholesale price	**0.56** 3.58	**0.62** 5.27	**0.56** 5.71	**0.60** 2.73	**0.66** 2.96	**0.74** 8.53
Trend	**0.45** 3.07	**0.97** 6.99	**0.52** 5.36	**0.86** 3.81	**0.94** 4.50	**0.47** 5.03
Intercept	**129.28** 3.31	**105.70** 3.57	**88.60** 4.64	***99.83*** 1.65	90.65 1.49	**54.35** 2.80
Dependent mean	244.22	252.47	211.37	291.54	289.76	241.62
Adjusted R-squared	0.24	0.42	0.35	0.38	0.44	0.45

Notes: a. Dependent variable is supermarket retail price (average price within an InfoScan market area), measured in cents. Coefficients measure the change in price, in cents, for a one-unit change in the variable.
b. For each variable in each of the six regressions the upper figure is the variable's OLS coefficient and the lower figure is the coefficient's t-statistic (in absolute value). Bold figures are coefficients that are significantly different from zero at the 5% confidence level. Italicized bold figures are coefficients that are significantly different from zero at the 10% level but not at the 5% level.
NA = not applicable.

For all six milk-based formula price regressions, the differences in coefficients are positive, as expected, and statistically significant in five of the six cases (the exception is Ross liquid concentrate formula). The contract brand effect ranges from a low of 1.88 cents (for Mead-Johnson powdered formula) to a high of 12.37 cents (for Carnation liquid concentrate formula). For the soy-based formula price regression the results are less conclusive: positive and statistically significant price effects were found in just three of the six cases, and in one case (Mead Johnson powdered formula) the price effect was negative and statistically significant. Because milk-based formula is a much larger part of the infant formula market than soy-based formula, our conclusion about infant formula "in general" draws heavily from the milk-based results. We conclude that in a given market area, holding other factors constant, the retail price of a manufacturer's product tends to be higher than it otherwise would be if the manufacturer is the WIC contract brand.

Appendix table D-4—Regression coefficients and standard errors for supermarket infant formula prices: soy-based infant formula by product base and brand

	Powder			Liquid Concentrate		
	Mead-Johnson	Ross	Carnation	Mead-Johnson	Ross	Carnation
Relative size of WIC, if contract brand	**13.75** 11.49	**12.87** 8.07	**4.85** 3.46	**15.15** 10.04	**12.04** 6.66	**5.79** 2.57
Relative size of WIC, if noncontract brand	**15.70** 10.20	**10.98** 8.85	-0.29 0.45	**15.09** 7.76	**14.01** 10.02	0.49 0.47
Change in contract brand	-0.8 0.79	0.83 0.78	**1.36** 3.06	**-2.67** 2.08	0.16 0.14	1.35 1.88
Presence of private label	-1.90 1.18	0.11 0.07	**-2.44** 3.49	NA	NA	NA
Presence of Wyeth	-1.20 0.66	-0.45 0.24	-0.36 0.44	3.71 1.43	2.67 1.21	-1.86 1.30
Discount stores	**-8.40** 10.02	**-6.56** 7.61	**-2.58** 6.57	**-12.38** 11.62	**-10.60** 10.8	-0.18 0.28
Supermarket concentration	**-3.08** 5.47	**-4.06** 6.98	**-1.15** 4.30	***-1.28*** 1.80	**-4.36** 6.63	-0.51 1.19
Household income	0.09 0.54	0.12 0.66	***-0.12*** 1.59	**0.85** 3.98	**0.80** 4.02	***-0.23*** 1.86
Poverty rate	**-1.54** 6.81	**-1.50** 6.36	**-0.23** 1.99	**-0.74** 2.58	**-0.95** 3.56	**-0.57** 3.13
Wholesale price	**0.47** 2.75	**0.73** 4.03	**0.77** 8.57	**0.63** 3.15	**0.6** 3.19	**0.61** 3.72
Trend	**0.84** 3.89	0.24 1.42	-0.06 0.68	**1.41** 5.23	**1.11** 4.06	**0.63** 5.13
Intercept	**161.01** 3.57	**95.35** 2.00	**75.92** 4.71	**94.13** 1.60	**111.32** 2.05	**109.89** 3.32
Dependent mean	272.31	267.17	201.86	311.08	305.51	230.59
Adjusted R-squared	0.40	0.23	0.20	0.43	0.41	0.16

Notes: a. Dependent variable is supermarket retail price (average price within an IRI market area), measured in cents. Coefficients measure the change in price, in cents, for a one-unit change in the variable.
b. For each variable in each of the six regressions the upper figure is the variable's OLS coefficient and the lower figure is the coefficient's t-statistic (in absolute value). Bold figures are coefficients that are significantly different from zero at the 5% confidence level. Italicized bold figures are coefficients that are significantly different from zero at the 10% level but not at the 5% level.

NA = not applicable

Appendix table D-5—Estimated contract brand effect[1]

	Powder			Liquid Concentrate		
	Mead-Johnson	Ross	Carnation	Mead-Johnson	Ross	Carnation
Milk-based formula	**1.88** 1.99	**3.03** 3.45	**5.46** 4.27	**4.74** 4.67	1.03 1.07	**12.37** 8.02
Soy-based formula	**-1.95** 2.16	**1.89** 1.95	**5.14** 4.11	0.05 0.05	***-1.97*** 1.78	**5.30** 2.62

[1] Differences between coefficients of *relative size of WIC if contract brand* and *relative size of WIC if noncontract brand* by product base, product form, and brand.

Note: Bold figures are coefficients that are significantly different from zero at the 5% confidence level. Italicized bold figures are coefficients that are significantly different from zero at the 10% level but not at the 5% level.

The variable change in contract brand measures, by quarters, the number of times the contract brand had changed between any two manufacturers in a market area, capturing whether turnover in the identity of the contract brand has effects on supermarket price for the product of each manufacturer (whether or not it was a contract winner, contract loser, or not involved with the contract turnover). In the milk-based price regressions in appendix table D3, results for the variable show that liquid concentrate formula prices exhibited a turnover effect that is positive and significant for each of the two major brands, but powdered formula prices exhibited such an effect for only one major brand (Ross); for neither product base does Carnation exhibit any price effect associated with the number of contract brand changes. In the soy-based formula price regressions, in contrast, Carnation formula was the only formula exhibiting a positive, statistically significant effect, while Mead Johnson exhibited an effect that is significant but negative. We conclude that the price effect of the variable is not strongly conclusive, with a positive turnover effect identified in some but not all cases.

The variable *presence of private label* had negative and statistically significant coefficients in the Ross and Carnation price regressions for milk-based formula. The interpretation of this result is that households consider private label formula to be a substitute for these brands, lowering the prices of these brands by about 2.85 cents and 2.75 cents, respectively. For the soy-based formula price regression, the coefficient is negative (at –2.44 cents) and statistically significant only for Carnation.

The variable *presence of Wyeth* has a negative and statistically significant effect in only one instance (Carnation milk-based liquid concentrate). Therefore, we conclude that the exit of Wyeth from the domestic market did not have an effect on infant formula retail prices in general (for given levels of wholesale prices of the remaining manufacturers).[7]

For Mead Johnson and Ross infant formula, each additional *discount store* (per 100,000 population) in a market area lowers supermarket retail price by a statistically significant amount for all product bases and forms. The amounts of price decreases ranged between 7.70 and 9.99 cents for milk-based formula, and between 6.56 and 12.38 cents for soy-based formula. Carnation formula had significant coefficients in two cases, equaling 2.58 cents and 0.25 cents, and in two other cases Carnation's coefficient for *discount stores* was insignificant. Even with those two cases of statistical insignificance, we considered it reasonable to conclude for infant formula in general that retail prices in the supermarket sector decrease in response to a greater presence of discount stores.

As explained in appendix C, if infant formula serves as an "attractor" item (of which a "loss leader" item is an extreme example), its price may be expected to decrease as supermarket concentration rises. For milk-based formula price regressions, the *supermarket concentration* variable has a negative, statistically significant coefficient in five out of six cases. For the two major brands, an increase in supermarket concentration as measured by a one-unit change in the variable (a 1000-unit change in the underlying Herfindahl-Hirschman Index) lowers retail price by as much as 4.75 cents to 4.93 cents. Carnation's coefficient for powdered formula was statistically significant, but much lower in magnitude (in absolute value) at just –0.66; Carnation's coefficient for liquid concentrated formula was statistically insignificant. For soy-based infant formula, a negative and statistically significant price effect was found in four out of six cases. We conclude for infant formula in general that supermarket concentration lowers—rather than increases—supermarket retail prices. We interpret this result as one that is consistent with the joint conditions that market power raises price for other supermarket items and infant formula serves as an "attractor" item.

[7] If the exit of Wyeth resulted in an increase in the wholesale prices of other manufacturers, retail prices of other brands would be expected to increase.

In four of the six milk-based formula price regressions, the coefficient on *household income* was positive and significant. Three of those four coefficients are found in the three regressions for liquid concentrate. The coefficients' magnitudes ranged from 0.62 to 0.76. For the Ross and Carnation liquid concentrate regressions, the coefficient of 0.62 means that an increase in a market area's median household income by $10,000 results in a supermarket retail price increase of 6.2 cents. In the soy-based formula price regression, the *household income* coefficient was positive and significant only for the two major manufacturers' liquid concentrate formula, as is the case for their milk-based price regression counterparts. In contrast, Carnation's two *household income* coefficients for its soy-based formula were each negative, although statistically insignificant. We conclude that, for the two major brands, there seems to be a qualitative difference between the two major forms of infant formula: household income affects supermarket prices for liquid concentrate formula but not for powdered formula.

The variable *poverty rate* is included in the regression as a rough proxy for the overall shape of the income distribution within a market area. In the six milk-based regressions, the sign is negative and statistically significant in five out of six cases. The magnitudes of the coefficient were smallest (in absolute value) for Carnation products (at -0.28 and –0.33), and ranged up to –1.07 for Mead Johnson powdered formula. Thus, an increase in a market area's *poverty rate* by one percentage point is associated with a reduction in the supermarket retail price of Mead Johnson powdered formula by 1 cent. In the soy-based formula price regressions, all six coefficients were negative and statistically significant, and again Carnation had the two lowest coefficients. We conclude that supermarket infant formula prices in general respond negatively to a market area's *poverty rate*.

The coefficients on the variable *wholesale price* are all positive and statistically significant, ranging between 0.56 and 0.74 in the six milk-based formula price regressions and 0.47 and 0.77 in the soy-based formula price regressions. The interpretation of these results is that an increase in the price paid by supermarkets to a brand's manufacturer results in an increase in that brand's supermarket retail price, but by less than the increase in the wholesale price. For example, the coefficient of 0.56 for Mead-Johnson powdered formula means that a 10-cent increase in Mead-Johnson's wholesale price results in an increase of 5.6 cents in that product's retail price.[8]

The variable *trend* captures any changes in a brand's retail price, on average over time, that is not statistically accounted for by other independent variables in the model (which already includes *wholesale price* and accounts for inflation in the general price level). The coefficients on *trend* are all positive and statistically significant for milk-based formula prices, ranging from 0.5 cents to 0.9 cents, and positive and statistically significant in four out of six cases for soy-based formula prices. Because the *trend* coefficients measure price changes per quarter, these magnitudes on an annual basis are higher than the coefficients by a factor of four, ranging from 2.0 cents to 3.6 cents per annum.

Alternative regression specifications were examined to identify the robustness of the model, including introducing some variables (such as regional dummy variables, market area population, and an interaction variable between contract brand status and *supermarket concentration*), and dropping certain variables (such as *change in contract brand* and *presence of Wyeth*). Two types of results are sensitive to regression specification. First, for various specifications of Ross milk-based liquid concentrate regressions, the coefficients on *relative size of WIC if contract brand* and *relative size of WIC if noncontract brand* were always positive, but in some specifications the coef-

[8] As discussed in appendix C, the result that the coefficients are positive fractions is consistent with the specification of linear infant formula demand curves adopted by the theoretical model on which the regression specifications are based.

ficient on *relative size of WIC if contract brand* is smaller than the coefficient on *relative size of WIC if noncontract brand*, yielding a negative contract brand price effect—a result that did not match the results found for the five other milk-based formula products. Second, the introduction of regional dummy variables diminishes the role played by *household income*, probably because the values of household income across market areas are related to the geographical region in which the market area is located. The specification reported here provides clean, straightforward interpretations of coefficients and yields the same basic results as alternative specifications—notably, the coefficients for *relative size of WIC if contract brand* and *relative size of WIC if noncontract brand* are positive and statistically significant under alternative specifications.

Appendix E—Data Sources and Construction of Variables

This appendix explains the sources and procedures that were used to construct the data for the empirical analysis in appendix D.

The regressions used quarterly data from the first quarter of 1994 through the third quarter of 2000. The InfoScan market areas that were selected for the sample were those for which 90 percent or more of the population resided in States that belonged to a single WIC contract. In addition, Mississippi was excluded from the regression sample because it does not use the retail distribution system.[1]

Dependent Variable

The regressions' dependent variable is a market area's inflation-adjusted supermarket retail price for the specific infant formula products produced by Mead-Johnson, Ross, and Nestle identified in table 6-1. For each manufacturer, the four products selected were distinguished by two product bases (milk-based and soy-based) and by two product forms (liquid concentrate and powder). Chapter 5, "Source of Infant Formula Data" describes the nature and limitations of the InfoScan data on supermarket retail prices for these products. The quarterly CPI-U was used to deflate the nominal supermarket price series.

Independent Variables

The variable *relative size of WIC if contract brand* is an interactive variable, constructed as the product of *relative size of WIC* and a dummy variable, *contract brand status*, for which *contract brand status* equals 1 if the manufacturer's brand is the contract brand for the observation and *contract brand status* equals 0 if it is a noncontract brand.

The variable *relative size of WIC if noncontract brand* is an interactive variable, constructed as the product of *relative size of WIC* and a dummy variable, *noncontract brand status*, for which *noncontract brand status* equals 1 if the manufacturer's brand is a noncontract brand for the observation and noncontract brand status equals 0 if it is the contract brand.

Information from USDA's Food and Nutrition Service (FNS) identified which manufacturer was a State's WIC contract brand in each quarter. If the manufacturer of the contract brand changed after the middle of a quarter, the change was treated as taking place at the start of the following quarter.

The variable *relative size of WIC* in a State was computed as the number of formula-fed WIC infants relative to the number of formula-fed non-WIC infants in the State. The number of formula-fed WIC (non-WIC) infants was calculated as the product of the number of WIC (non-WIC) infants in the State and the State's WIC (non-WIC) formula-feeding rate. A State's *relative size of WIC* value was used to proxy the relative size of WIC value in all market areas within the State.

The number of WIC infants, by State, was obtained from USDA's Food and Nutrition Service (FNS). The annual number of live births, by State, was available from the U.S. Department of

[1] Furthermore, certain quarterly observations were dropped for market areas in the sample if either there was more than one contract brand (Open Market System) in effect during a quarter (Phoenix; seven quarters of 1994:1-1995:3) or, in one instance, if there was no contract brand for a quarter (Atlanta; 1994:4).

Health and Human Services' Centers for Disease Control and Prevention (CDC). Quarterly data for each series were obtained by interpolation of annual data. The difference between live births and WIC infants represents the number of non-WIC infants. Formula-feeding rates were obtained from breastfeeding rates using the relationship that a breastfeeding rate and its corresponding formula-feeding rate sum to 1.0. Annual data for the breastfeeding rates of women, by State, were obtained from a breastfeeding survey conducted by Ross Laboratories (Ross Labs Mothers' Survey, various years). Separate data were available for breastfeeding rates for a State's WIC mothers (households) and for a State's non-WIC mothers (households). Annual data were interpolated on a quarterly basis.

The quarterly variable *number of contract brand changes* equals the number of contract brand changes that have occurred in the market area since the inception of the study period (for the product base and product form of each separate price regression). The variable is market-area specific rather than manufacturer-specific: its value is shared within a given market area for all manufacturers. Its values begin at zero in the first quarter of 1994 for each market area, and for some market areas it reaches a value of 2 by the end of the sample period in which case the contract brand changed twice among the manufacturers in the market area.

For each regression—for an infant formula product distinguished by manufacturer, product base, and product form—a quarterly dummy variable was constructed to represent the presence of Wyeth products in a market area. The variable *presence of Wyeth* equaled 1 for a given observation if Wyeth marketed an infant formula product of the relevant product base and product form in the given market area in the given quarter. Although Wyeth phased out production of its infant formulas for the U.S. market in 1996, the quarter in which it ceased marketing in any one market area differed across market areas.

A similar approach was used to construct the dummy variable *presence of private label*. PBM began marketing powdered infant formula in 1997, although the quarter in which it began marketing in any one market area differed across market areas and as of the third quarter of 2000 it was not marketing in every market area in the sample.

Annual data on a market area's number of discount stores and population were obtained from Metro Market Studies; together these data were used to calculate the number of discount stores per 100,000 population, a variable that is labeled *discount stores* in appendix D.[2] The discount stores that were counted include such retailers as Wal-Mart, K-Mart, and Target who carry infant formula; chains such as T.J. Maxx whose product line does not included infant formula were not counted. Quarterly data were obtained by interpolation.

The variable *supermarket concentration* is the standard Herfindahl-Hirschman Index used to measure concentration within a market area among its supermarket chains. The more closely a market area resembles one that is served by a single, monopoly supermarket chain, the greater is the value of the market area's *supermarket concentration*. Each market area had a single *supermarket concentration* value (based on 2000 data) that was used to represent the entire study period. Market share information was gathered from *MarketScope2000*.[3]

[2] The annual publication *Discount Store Distribution Analysis and Guide* is written and published by Metro Market Studies of Tucson, AZ.

[3] For each market area, if two or more chains with different names were owned by a single entity, the market shares for those chains were aggregated. The *Supermarket Concentration* utilized all available share information, including independents.

The real (constant purchasing power) median *household income* in a market area was obtained using three series. A State's nominal median income was treated as the nominal median income of its market area(s). State nominal median income figures on an annual basis were obtained from the U.S. Department of Commerce's Census Bureau; quarterly figures were obtained by interpolation. The nominal median income data were adjusted for both intertemporal and cross-sectional differences in the purchasing power of a dollar. The data were adjusted for inflation using the quarterly CPI-U. The data were adjusted for a local market area's cost-of-living relative to the U.S. average cost-of-living using the American Chambers of Commerce Research Association (ACCRA) cost-of-living index.[4]

It is noted that the geographic boundaries of the InfoScan market areas, which are reflected in the determination of the independent variables of supermarket retail prices, do not coincide exactly with the geographic boundaries used for determining the variables *discount stores, supermarket concentration,* and *household income*.

The variable *poverty rate* represents the percentage of people in poverty, based on annual data from the U.S. Census Bureau (Department of Commerce). A State's poverty rate was used to proxy for the poverty rate in all market areas within the State. Annual figures were interpolated on a quarterly basis.

For each of a manufacturer's four infant formula products, the variable *wholesale price* was obtained from wholesale price lists published by the manufacturer. Price changes that took effect after the middle of a quarter were treated as taking place at the start of the following quarter. A product's inflation-adjusted wholesale price was obtained by deflating the nominal price series by the CPI-U.

A simple linear time *trend* was created, which changes by one unit each quarter.

[4] For most market areas, the 1995 value of the ACCRA index was used, although for a few market areas, the value of the index was taken from a different period under the assumption that the market area's cost of living relative to the U.S. average was steady over time.