Case Study

Economic Implications of a Major US Infant Formula Recall: Understanding the Industry, Consumer Behavior, and Policy Response

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Abstract
The infant formula recall of 2022 led to substantial shortages in the marketplace for a product that has no market substitutes and is often the sole source of nutrition for young infants. In this case study, we explore the food safety recall from an economic perspective, explaining the industry structure, discussing consumer choice, and exploring government response. The case invites students to explore the complexities that lead to a desperate market situation, with out-of-stock rates for infant formula exceeding 90 percent in many regions of the country. The accompanying teaching note provides guidance and suggested answers for discussion and analytical questions.

1 Introduction

Infant formula is a major, and often only, source of nutrition for infants up to six months old (CDC 2023a).[1] Beyond six months of age, many infants continue to be fed infant formula, in conjunction with solid foods, before being able to be fed cow's milk at one year old (US Department of Agriculture and US Department of Health and Human Services 2020). During the first year of life, infants have weak and developing immune systems, making them highly susceptible to foodborne pathogens (FoodSafety.gov 2025). In February 2022, Abbott Nutrition, the largest manufacturer in the highly concentrated US infant formula industry, closed a large production facility and voluntarily recalled several lines of infant formula due to potential contamination with *Cronobacter sakazakii*, a pathogenic bacterium (FDA 2022b).[2] The recall further exacerbated a fragile supply of infant formula, which resulted from a concentrated market with restricted imports due to high quality standards and inspection requirements and that had been further impacted by supply chain issues due to the COVID-19 pandemic (Muhammad et al. 2023). The recall led to substantial shortages of a product that has no close marketplace substitutes as a source of nutrition for young infants up to six months old.[3] The recall led to major short-term policy changes and has had profound implications for both consumers and producers (FDA 2023a). This case study explores the 2022 food safety infant formula recall from the economics perspective, focusing on implications for the supply chain, consumer behavior, and policy response.

[1] Data from the Centers for Disease Control and Prevention (CDC) on US infant breastfeeding from 2013–2020 indicate that as of 2020, only approximately 25 percent of infants are exclusively breastfed up to six months old, with the rest formula-fed exclusively or as a supplement.
[2] The Abbott Nutrition Sturgis, Michigan facility resumed production on June 4, initially focusing on EleCare® and other specialty formulas. Severe storms in June temporarily halted production, which subsequently reinstated on July 1 (Abbott 2022). Similac® production at the Sturgis, Michigan, plant restarted on August 26, 2022.
[3] Human milk is a substitute to formula for the first six months of life; however, many mothers are unable to provide breastmilk. Infants older than six months may be fed solid foods; however, they need to continue to consume either breastmilk or infant formula if breastmilk is not available. Infants older than one year of age may switch from infant formula to cow's whole fat milk, assuming no dietary or health restrictions (CDC 2024).

Table 1. Student Learning Objectives

SLO1	Students should be able to describe the infant formula food safety recall of 2022, including manufacturer involved, impact on consumers, and policy response.
SLO2	Students should be able to explain the Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC) program, identifying its strengths and weaknesses specifically with respect to infant formula.
SLO3	Students should be able to identify the characteristics that make infant formula a unique food product.
SLO4	Students should be able to explain factors that impact consumer choice for infant formula and factors that impact mothers' decision-making around breastfeeding.
SLO5	Students should be able to use graphical analysis to show the impact of recalls using supply and demand shifts.

2 Industry Background

In the United States, infant formula is a $2.1 billion industry, where four companies account for over 90 percent of the market (Muhammad et al. 2023).[4] Before the recall, in 2021, the market shares for the four top companies were: Abbott Nutrition (40 percent), Mead Johnson Nutrition/Reckitt (31 percent), Nestle/Gerber® (17 percent), and Private Label/Perrigo Company (11 percent) (Yenerall et al. 2024). In addition to a concentrated market, producers rely on relatively few large production facilities, with Abbott reportedly operating five production facilities in the US (Abbott 2022). Prior to its temporary closure due to the recall, Abbott's Sturgis, Michigan, plant produced 40 percent of Abbott's powdered formula products (Yenerall et al. 2024). There are 21 infant formula production facilities in the US across all companies, primarily concentrated in Michigan and Ohio, due to proximity to input suppliers, workforce availability, and transportation infrastructure (IBISWorld 2023; Muhammad et al. 2023). The infant formula industry is thus characterized by a high concentration of input suppliers and a *just-in-time* approach to production (Sariman et al. 2025). The oligopolistic nature of the industry, coupled with the high concentration of production in a handful of infant formula manufacturing plants for efficiency reasons, leads to significant impacts in the marketplace from the closure of a single manufacturing facility (Horsley 2022a).

Each manufacturer produces multiple brands of liquid and powdered formula; however, Abbott's most recognized brand is Similac® and Reckitt's most famous brand is Enfamil® (Abbott 2024; Reckitt 2024). Infant formula products include both products that meet the general nutrition needs of healthy infants and specialty formulas that address one or more issues that infants may face, such as metabolic issues, allergies, or premature birth (USDA FNS 2023a). While there is a risk with market concentration for regular infant formula, the risk is even greater for specialty formulas, as they are an important source of nutrition for infants in an already vulnerable state, whose dietary restrictions might not allow for substitution between brands. Not all manufacturers produce all types of specialty formulas, and those that do also export to other countries; hence supply, in general, is tight for such formulas, posing an additional challenge in times of shocks such as during a food safety recall (Abrams, 2023). In this

[4] The degree of concentration in an industry is measured by the number of the firms and the market shares. The fewer the number of firms and/or the greater the share of sales accounted by few firms, the greater the concentration in the marketplace (Penson et al. 2018).

particular case, Abbott's Sturgis, Michigan, plant is not only the largest infant formula manufacturing plant in the country but is also a major supplier of specialized formula (Horsley 2022a).

Infant formula is primarily produced domestically, with very little imports before the food safety recall of 2022 (Ahmed 2022). In the decade prior to the 2022 food safety recall, the US produced over half a million metric tons annually but only imported about 5,000 metric tons (Abrams 2023; Muhammad et al. 2023). This is primarily because of the FDA regulations and requirements regarding infant formula nutritional content, labeling, production facilities, production process, and product storage and handling (Muhammad et al. 2023).[5] Producers outside of the US might not be able to prove, in a cost-effective way, that they meet those FDA standards and requirements. While imports show an upward trend in recent years, including in the two years before the recall, the US imports significantly less infant formula than many other large economies, including Nigeria, Germany, Australia, France, and Canada (Muhammad et al. 2023). While US infant formula imports drastically increased in 2022, the year of the food safety recall, to over 40,000 metric tons,[6] many short-term policy changes contributed to this spike, as discussed in Section 7, and it is unlikely that such high levels of imports will persist without more robust long-term regulatory changes.

3 The Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC)

According to the American Academy of Pediatrics, babies should be exclusively breastfed up to six months old; however, formula is a substitute for breastmilk if the latter is not available at all or in sufficient quantity (AAP 2022). In the United States, approximately 3.5 million babies are born each year (CDC 2023c). Data from the Centers for Disease Control and Prevention (CDC) show that about 54% of infants are fed formula, either exclusively or as a supplement, during their initial three months of life; this percentage increases to 75% by the time they reach six months (CDC 2023c). Millions of infants rely on infant formula to meet their nutritional needs, fully or partially, during an important part of their growth and development.

Infant formula reaches the consumer primarily via food retailers as well as from samples distributed at hospitals, clinics, and pediatricians' offices. A unique feature of this product is that it is primarily purchased with federal government funds via the WIC program (ERS 2022). WIC participants use the benefits from this program to purchase WIC-approved infant formula. This is a very important program, as over half of all infant formula in the United States is purchased using WIC benefits (ERS 2022). Each state, or group of states, uses a bidding system to contract with one manufacturer, which is then the sole source of WIC-approved formula for that state or group of states (Yenerall et al. 2024). For example, Abbott is currently the contract holder for the state of Michigan, Mead Johnson is the contract holder for Minnesota, and Nestle/Gerber® is the contract holder for Oklahoma (Food and Nutrition Service 2024). In general, these three companies hold all of the WIC contracts for all the states as well as for 14 Indian Tribal Organizations (USDA FNS 2024b). In simplified terms, states award contracts to the manufacturer who submits the highest rebate level, which is given as a percentage of the wholesale price for infant formula (Yenerall et al. 2024). The WIC program pays the full retailer price for infant formula purchased with WIC benefits. However, because it receives a manufacturer rebate, the actual cost of infant formula for the WIC program is given by Net Price, calculated as

$$\text{Net Price} = \text{Wholesale Price} - \text{Manufacturer Rebate} + \text{Retail Markup} \quad (1)$$

[5] The FDA does not grant approval for infant formula; however, the manufacturers of infant formula must notify the FDA before marketing a new infant formula product. The FDA has the jurisdiction to enforce mandatory recalls for products that fail to comply with regulation.

[6] In 2022, imports accounted for 4.9% of US domestic demand (IBISWorld 2023).

In other words,

$$\text{Net Price} = \text{Retail Price} - \text{Manufacturer Rebate} \quad (2)$$

Equation (2) shows that the WIC program minimizes the cost of infant formula provided to eligible households by receiving the largest possible rebate from the manufacturers.

While this strategy minimizes overall costs to the WIC program, the impacts of this strategy on the industry and on consumers are very significant (see a more detailed explanation in Yenerall et al. 2024).[7] Research suggests that the structure of the WIC program contributes to the high level of industry concentration, as smaller companies and new companies find it difficult or impossible to compete with large companies on providing large rebates to WIC and hence fall short of obtaining state contracts (Yenerall et al. 2024). For consumers who receive WIC benefits, this strategy limits their choice to only the brands from the single manufacturer that obtains the state's contract (Yenerall et al. 2024).

The WIC program provides benefits for pregnant and postpartum women, children, and infants (Michigan Health and Human Services n.d.). For infants up to 12 months old, WIC provides infant formula, including specialty formula for infants with medical diagnoses (Michigan Health and Human Services n.d.). In addition, WIC provides infant cereal, fruits, vegetables, and meats – appropriate for infant feeding, for infants 6 months old and older (Michigan Health and Human Services n.d.). To be eligible, participants must meet certain requirements, including categorical,[8] residential, income, and nutrition risk (USDA FNS 2024c). Households of eligible beneficiaries may not exceed 185 percent of the federal poverty income guideline (USDA FNS 2024c). For example, effective July 1, 2024, 185 percent of the federal poverty income level for a household of four members is an annual gross household income of $57,720 (USDA FNS 2024d). Families above that income level are not eligible, but families below that income level that meet the requirements in the other three categories outlined above are eligible to receive WIC benefits. For households that receive WIC benefits, obtaining infant formula in general, and specialty formula in particular, free of charge, may be a significant financial assistance.[9]

4 Food Safety Recall of Infant Formula

On February 17, 2022, Abbott issued a voluntary recall of many of its powdered formula products, including Similac®, Alimentum®, and EleCare® due to potential contamination from *C. sakazakii* or *Salmonella* Newport (Abbott 2022). On February 28, Abbott expanded its product recall to include a specific lot of Similac® produced in Sturgis, Michigan. This decision was prompted by a tragic incident in which a child died from a *C. sakazakii* infection after consuming a product from the recalled lot (Abbott 2022). Describing the case, CDC (2022) reports that four infants with *Cronobacter* infections consumed infant formula produced in the Sturgis, Michigan, plant before they got sick and that *Cronobacter* infections may have contributed to the death of two infants who consumed formula produced in the same facility (CDC 2022). It is important to note that these cases were spread across three different states—Minnesota, Ohio, and Texas—showing the wide distribution of formula produced in the same facility in Michigan (CDC 2022).

[7] By comparison, the price for a non-WIC consumer is the wholesale price plus retail markup, hence higher than the price paid by WIC consumers.

[8] Categories include women, infants, and children, each with specific criteria: Women must be pregnant (up to 6 weeks postpartum), postpartum (up to 6 months after giving birth), or breastfeeding (up to the infant's first birthday). Infants can participate up to 1 year of age, and children up to 5 years of age (FNS 2022b).

[9] For powdered formula, in August 2025, Similac® 360 Total Care® (a regular formula), sold for $49.99 for a package of 1.92 lb. ($1.62/ounce), while Hypoallergenic EleCare® (a specialty formula), sold for $49.99 for a package of 0.88 lb. ($3.55/ounce) (prices obtained from Target). Consumers may seek to decrease the cost by utilizing retailer coupons and price promotions when available, and/or by joining company specific rewards' programs such as "Enfamil® Family Beginnings" or "MySimilac® Rewards."

The FDA inspected Abbott's Sturgis facility in 2019, 2021, and 2022 (FDA 2019, 2021a, 2022a). Inspection reports (Form 483, Notice of Inspectional Observations) documented various observations that potentially compromised product safety, putting the infant formula at risk of contamination with *C. sakazakii* (Beach 2022). Observations included cracks and pits on equipment, unvalidated dryer sanitation practices,[10] pooled water throughout the facility,[11] and personnel not wearing the proper protective apparel. Environmental samples from various surfaces in the facility, including product contact surfaces, tested positive for *C. sakazakii.* Additionally, in 2019 and 2020, Abbott's testing showed that two finished products from the Sturgis facility tested positive for *Cronobacter* spp. (FDA 2019, 2021a, 2022a). Despite these findings, the CDC's whole genome sequencing analysis found no evidence linking the bacteria isolated from the two patients to the Sturgis facility (CDC 2022).

C. sakazakii is a pathogenic bacterium that can cause life-threatening illness in infants. While *Cronobacter* infections are rare, about 2–4 cases are reported to the CDC each year;[12] the results in those cases are very severe, often causing sepsis or meningitis (CDC 2024). Infants younger than one month old make up 75% of the children infected with *Cronobacter*, while infants older than 6 months and adults are rarely affected (bad bug).[13] *Cronobacter* is particularly problematic because it can survive long periods in powered infant formula, the processing environment, and in the home on surfaces such as the kitchen counter or sink (FDA 2012). Because of this, steps to prevent contamination of powered infant formula during manufacturing and preparation in the home must be implemented. In the processing environment, basic hygiene like handwashing, cleaning and sanitizing equipment and surfaces, and keeping pooled water out of the facility is key. At home, in addition to basic hygiene, once the formula is prepared it must be used quickly or properly stored in the refrigerator and used within 24 hours.

In the weeks and months after the recall, the shortage of infant formula was significant and noticeable. By the end of May, out-of-stock rates climbed to over 74% nationwide, with 10 states experiencing out-of-stock rates higher than 90% (Paris 2022). Georgia experienced the highest state out-of-stock rate at that period, at 94%; among large metropolitan areas, Sacramento, California, had the highest out-of-stock rate at 94.6% (Paris 2022). In May 2022, the US Department of Justice reached a deal with Abbott Laboratories that paved the way for the reopening of the Sturgis, Michigan, plant, the largest infant formula manufacturing plant in the United States (Burke and Ruble 2022). In an August press release, the company announced that it was resuming production of Similac® infant formula at the Sturgis, Michigan, plant; in the months that followed, the supply of infant formula increased in the marketplace (Abbott 2022).

5 Consumer Behavior

Consumer demand for infant formula shows interesting and important dynamics. First, the consumer base changes frequently: Parents purchase infant formula to feed their infants; within one year, infants no longer need formula. In addition, economic theory predicts that infant formula has an inelastic demand. This is because of the lack of substitutes for the product in the marketplace. It is likely that demand for particular brands is also inelastic: Infants often show preference for one type of formula (likely because of taste preferences) and many consumers are restricted in their ability to substitute between brands if they purchase formula with WIC benefits (Ahmed 2022).

[10] The dryers were not validated to confirm whether complete dryness was achieved. Furthermore, the dryers showed signs of deterioration (Department of Health and Human Services, FDA 2022b).

[11] Water was observed in various areas such as the dryers, floors, walls, and floor drain, due to leaks from the inlet and drips from the valves (Department of Health and Human Services & FDA 2022b).

[12] This figure is an underestimate of the true number of cases because hospitals and clinics across the country were not mandated to report the cases to health departments and, hence, the CDC (CDC 2022, 2023d). However, this has changed as of 2024, and *Cronobacter* infections must now be reported to CDC, which will allow for better data tracking and a better understanding of the true risks from this bacterium (Beach 2023).

[13] Bad bugs refer to foodborne pathogenic microorganisms and natural toxins (Lampel et al. 2012).

In practice, the availability of manufacturer free samples, coupons, rebates, and rewards also likely influences consumer choice. For example, two large brands of infant formula—Similac® and Enfamil®—currently advertise to consumers that they may get up to $400 in offers and rewards (Similac® n.d., Enfamil® n.d.). Consumers' choice is also influenced by the recommendation of pediatricians and healthcare professionals, either directly or indirectly (e.g., by providing free samples in hospitals and clinics). Free samples are supplied by the manufacturers to the hospitals and clinics in a practice called "medical detailing" that is unique to the US (Yenerall et al. 2024). While other countries regulate infant formula marketing more strictly, Speed (2023) reports that in the UK most parents pick the formula brand for their baby while in the hospital, likely influenced by the brands utilized in the hospitals; once they pick a brand, 65 percent of parents stick with it.

In the US, the food safety recall of major brands of infant formula deepened the shortage of this product in the marketplace, which already existed due to bottlenecks in the supply chain created by a combination of government policies and the global COVID-19 pandemic (Marino et al. 2023). Various newspaper articles at the time explored consumers' behavior, attitudes, preferences, and fears regarding the food safety recall and shortage. The US Census Bureau Household Pulse Survey included questions regarding parents' coping mechanisms during the shortage period. Survey data suggests that over half of the parents shopped for formula in a different store (57%) or switched to a different brand (55%) (Keeve et al. 2024). Other coping mechanisms reportedly used by parents included purchasing formula online (40%), increasing breastfeeding (25%), changing from powder to liquid formula (23.4%), changing from infant formula to something else (10.3%), obtaining shipments directly from infant formula manufacturers (8.6%), watering down formula or making their own (5.6%), and stopping offering infant formula (3.5%) (Keeve et al. 2024). Some of these coping mechanisms required more time and effort from parents (such as switching stores by driving to further locations to find infant formula in stock) while others posed a significant threat to infants' health and wellbeing. The FDA (2021b) strongly advises against feeding babies with homemade infant formula, stating that the agency regulates commercially available infant formula but does not regulate homemade formula, which may often be contaminated or not include nutrients in the specified range to be appropriate for infants' healthy growth. In the past, there have been cases of hospitalization of infants who had been fed homemade infant formula and then suffered hypocalcemia (low levels of calcium) (FDA 2021b).

Several studies conducted interviews with parents to understand their experiences during the infant formula shortage. One study found that the negative impacts on parents included feelings of emotional distress, higher financial costs, increase in time and effort to search for available formula, and changes in feeding practices, to name a few (Sylvetsky et al. 2022). While the economic literature is still limited in this regard, it is expected that consumers may have switched some behaviors more permanently. Indeed, consumer data shows that market shares shifted quite significantly for the main four manufacturers following Abbott's food safety recall (Yenerall 2024).[14]

One of the key outcomes of the infant formula shortage of 2022 is a reported increase in breastfeeding rates (Keeve et al. 2024). Many factors impact mothers' decisions related to breastfeeding versus formula-feeding, influenced by personal and health circumstances, individual values, societal norms, historic trends, government policy, and industry interference. During the infant formula shortage, Horsley (2022b) reported the opinions of multiple experts on ways to encourage an increase in breastfeeding rates, citing the low rates of breastfeeding in comparison to the American Academy of Pediatrics recommendations. Many economists have done work in this area, such as understanding the results of empirical studies related to the benefits of breastfeeding for infants and mothers (Oster 2019)

[14] In 2021, the market shares of Abbott, Reckitt, Nestle/Gerber, and Perrigo were 40%, 31%, 17%, and 11%, respectively. By 2022, these shares had changed to 27%, 39%, 18%, and 13%, respectively, showing that Reckitt experienced the highest increase in market share due to the Abbott recall (FDA 2023a).

as well as quantifying the costs of breastfeeding for mothers (Mahoney et al. 2023). Mahoney et al. (2023) conclude that the costs of breastfeeding—including equipment, nutrition for mothers, and opportunity cost of time—add up to $8,640–$11,611 annually. This, the authors argue, is much higher than the cost of infant formula, estimated at $760–$2,280 for one year's supply by the Plutus Foundation (Mahoney et al. 2023). Other work in this area has also explored the racial disparities in breastfeeding rates, primarily due to the lack of resources and support, particularly for non-Hispanic Black mothers (Beauregard et al. 2019; Crumpler 2022). Future empirical studies will show whether the increase in breastfeeding rates during the 2022 infant formula shortage represent a long-lasting trend or just a short-term coping mechanism.

6 Regulation and Policy Response

In the United States, the Food and Drug Administration (FDA) regulates the infant formula market.[15] To address high out-of-stock rates, the FDA took several steps to temporarily boost supply of infant formula in the US marketplace. The FDA exercised enforcement discretion for several manufacturers to introduce infant formula into interstate commerce, subject to certain conditions. On May 16, 2022, the FDA issued guidelines for enforcement discretion which allows the safe and nutritionally adequate infant formulas to enter the market, even if they do not fully align with certain requirements (FDA 2022b). In September 2022, the *Infant Formula Transition Plan for Exercise of Enforcement Discretion: Guidance for Industry* (FDA 2022c) led to an extension of its timeline by the FDA. This extension specifically applied to companies that displayed their commitment to aligning with all US infant formula requirements (FDA 2023b). Nevertheless, for those manufacturers that failed to submit a letter of intent, the enforcement discretion associated with the guidance ended on December 5, 2022. The *Infant Formula Transition Plan* guidance will remain in effect until October 18, 2025, and it redirects the FDA's focus towards evaluating manufacturer information that adheres to FDA regulations before the issuance of the May 2022 enforcement discretion guidance (FDA 2022d). Among companies that received enforcement discretion letters,[16] eight of them are participating in a transition plan to comply with the US requirements (FDA 2022e). Imports allowed by enforcement discretion were pivotal during the recovery from the infant formula shortage due to the food safety recall.

The Infant Formula Supplemental Appropriations Act, passed on May 18, 2022, funded $28 million to the FDA to recruit more staff for inspecting infant formula facilities, review import applications, increase supply, prevent shortages, and collect market data (US Congress 2022a,b; Jaffe 2022).

Moreover, the Defense Production Act was invoked on May 18, 2022, which expedited infant formula production by mandating ingredient suppliers to prioritize infant formula manufacturers in obtaining essential ingredients.[17] This act allowed Abbott Nutrition to increase its production by 25%, and Reckitt, the second major player in infant formula production, projected a 40% production boost (White House 2022). Simultaneously, the government-initiated Operation Fly Formula, collaborating with various agencies like the Department of Health and Human Services (HHS), the US Department of Agriculture (USDA), the General Services Administration (GSA), and the Department of Defense (DOD) to secure safe infant formula from overseas. This operation successfully conducted 74 flights, importing

[15] Appendix Table 1A provides a brief overview of the regulatory framework for infant formula.

[16] Eleven companies received enforcement discretion letter for standard formulas, and six companies received it for specialty formulas (Food and Drug Administration 2023b).

[17] According to Remmel (2021), infant formula components are set by the Codex Alimentarius, a food standards program jointly led by the Food and Agriculture Organization of the United Nations and the World Health Organization. The author notes that the Codex Alimentarius requires around 30 ingredients for formula, a combination of macronutrients and vitamins and minerals. Citing a pediatrician, Remmel (2021) outlines that formula producers typically use cow's milk protein (whey, casein), vegetable oils to meet the fat requirements, and lactose as carbohydrate source to meet the requirements for the macronutrients as well as iron and other vitamins and minerals.

over 97.9 million 8-ounce bottle equivalents of infant formula by September 29, 2022.[18] Additionally, President Biden urged the Federal Trade Commission (FTC) and state attorneys to combat price gouging and unfair market practices. Price gouging involves vendors increasing prices for vital products such as food and fuel during times of crises or natural disasters and is considered illegal under many state laws (New York State Attorney General 2024; National Conference of State Legislatures 2025). An FTC investigation and the Department of Justice encouraged state attorneys to oversee and address instances of price gouging (US Department of Health and Human Services 2022a,b; White House 2022).[19]

With over half of the infant formula purchases being conducted through the WIC program, it becomes evident that low-income families are the demographic most profoundly impacted by this situation (Samuel et al. 2022; Kalaitzandonakes et al. 2023). When out-of-stock rates surged, WIC participants faced significant challenges in finding Abbott Nutrition's products. On February 20, several US institutions (USDA, HHS, FDA, and the White House) collaborated to grant waivers to WIC state agencies. Such wavers provided flexibility in terms of brand, type, size, vendor exchange, and medical documentation for noncontracted formulas (USDA FNS 2024a). In practice, this allowed WIC participants to obtain infant formula of any brand during the recall period, not confining these households only to the manufacturer (brands) with the state contract. The Access to Formula Act of 2022, passed on May 21, 2022, gave the USDA permanent authority to issue such waivers during emergencies, enabling proactive flexibility for WIC participants to obtain infant formula in possible future emergencies (USDA FNS 2023b).

On December 29, 2022, President Biden signed the "Food and Drug Omnibus Reform Act of 2022" (FDORA) into law. Subtitle D focuses on infant formula supply and safety, aiming to address regulatory deficiencies that led to infant formula shortages (FDA 2023a). FDORA mandates the FDA to provide annual reports to Congress, disclose infant formula manufacturers' plans to boost supply, and establish a national strategy with federal entities to enhance the supply chain (FDA 2023a). Moreover, FDORA seeks to facilitate market entry and increase access to formula by mandating the creation of an "Office of Critical Foods" within the Center for Food Safety and Applied Nutrition (CFSAN) and requiring risk management plans from manufacturers (FDA 2023a). These changes to policies and regulations—some of which are short term, such as Operation Fly Formula, and others longer term—have likely had an impact on producers, retailers, and consumers of infant formula. However, the full extent of the impact remains to be analyzed in more depth by researchers.

7 Theoretical Framework

Microeconomic theory is useful in understanding the implications of the various shifts in demand and supply, due to the food safety recall in infant formula. Below, we use graphical analysis to understand the impact of the demand and supply shifts on equilibrium price and quantity. Given the high concentration levels in the infant formula industry, this industry is classified as an oligopoly at the national level.[20] An oligopoly is defined as an industry with differentiated products and few sellers, where each seller is large enough to have an influence on market volume and price (Penson et al. 2018). In such a case, firms may either take the approach of matching each other's price cuts so that their products are not undersold or

[18] 8 ounces of infant formula typically equals two feedings for many infants under 4 months old, who generally require six feedings daily to consume a minimum of 24 ounces for proper growth and development. For infants between 6 and 12 months of age, 8 ounces equals one feeding, with a minimum of four feedings needed daily to reach 32 ounces (AAP 2022; CDC 2023b).
[19] In May 2022, the New York attorney general found that Walgreens had raised retail prices from 10 to 20 percent and in one instance as high as 70%. That case was settled in 2024, with Walgreens neither admitting nor denying fault but agreeing to pay a $50,000 fine and donating over 9,500 cannisters of infant formula to organizations serving needy or low-income New Yorkers (New York State Attorney General 2024).
[20] At the state level, because of the WIC state contract, the company that has a state contract may have monopoly power for the segment of households that use WIC benefits to purchase formula in that state, as explained in Section 3.

they may collude with the objective of maximizing joint profits (Penson et al. 2018). Analyzing which approach the infant formula producers adopt is an empirical question and beyond the scope of this case study. In the analytical analysis that follows, we take a simplified approach of depicting generic supply and inelastic demand curves, as in perfect competition. While this approach does not entail the full complexity of infant formula supply and demand in the US, it does allow us to understand the impact of the recall and subsequent events on the equilibrium, particularly focusing on the impact on quantity.[21]

Suppose that prior to the recall, the equilibrium quantity and price of infant formula are given by point E_1, as in Figure 1. This figure shows the impact of a decrease in supply when Abbott Nutrition brands were recalled from the market on equilibrium price and quantity. A decrease in supply leads to an increase in market price and a decrease in market quantity.

As discussed in this case, many consumers increased demand for infant formula due to fear related to the shortage (Horsley 2022a; Naidu 2022). When supply falls and demand increases, economic theory predicts that prices will increase. However, the impact on quantity is ambiguous, as it depends on how large the increase in demand is relative to the decrease in supply. Figure 2 illustrates this case. Specifically, demand increases as a result of parents purchasing large quantities quickly due to being afraid of a shortage in the marketplace (also referred to as "panic buying").[22] In this case, if there are no interventions in the marketplace, the price will increase even further than what is shown in Figure 1. If, following a drop in supply, demand increases substantially, the equilibrium quantity increases. Alternatively, if demand increases by a little bit following a drop in supply, equilibrium quantity decreases.

As discussed in Section 6, federal and state governments instituted a series of short-term and long-term policy changes in an effort to address the shortage of infant formula in the marketplace following the recall. Each initiative, including increasing imports and mandating input suppliers to prioritize infant formula manufacturers, likely had an impact in increasing overall supply of infant formula in the marketplace. The impact of government policies is given in Figure 3, showing that as supply increased, quantity in equilibrium increased.

[21] Refer to Chapter 9 in Penson et al. (2018) for a more detailed overview of oligopolies. Assuming a perfect competition, as we do here, relaxes two important assumptions: number of firms and degree of differentiation. In the case of oligopolies, the number of firms is few, and the product is differentiated. In terms of pricing, Penson et al. (2018) explain that while oligopolists match each other's price drops as they do not want to be undersold, they do not match all price increases because they want to capture a larger market share. Instead of the supply curve as in perfect competition, oligopolies have marginal cost curves and make decisions on the quantity to produce (Cournot model) or the price to charge (Bertrand model) in order to maximize profits (Besanko and Braeutigam 2002). The complexity for oligopolists is in depicting the demand curve. Depending on the pricing strategy used by one oligopolist and the response of other oligopolists, we end up with a kinked demand curve. Overall, it is important to understand that oligopolists make an economic profit per unit of the price per unit minus the average total costs. Thus, while long run economic profits are not possible in perfect competition, they are possible in oligopolies. Finally, according to Penson et al. (2018), oligopolists facing similar demand and cost conditions may also behave in a collusive way (i.e., charge the same price for their output), with the objective of maximizing joint profits. In such a situation, the prices and quantities in equilibrium would resemble the case of a monopoly, and each oligopolist would get their share of the market at higher overall market profits. Whether the Cournot model or the Bertrand model is more appropriate for the infant formula industry in the national versus state markets constitute empirical questions. In our analysis, we are significantly simplifying the case by using a perfect competition case to simply illustrate the impact on marketplace quantity (i.e., resulting shortage). Due to anti-price-gouging rules in several states, and due to the extensive use of WIC benefits to purchase infant formula, the impact of the infant formula recall on pricing, in our opinion, is not as much a concern, as the impact on product availability/quantity.

[22] Billore and Annisimova (2021), reviewing the literature on panic buying, indicate that there are many reasons that lead to this behavior. Some reasons are external, such as the onset of a global pandemic or a food safety recall. Other reasons are internal, such as consumer anxiety or fear ("affective reactions") or stocking up due to a perceived shortage ("cognitive response") (Billore and Annisimova 2021).

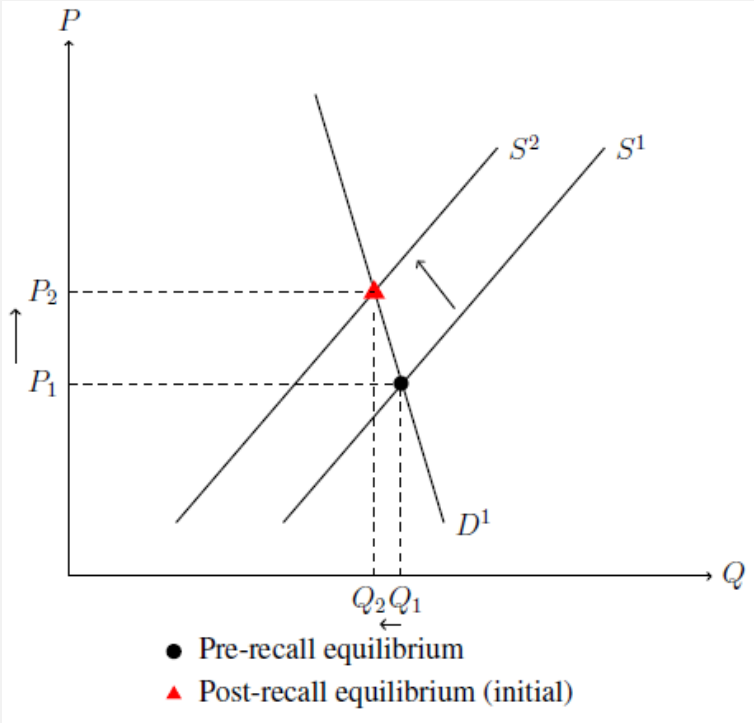

Figure 1. The impact of a decrease in infant formula supply on equilibrium, indicating a decrease in quantity

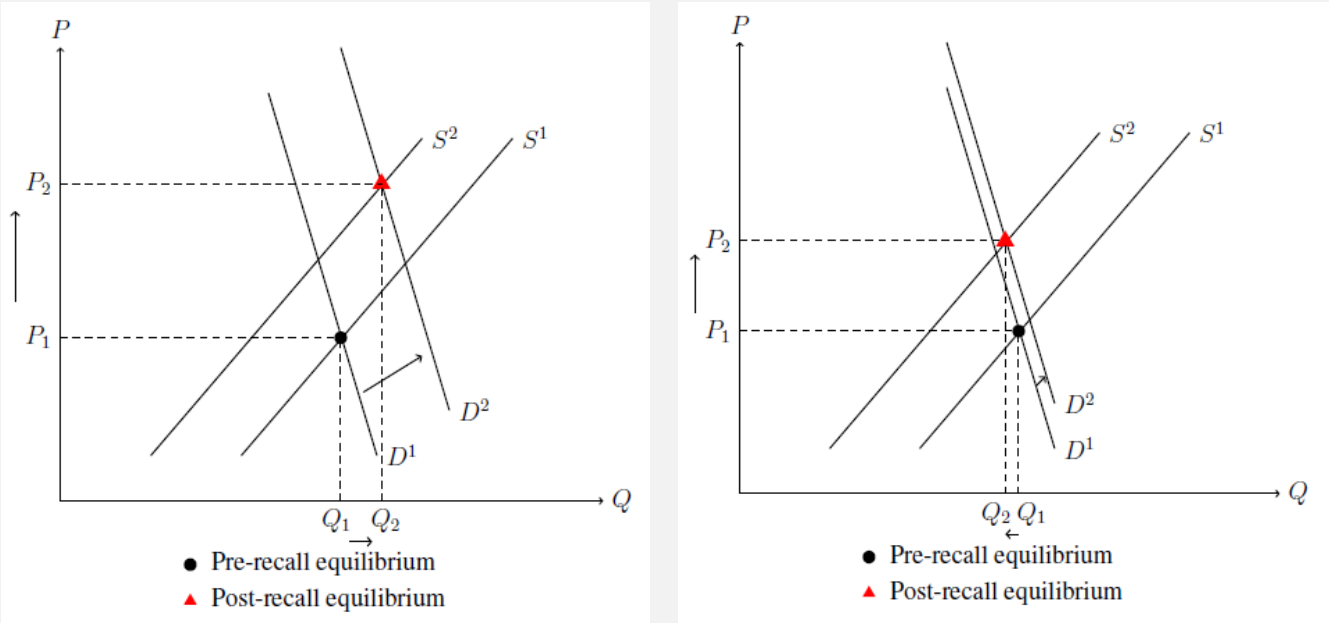

Figure 2. A decrease in infant formula supply paired with an increase in demand leads to an increase in price but has an ambiguous effect on quantity in equilibrium

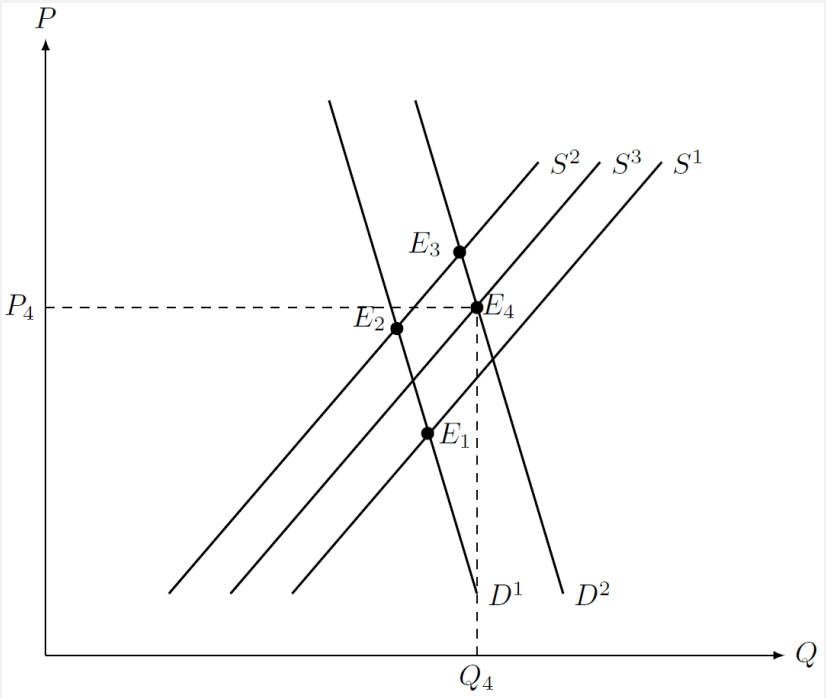

Figure 3. Government intervention via various changes in policies and programs increased the supply of infant formula (S3), hence increasing quantity in equilibrium

In August 2022, Abbott resumed production of infant formula and the supply of the product increased in the marketplace. Figure 4 shows the impact of the increase in supply. Here, we show that the combination of government policies and initiatives (the majority of which remained in effect at least until the end of 2022) and the production from Abbott led to an increase in supply that approached or surpassed the market supply before the recall. This decreased prices further while increasing equilibrium quantity in the marketplace, leading to an end in infant formula shortage. While the model presented here is a simplified version of reality, it allows us to understand the impact of the recall and subsequent events, on market quantity for infant formula.[23]

8 Conclusion

The infant formula food safety recall of 2022 led to a significant shortage of an important food product in the United States. Many families experienced varying levels of hardship as they tried to secure sufficient infant formula for their babies. The shortage was the result of a major plant of the biggest infant formula manufacturer shutting down production. The industry is characterized by few firms with significant market share. The consumer base of infant formula changes frequently, as infants only need the product in their first year of life. However, during that period, consumers had few to no market substitutes for this product, and even substitutability between brands is limited in the case of specialty formulas for infants with medical conditions. Further, consumer choice is restricted for participants in the WIC program, as the benefits from the program may be used to purchase only formula from a state-contracted manufacturer. During the recall period, many short-term policies were put into place, and government

[23] The model does not take into account anti-price-gouging regulations by several states, imperfect information among consumers and producers, the small number of manufacturers, or product differentiation.

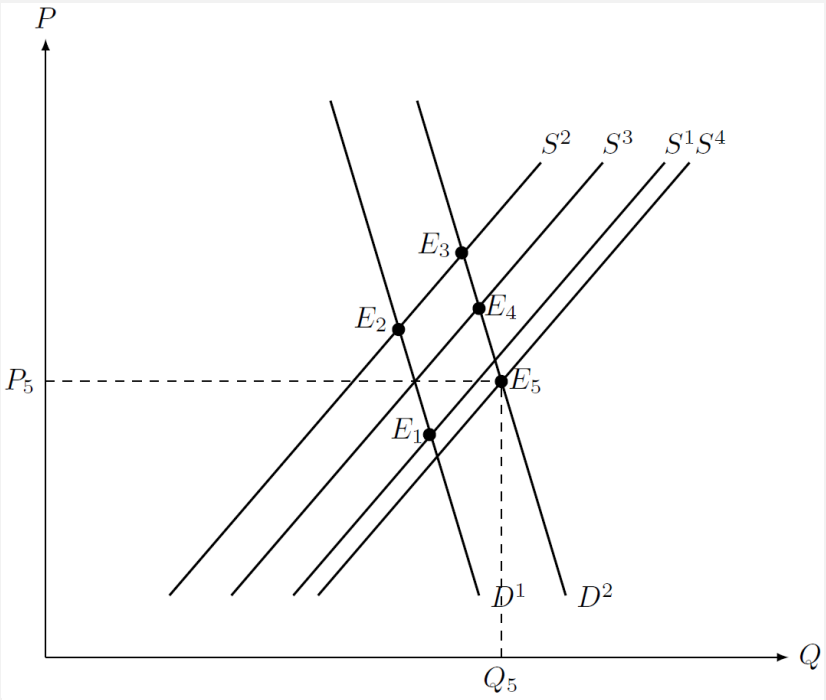

Figure 4. Abbott resumes infant formula production and this further increases supply of infant formula (S4), increasing quantity in equilibrium

actions focused on alleviating the shortage. Those included the Infant Formula Supplemental Appropriations Act, Defense Production Act (DPA) to expedite infant formula production and Operation Fly Formula, among other efforts. These short-term measures had implications for infant formula production and trade, shifting the market shares among domestic producers and increasing imports from trading partners. However, the full extent of the impact and the extent to which the impact will persist over time remain to be studied.

9 Discussion and Analytical Questions

The teaching note provides suggested answers to the following questions as well as additional information.

9.1 Discussion Questions

1. Is the infant formula industry highly concentrated? If so, what are the factors that affect concentration levels in this industry? Which are the top manufacturers, and what is the current market share for the top four companies?
2. What additional information (not discussed in the case study) do we need about the infant formula input industry in order to create a better picture of the challenges, opportunities, and profitability of the infant formula manufacturing sector?
3. What could lead to an increase in competition in the infant formula industry, and what could make the supply chain of this product be made more resilient in cases of shocks, such as food safety recalls?
4. What other industries may be considered similar to the infant formula industry in terms of market concentration, high levels of regulation, and/or lack of close market substitutes?

5. How did the infant formula industry manage the burden of the food safety recall? Identify the direct costs (such as compliance) of the food safety recall for this industry. Then, identify the indirect costs of the food safety recall for this industry.
6. If you were a marketing manager in the infant formula industry, what would be your marketing strategies to regain the consumers' trust following the food safety recall?
7. For whom is infant formula an important product, and why is it an important product?
8. What factors affect consumers' choice of infant formula?
9. Identify factors that impacted changes in consumer behaviors (i.e. coping mechanisms) following the food safety recall.
10. What are the impacts on the marketplace of consumers purchasing infant formula in bulk?
11. Why did consumers resort to "panic buying" of infant formula during the recall? What marketing strategies could retailers use to discourage panic buying?
12. What may be the long-term effects of the infant formula recall on consumer demand and why?
13. What is the role and impact of the WIC program for consumers, producers, and retailers of infant formula? What suggestions do you have to improve this program as it pertains to infant formula purchases?

9.2 Analytical Questions

1. Identify the shifts in infant formula supply and in consumer demand due to the food safety recall. What is the impact on market equilibrium price and quantity?
    - Show the impact on infant formula supply from Operation Fly Formula.
    - Show the impact on infant formula demand from an increase in breastfeeding rates.
2. Consider the supply and demand for Abbott Nutrition infant formula brands (Similac®, Alimentum®, and EleCare®). Using supply and demand graphs, show the impact of:
    - The recall of certain lots of Abbott Nutrition infant formula brands.
    - Consumer demand for these brands immediately following the recall announcement.
    - Abbott Nutrition resuming production in August 2022.
    - Consumer demand for these brands in the long run.
3. Consider the supply and demand of infant formula brands produced by other firms that are competitors of Abbott Nutrition, such as Enfamil® produced by Mead Johnson. Using supply and demand graphs, show the impact of:
    - The recall of Abbott Nutrition brands, on the demand for Mead Johnson brands.
    - Government policies, such as WIC wavers and mandating input suppliers to prioritize infant formula manufacturers, on the supply and demand for Mead Johnson brands.
    - Abbott Nutrition resuming production and eventually returning to full capacity production, on the demand for Mead Johnson brands.

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