USDA Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Service

Economic Research Report Number 291

June 2021

Super Stores' Impact on the Availability of Supplemental Nutrition Assistance Program-Approved Stores

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Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Service
www.ers.usda.gov

Recommended citation format for this publication:

Ollinger, Michael, Michele Ver Ploeg, and Chris Dicken June 2021. *Super Stores' Impact on the Availability of Supplemental Nutrition Assistance Program-Approved Stores,* ERR-291, U.S. Department of Agriculture, Economic Research Service.

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Abstract

Super stores have become the store of choice for USDA's Supplemental Nutrition Assistance Program (SNAP) beneficiaries over the past 30 years and now account for more than one-half of SNAP redemptions. However, by diverting SNAP beneficiaries away from supermarkets, grocery stores, and other food retailers, super stores could force some smaller stores to exit the market. These dynamics could mean reduced access for some SNAP beneficiaries while offering cost savings to many other SNAP beneficiaries. This study examines the impact of new super store entries on the survival of existing traditional stores and the cost savings accruing to SNAP beneficiaries. We find no evidence that super store entry has reduced the number of SNAP-approved stores. SNAP beneficiaries save about $6,390 in SNAP benefits per year, per super store. If extended across all super stores, the savings would be about $108.6 million in 2015—0.26 percent of SNAP benefits—based on estimates over 2005–15 and the number of super stores in 2015.

Keywords: Supplemental Nutrition Assistance Program, SNAP, super stores, grocery stores, supermarkets, Store Tracking and Redemption System, STARS, food and nutrition assistance, store access, store availability, SNAP redemptions, store exits, store entry

Acknowledgments

The authors thank USDA associates Ket McClelland of the Information Services Division and Dave Smallwood of the Food Assistance Branch of Food Economics Division for data acquisition and Jean Buzby, Jay Variyam, Fred Kuchler, and Brandon Restrepo of the Economic Research Service (ERS) for reviewing the paper. Thanks also go to Peer Review Coordinating Council reviewers Richard Volpe of the California Polytechnic University, Art Carden of Samford University, and Eliana Zeballos of ERS. Thanks also to Angela Brees, Grant Wall, and Jana Goldman of USDA, ERS for editorial and Christopher Sanguinett for design services.

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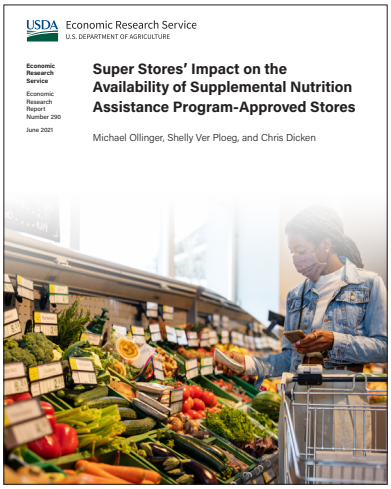


What Is the Issue?

The USDA's Supplemental Nutrition Assistance Program, or SNAP, is the largest U.S. food assistance program with Federal expenditures of $70.8 billion in fiscal year 2016. SNAP serves low-income U.S. citizens; 84 percent of recipients earned income below the poverty level in 2016 and about 64 percent were children, elderly, and nonelderly adults with disabilities (Gray et al., 2016). These low-income SNAP participants can redeem their benefits only at approved stores. According to Ver Ploeg et al. (2017), about 6 percent of households do not use their own vehicle to travel to a store and live more than 0.5 miles from a supermarket. For these transportation-challenged SNAP beneficiaries, access to a SNAP-approved store can be difficult, and changes to the retail landscape threaten the availability of local stores.

The emergence of super stores in the SNAP-approved store retail environment has been a disruptive force. Super stores offer lower prices (Volpe and Lavoie, 2008) and one-stop shopping for time-strapped, cost-conscious consumers, replacing supermarkets as the primary destination for SNAP beneficiaries. However, by diverting consumers away from supermarkets and grocery, convenience, and combination stores, super stores may force these traditional stores to exit the market entirely, reducing access for some SNAP beneficiaries. This study examines the impact of new super store entry on the survival of existing traditional stores and the cost savings SNAP beneficiaries experience because of the lower prices offered at super stores.

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

What Did the Study Find?

This study found that the entry of a super store into a 5-kilometer (approximately 3-mile) radius market area, in which no other super store entered in the preceding or proceeding 3 years, was associated with the following:

- Between 1994 and 2015, about 0.25 supermarkets and 0.05 grocery, convenience, and combination stores exited the market when a super store entered. The impact grew over time, rising from a loss of about 0.20 supermarkets over 1994–2004 to 0.37 supermarkets and 0.20 other traditional stores exiting per super store over 2005–15.
- Between 1994 and 2015, traditional stores in the 5-kilometer (3-mile) radius market areas lost about $191,000 per year in SNAP redemptions to super stores. The impact of super store entry rose over time, increasing from $143,000 per year from 1994 to 2004 to $213,000 per year from 2005 to 2015. About 90 percent of the redemption loss was at supermarkets. Super store redemptions greatly exceeded that which was lost by traditional stores.
- The effect of super store entry diminished as the distance from the store increased. There was no further effect beyond about 5 kilometers (3 miles).
- The migration of SNAP benefits to super stores enabled SNAP beneficiaries to save about $6,390 per year per super store entry over 2005–15. If applied to all super store entrants, the savings would amount to $108.6 million in 2015 (0.26 percent of SNAP benefits), based on estimates over 2005–15 and the number of super stores in 2015.
- There was no loss of store availability, even in the later years, as the loss of traditional stores (0.57 stores) was more than offset by the entry of one super store.

How Was the Study Conducted?

The primary data were from the Store Tracking and Redemption System (STARS), which is administrative data on SNAP-approved stores from the U.S. Department of Agriculture's Food and Nutrition Service (FNS). The 1990 and 2000 Decennial Census data and 2005–15 American Community Survey data were also used. The STARS data included all stores accepting SNAP payments over the 1990–2017 period and included store name, store format, a unique store identifier that links stores across time, store geographic location, SNAP redemptions, and the number of cash registers. We used these data to create a 6-year event window and examined the impact of super store entry on the number of supermarkets, and grocery, convenience, and combination stores and the value of their SNAP-redemptions in a 5-kilometer radius area surrounding the super store entrant.[1] The 2 years before super store entry served as a reference against which changes in the entry year and the 3 post-entry years were measured.

Using a fixed effects linear regression, the number of stores or value of redemptions of all traditional stores in the super store's marketing area were estimated as functions of the number of stores or value of redemptions in the previous year; the value of SNAP redemptions during the current year; demographic variables; number of surrounding super stores; and dummy variables for the event year and the post-entry period of 3 years. The dummy variables for the event year and the post-entry period indicated how the number of stores and value of redemptions changed after the super store entry.

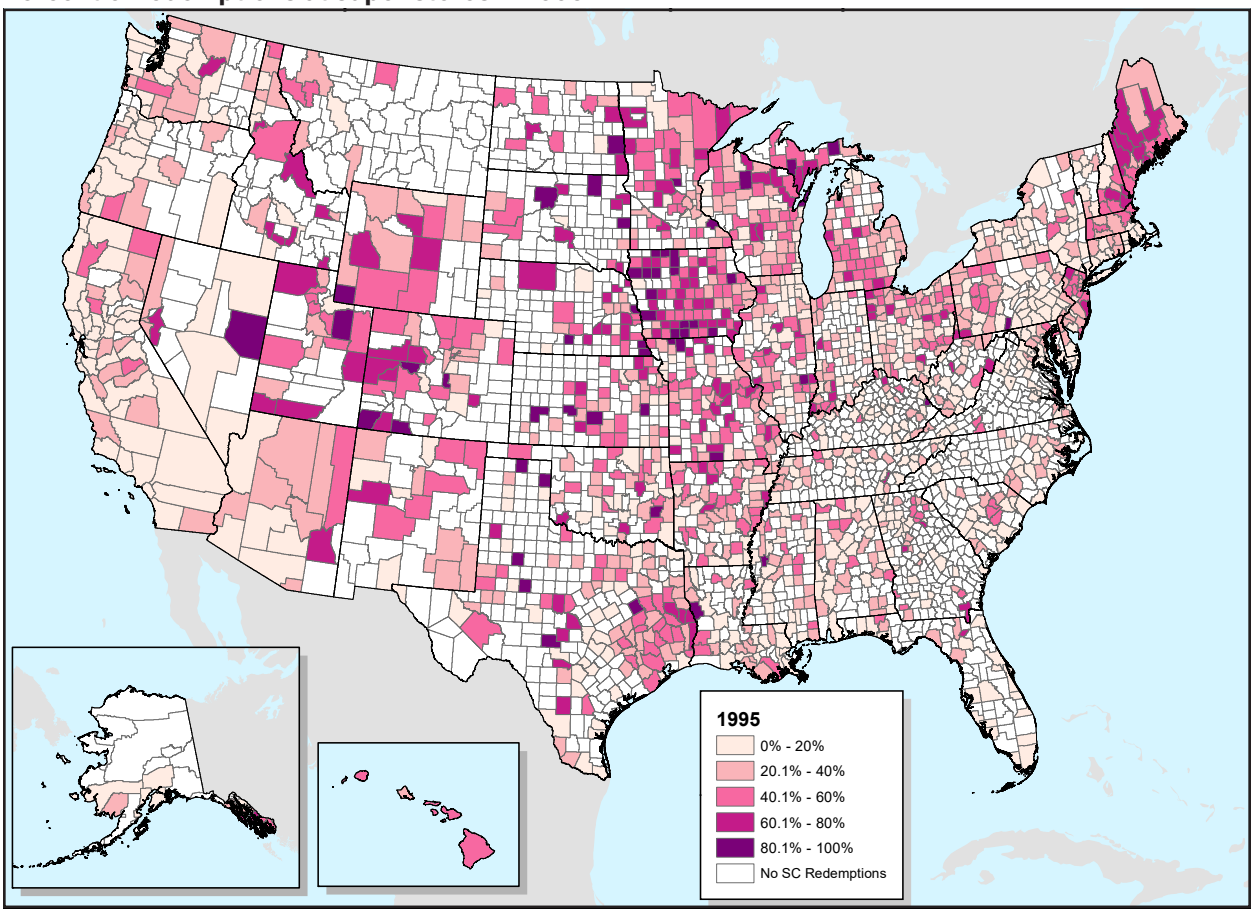
[1]This paper focuses on changes in the availability of traditional stores as super stores entered the retail environment. The paper considers access when it discusses redemptions, i.e., the ability of a consumer to purchase food. Food is accessible if available in stores that can be reached by public or private transportation, and consumers have the financial means to purchase it. See Bodor et al. (2010) for a discussion.

Super Stores' Impact on the Availability of Supplemental Nutrition Assistance Program-Approved Stores

Introduction

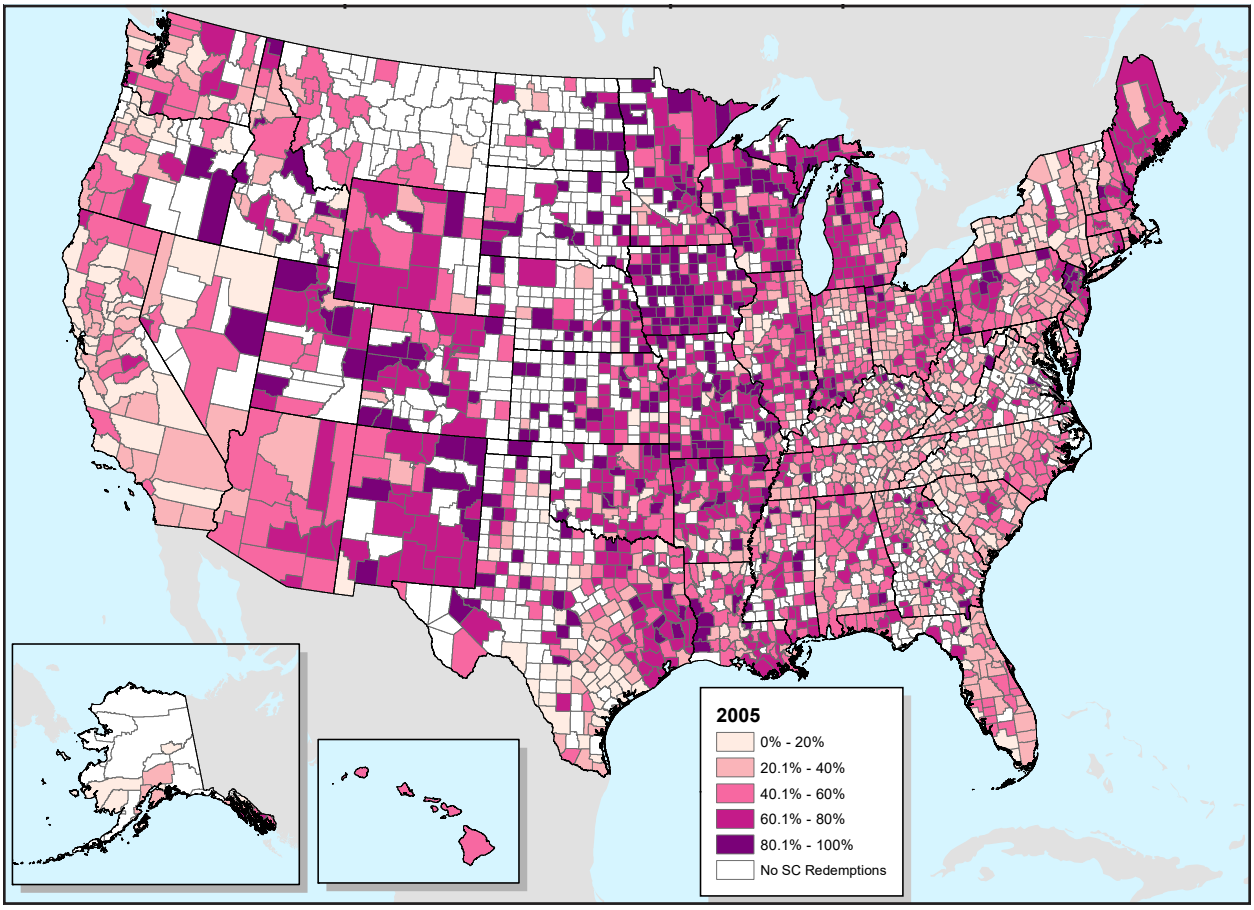
The Supplemental Nutrition Assistance Program, or SNAP, provides low-income households with benefits that can be redeemed for food at participating stores. The stores include small, more densely distributed food stores, such as corner grocery stores, convenience stores, or pharmacies, and lower cost, but usually less densely distributed larger stores, such as supermarkets and super stores. See box 1 for a definition of store types. In recent years, SNAP beneficiaries shifted their SNAP redemptions away from supermarkets to super stores (figures 1, 2, and 3). The differences were particularly sharp between 1995 (figure 1) when super stores received a relatively small share of redemptions, and 2005 (figure 2) when super stores accounted for more than 40 percent of all SNAP redemptions. New Mexico and Arizona (lower left corners of each map) went from 0–20 percent super store market share of redemptions to about 60–80 percent market share. Figure 4 illustrates these trends graphically, showing that the share of SNAP benefits redeemed at super stores rose from 0.14 to 0.51 over 1992–2017. Most of the super store gains came at the expense of supermarkets, which saw their share of SNAP redemptions drop from 0.62 to 0.37. The share of redemptions at grocery and convenience stores also fell, but the share of redemptions at combination stores rose sharply.

Figure 1
Percent of redemptions at super stores in 1995



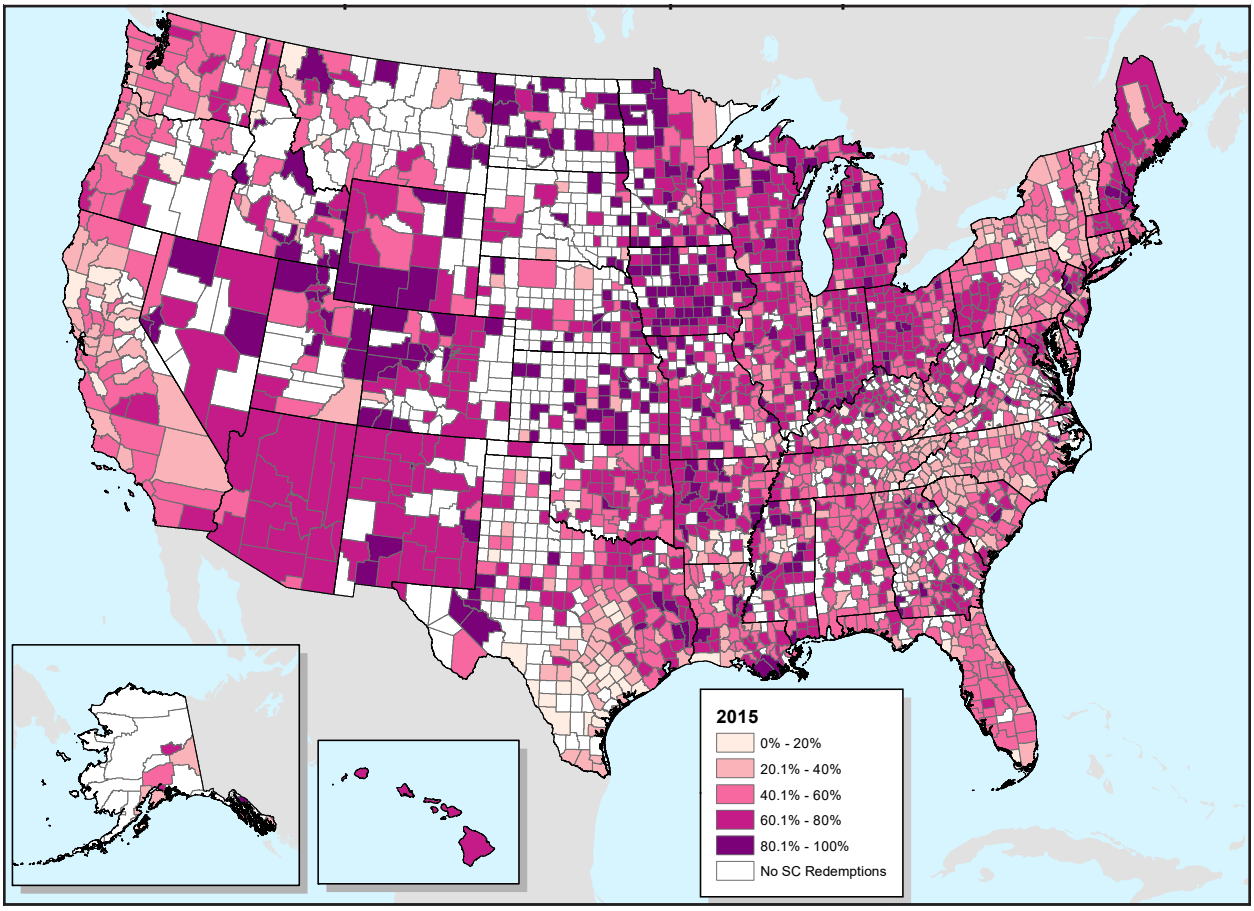
Source: USDA, Economic Research Service using USDA, Food and Nutrition Service data.

Figure 2
Percent of redemptions at super stores in 2005



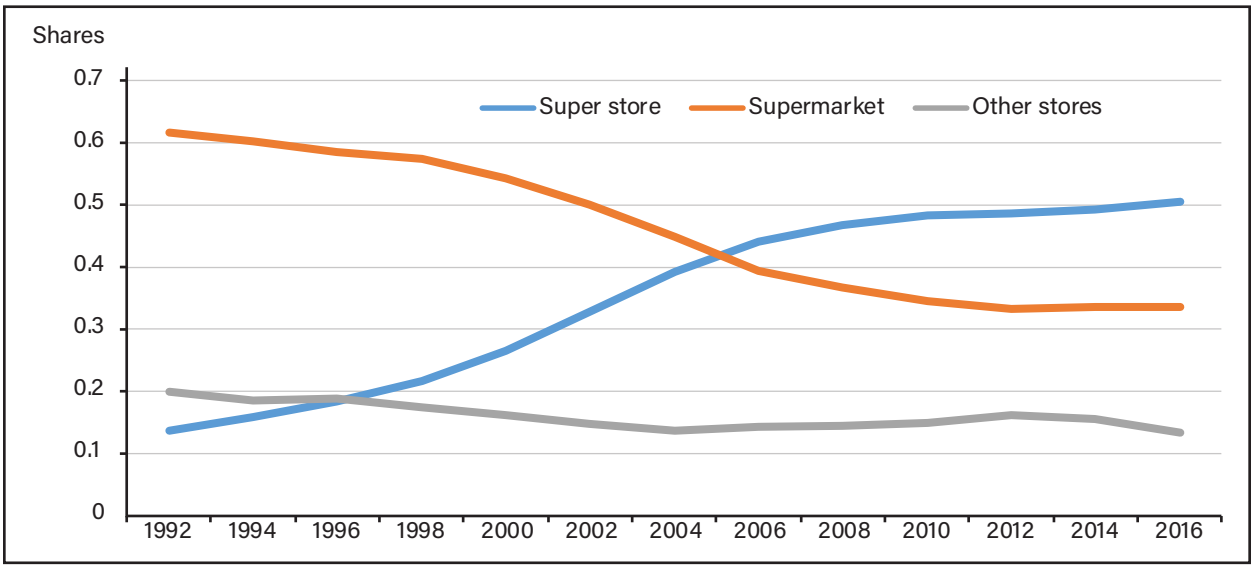
Source: USDA, Economic Research Service using USDA, Food and Nutrition Service data.

Figure 3
Percent of redemptions at super stores in 2015



Source: USDA, Economic Research Service using USDA, Food and Nutrition Service data.

Figure 4
Share of Supplemental Nutrition Assistance Program (SNAP) redemptions, 1992–2016



Source: USDA< economic Research Service, using data from National Establishment Time Series from 2015.

Table 1

Supplemental Nutrition Assistance Program (SNAP) redemptions and share of redemptions by store type, 1992–20171

Year	Redemptions[1]	Store type					
		Super stores[2]	Super- markets[3]	Grocery stores[4]	Convenience stores[5]	Combination stores[6]	Other stores[7]
	billions $	share of redemptions					
1992	10.79	0.137	0.617	0.094	0.080	0.025	0.047
1993	21.31	0.147	0.612	0.086	0.076	0.026	0.053
1994	21.23	0.158	0.603	0.085	0.075	0.026	0.053
1995	20.50	0.172	0.593	0.088	0.075	0.028	0.044
1996	19.45	0.184	0.586	0.088	0.072	0.028	0.042
1997	16.16	0.198	0.579	0.086	0.068	0.029	0.040
1998	14.17	0.217	0.574	0.083	0.061	0.030	0.035
1999	13.02	0.239	0.562	0.081	0.055	0.031	0.032
2000	11.99	0.265	0.543	0.078	0.052	0.032	0.030
2001	12.77	0.296	0.521	0.074	0.048	0.033	0.028
2002	14.72	0.328	0.500	0.067	0.046	0.034	0.025
2003	16.95	0.361	0.475	0.063	0.043	0.035	0.023
2004	19.12	0.392	0.449	0.060	0.041	0.036	0.022
2005	21.14	0.421	0.417	0.058	0.041	0.040	0.023
2006	20.61	0.441	0.394	0.058	0.042	0.043	0.022
2007	21.00	0.459	0.376	0.058	0.041	0.045	0.021
2008	24.11	0.468	0.367	0.057	0.040	0.048	0.020
2009	35.61	0.476	0.358	0.055	0.041	0.050	0.020
2010	42.82	0.484	0.345	0.053	0.044	0.052	0.022
2011	45.48	0.485	0.339	0.053	0.047	0.055	0.021
2012	45.84	0.486	0.332	0.052	0.050	0.059	0.021
2013	45.00	0.488	0.332	0.051	0.050	0.062	0.017
2014	41.14	0.492	0.336	0.046	0.046	0.063	0.017
2015	40.25	0.501	0.336	0.041	0.042	0.064	0.016
2016	37.83	0.505	0.336	0.038	0.040	0.066	0.015
2017	36.99	0.511	0.341	0.034	0.036	0.065	0.013

Notes: [1] Value of redemptions are deflated by the consumer price index to 1992 dollars.

[2] Super stores are defined as large food/drug combo stores and mass merchandisers under a single roof, and membership retail/wholesale hybrids offering a limited variety of products in warehouse-type environment.

[3] Supermarkets sell an extensive variety of grocery and other store merchandise. This store may have 10 or more checkout lanes. Customers normally make large volume purchases.

[4] Grocery stores carry all four staple food categories. They may sell ineligible items as well, but their primary stock is food items. Large groceries have three or more registers, whereas medium grocery stores may only have two registers; small grocery stores usually have one register.

[5] Convenience stores offer a limited line of convenience items and are typically open long hours to provide easy access for customers. Food items may include canned goods, dairy products, pre-packaged meats, and other grocery items in limited amounts.

[6] Combination stores primarily sell general merchandise but also sell a variety of food products. Such stores include independent drug stores, dollar stores, and general stores.

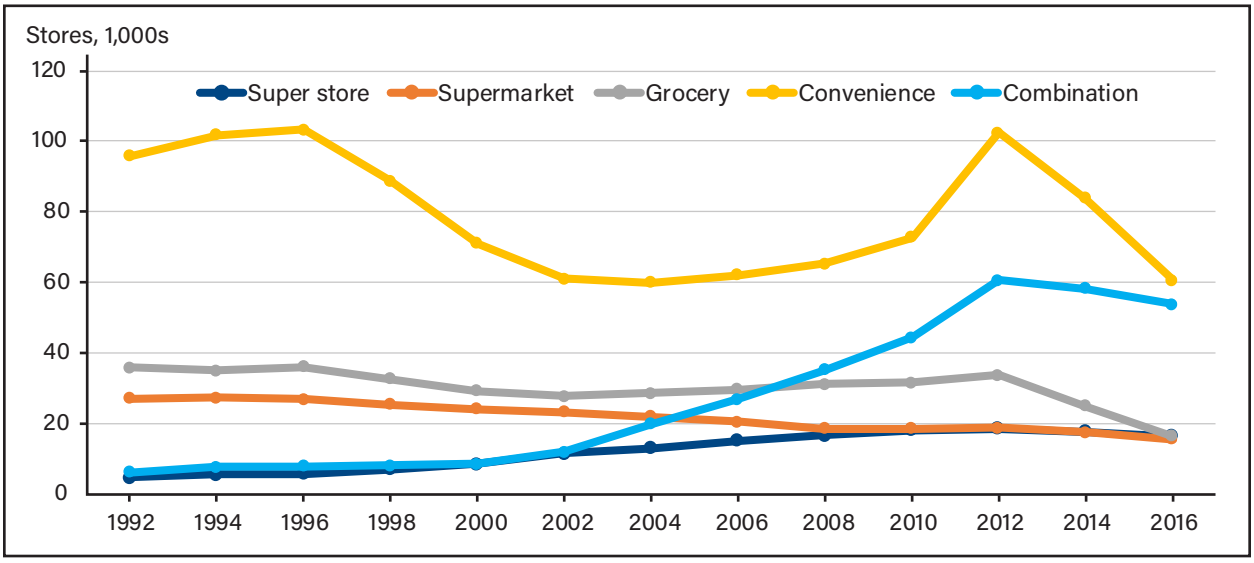
[7] Other stores are farmers' markets and other non-traditional food outlets.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Super stores earn profits from high sales and low prices (Volpe and Lavoie, 2008). The low prices may have encouraged SNAP beneficiaries to shift their redemptions to super stores (table 1), which could result in lost revenues and possible business exit of traditional stores. Because super stores are less densely distributed than other store formats, this could result in a loss of access to closer food stores for SNAP recipients lacking a vehicle to travel to a store. Ver Ploeg et al. (2017) found that about 6 percent of households do not use their own vehicle to travel to a store, live more than 0.5 miles from a supermarket, and are less likely to shop at a super market or super store.[2] The net effect for access-burdened households could be higher prices as they shift their purchases to higher-cost traditional stores.

There is evidence that the mix of stores has been changing. Figure 5 shows that super stores steadily increased in number during 1992–2017 as the number of supermarkets and convenience stores dropped by about 50 percent, and the number of grocery stores was down about 66 percent (table 2). Offsetting some of these declines was a sharp increase in the number of combination stores.

Figure 5
Stores approved to accept Supplemental Nutrition Assistance Program (SNAP) benefits, 1992–2016



Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from the USDA, Food Nutrition Service.

The purpose of this paper is to examine the impact of super store entry on the number of traditional stores that accept SNAP benefits and the value of their SNAP redemptions. Related research has provided evidence that super stores affect consumer welfare (Hausman and Leibtag, 2007), offer lower food prices (Basker, 2005a; Courtemanche and Carden, 2014; Volpe and Lavoie, 2008; Basker and Noel, 2009), and improved food security (Courtemanche et al., 2019). Research also has shown that super stores affect labor markets (Basker, 2005b; Ciccarella et al., 2008) and raise real estate values (Pope and Pope, 2015). Finally, studies have shown that supermarkets did not lower their prices in response to Costco, Sam's Club, and other club stores' entry (Courtemanche and Carden, 2011) but did improve service quality (Matsa, 2011).

[2]This lack of access may not adversely affect the types of food purchases, however. Ver Ploeg et al. (2017) found that expenditures of access-burdened households were about the same percentage of income as other consumers, and Rahkovsky and Snyder (2015) determined that households in low income census tracts and have limited availability to supermarkets purchase modestly lower amounts of fruits and vegetables and modestly more amounts of other foods such as red meat, diet soft drinks, and non-diet drinks.

This USDA, Economic Research Service (ERS) report most closely follows research by Ellickson and Grieco (2013), who considered employment growth at nearby supermarkets, Haltiwanger et al. (2010), who examined how employment at stand-alone retail stores changed as the number of big box stores changed, and Schuetz (2014), who examined competition and entry among big box stores in southern California. This paper differs from those in that we examined the effect of super store entry on the number of supermarkets, grocery stores, and combination stores that accept SNAP benefits and SNAP redemptions.

The results of this report highlight the dynamics of the market for SNAP benefits and provide information on how access-burdened SNAP beneficiaries may fare in a changing food store environment. This report also illustrates a unique administrative dataset, the Store Tracking and Redemption System (STARS) dataset, which identifies the number of cash registers, store format, SNAP redemptions, and name and address information for all stores accepting SNAP benefits between 1992 and 2017. STARS assigns a unique store identifier that allowed us to identify store entries across a range of different retail environments and evaluate the period before 2004 separately from the period after. The study of the post-2004 period is important because super stores emerged as the dominant food retailer to SNAP beneficiaries after 2004.

Table 2

Number of Supplemental Nutrition Assistance Program (SNAP)-approved food stores in U.S., 1992–2017[1]

		Store type				
Year	SNAP stores	Super stores[2]	Super-markets[3]	Grocery stores[4]	Convenience stores[5]	Combination stores[6]
	thousands of stores					
1992	169.9	4.8	27.1	35.9	95.9	6.2
1993	177.3	5.1	27.9	35.9	101.2	7.2
1994	177.4	5.5	27.4	35.1	101.7	7.7
1995	180.3	5.9	27.0	36.2	103.2	8.0
1996	177.3	6.4	26.4	35.9	100.5	8.1
1997	171.7	6.8	25.9	34.6	96.2	8.2
1998	162.4	7.2	25.5	32.7	88.8	8.2
1999	152.1	7.8	25.1	31.0	80.1	8.1
2000	141.6	8.6	24.2	29.3	71.0	8.5
2001	138.9	10.1	24.1	28.3	65.5	10.9
2002	135.5	11.5	23.3	27.7	61.0	12.0
2003	135.2	12.3	22.7	28.0	59.5	12.7
2004	143.4	13.1	22.0	28.6	59.9	19.8
2005	149.3	13.7	21.2	29.1	61.4	23.9
2006	154.4	15.1	20.5	29.6	62.2	27.0
2007	159.2	16.1	18.9	30.5	62.8	30.9
2008	167.0	16.6	18.7	31.1	65.4	35.2
2009	185.8	18.1	18.7	31.7	72.8	44.5
2010	206.8	18.2	18.6	31.7	72.8	44.5
2011	222.5	18.4	18.8	34.2	95.2	55.9
2012	234.3	18.6	18.9	33.8	102.4	60.6
2013	220.1	18.2	18.2	29.6	94.4	59.7
2014	202.6	17.8	17.6	25.1	83.8	58.3
2015	174.7	17.0	16.3	19.0	67.3	55.1
2016	163.0	16.4	15.6	16.5	60.6	53.9
2017	147.6	15.6	14.8	13.4	51.8	52.0

Notes: [1]Other store formats are not included as they account for a very small share of Supplemental Nutrition Assistance Program (SNAP) redemptions.

[2]Super stores are defined as large food/drug combo stores and mass merchandisers under a single roof, and membership retail/wholesale hybrids offering a limited variety of products in a warehouse-type environment.

[3]Supermarkets sell an extensive variety of grocery and other store merchandise. This store may have 10 or more checkout lanes. Customers normally make large volume purchases.

[4]Grocery stores carry all four staple food categories. They may sell ineligible items as well, but their primary stock is food items. Large groceries have three or more registers, whereas medium grocery stores may only have two registers; small grocery stores usually have one register.

[5]Convenience stores offer a limited line of convenience items and are typically open long hours to provide easy access for customers. Food items may include canned goods, dairy products, pre-packaged meats, and other grocery items in limited amounts.

[6]Combination stores primarily sell general merchandise but also sell a variety of food products. Such stores include independent drug stores, dollar stores, and general stores.

Source: USDA, Economic Research Service computations based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Store type definitions

Combination grocery/other:
Primary business is the sale of general merchandise, but these stores also sell a variety of food products. Such stores include independent drug stores, dollar stores, and general stores.

Convenience store:
Self-service stores that offer a limited line of convenience items and are typically open long hours to provide easy access for customers. Primarily engaged in the retail sale of a variety of canned goods, dairy products, pre-packaged meats, and other grocery items in limited amounts. Usually sell a large variety of ineligible products, such as hot coffee, alcohol, or tobacco products.

Large grocery store:
A store that carries a wide selection of all four staple food categories. They may sell ineligible items as well, but their primary stock is food items.

Medium grocery store:
A store that carries a moderate selection of all four staple food categories. They may sell ineligible items as well, but their primary stock is food items.

Small grocery store:
A store that carries a small selection of all four staple food categories. They may sell ineligible items as well, but their primary stock is food items.

Supermarket:
Establishments commonly known as supermarkets, food stores, grocery stores, and food warehouses primarily engaged in the retail sale of an extensive variety of grocery and other store merchandise. This store typically has 10 or more checkout lanes with registers, bar code scanners, and conveyor belts.

Super store/chain store:
Very large supermarkets, "big box" stores, super stores, and food warehouses primarily engaged in the retail sale of a wide variety of grocery and other store merchandise. Includes stores that are large food/drug combo stores and mass merchandisers under a single roof, and membership retail/wholesale hybrids offering a limited variety of products in a warehouse-type environment.

Other stores:
Direct marketers, such as pick-your-own operations, delivery routes (no permanent location), farmers' markets, military commissaries, non-profit food buying cooperatives, wholesalers with a retail operation, and specialty food stores selling mainly bakery products, fruits and vegetables, meat and poultry, or seafood products and stocking other food items.

The Food Retail Environment and Store Business Strategies

USDA, Economic Research Service (ERS) reports (USDA, 2009; Ver Ploeg et al., 2012; Rhone et al., 2017; 2019) provided insights into the U.S. population's distance from the nearest supermarket, super store, or large grocery store. Because demographic characteristics and vehicle access can be key to food access, ERS also evaluated recipients' distance to food stores by age, race, income, and vehicle access.[3] These reports provided important information regarding food store access from the perspective of consumers but did not consider the economic forces shaping the consumer retail environment. Yet, food retailing—including the segment serving SNAP beneficiaries and like all industries—has been subject to the process of creative destruction described by Schumpeter (1942). Table 1 shows that the super store share of SNAP redemptions rose from 0.14 to 0.51 between 1992 and 2017 as the supermarket share of SNAP benefits dropped from 0.61 to 0.34.

Ellickson and Greico (2013) considered super stores to be an extension of the supermarket model, which emerged as a major force in food retailing in the 1930s and 1940s as a format type that offered canned and other dry goods, a meat counter, and fresh produce. Over the next several decades, supermarkets consolidated, developed large-scale, hub-and-spoke distribution networks, and adopted bar scanners and other cost-reducing information technologies (Ellickson and Greico, 2013). By 1992, supermarkets dominated food retailing, including service to SNAP beneficiaries (Table 1).

The processes driving changes in food retailing continue up to the present. Foster et al. (2006) found almost all the labor productivity growth in the retail sector in the late 1990s was due to the entry and expansion of high productivity firms and the exit of less productive firms. A key to this high productivity at Walmart, for example, was a highly efficient distribution network (Holmes, 2011). In terms of store format, Haltiwanger et al. (2010) found that employment at small stand-alone food and other retail stores dropped as the number of big box stores rose. Ellickson and Grieco (2013), focusing on food retailing, determined that labor growth at nearby supermarkets dropped as Walmart super stores entered the market. The effect of super stores on prices was mixed, however. Walmart's entry led to lower prices (Volpe and Lavoie, 2008), while the entry of club stores like Costco and Sam's Clubs that require paid membership did not (Courtemarche and Carden, 2014).

High productivity is a key competitive advantage, but location is fundamental to success. Hotelling (1929) asserted that consumers would purchase products from the nearest vendors. Studies have shown that gasoline stations are dispersed because nearby competition drives down prices and profitability (Netz and Taylor, 2002), but auto parts suppliers are clustered near assembly plants to lower transportation costs (Klier and McMillen, 2008). Schuetz (2014) showed that big box stores avoid locating near their own existing stores and locate near complementary big box stores. They found no evidence that big box stores avoid competitors. Others, such as Neumark et al. (2008), used distance from Bentonville, AR, (the location of Walmart's headquarters) multiplied by time to identify sites of Walmart stores. These studies make it clear that entry is endogenous to the strategic business plan of management, and identification of that business plan is important to evaluate the effects of subsequent expansion into new markets.

Ellickson and Grieco (2013) asserted that failure to identify a business strategy limits the implications of a model to the types of markets already entered. However, this did not prevent them from studying the impact of Walmart's entry on labor growth at nearby supermarkets. They acknowledged the applicability of their results is limited to the types of markets Walmart had already entered. Because Walmart had entered most

[3]This paper focuses on changes in the availability of traditional (not super store) stores as super stores entered the retail environment. The paper considers access when it discusses redemptions, i.e., the ability of a consumer to purchase food. Food is accessible if available in stores that can be reached by public or private transportation, and consumers have the financial means to purchase it. See Bodor et al. (2010) for further discussion.

types of markets in the U.S. by 2013, they argued their results were predictive for most markets Walmart was likely to enter. Thus, identification is important during a geographic expansion phase when past entry is less predictive of future effects. However, identification is less important after a market has matured because most if not all markets have already been entered, making the past predictive of the future.

A common finding of this research is that consolidation in the food retail sector is an ongoing process through which new technologies and store formats drive change. After describing the data, we extend research by Ellickson and Grieco (2013) and others to a study of the impact of super store entry on the number of food retail outlets in their market area.

The Data

We used the Store Tracking and Redemption System (STARS) data from the USDA, Food and Nutrition Service (FNS) and Bureau of the Census demographic data. The STARS data included all stores authorized to accept SNAP payments over the 1992–2017 period accompanied by store name, store format, a unique store identifier that links stores across time, store geographic location, SNAP redemptions, and the number of cash registers. The STARS data we obtained from FNS served as annual snapshots of the stores and their characteristics.

Stores eligible to accept SNAP must provide a minimum requirement of staple foods and obtain authorization from FNS. FNS approves applications to accept SNAP benefits based on the retailer's inventory or sales of staple foods. FNS monitors SNAP retailers to ensure they follow program rules and can withdraw or disqualify retailers from accepting SNAP benefits if they break the rules or no longer qualify to accept SNAP benefits (USDA, 2019). According to Rhone et al. (2017), most major super stores and supermarkets accept SNAP benefits and, according to Tiehen and Frazao (2016), "Ninety-eight percent of WIC retail vendors were also authorized by SNAP." [4]

Store formats included super stores, traditional stores—supermarkets and grocery, convenience, and combination stores—and other less frequented venues, such as farmers' markets. Box 1 provides the characteristics of formats, including three types of grocery stores. For purposes of analysis, we combined all grocery stores into one category. Combination stores include dollar stores, pharmacies, and other stores selling a variety of products. Some traditional supermarket chains that sold gasoline or contained an in-store pharmacy were classified as combination stores in STARS; we then reclassified those combination stores as supermarkets for consistency. Farmers' markets, specialty food stores, and other less-frequented stores and markets accounted for a 0.014 to 0.054 share of SNAP redemptions over 1992–2017 (table 1) and are not included in this report.

[4]WIC is an abbreviation of USDA's Supplemental Nutrition Program for Women, Children, and Infants.

The Analytical Framework

The retail environments for SNAP beneficiaries underwent a considerable change over 1992–2017. The most substantive changes occurred up to 2004 when super stores overtook supermarkets as the dominant retail store format for SNAP beneficiaries (figure 4). By 2011, super store growth reached its peak (figure 5), and the share of SNAP redemptions stabilized (figure 4). Moreover, super stores were located nationwide (figures 2 and 3), present in rural, urban, and suburban areas (table 5), and included regional and national stores. There were 21,816 super stores in our dataset, including 8,419 national-branded super stores and 13,397 regional and other super stores.[5] Together, these data suggest super stores entered most markets they would enter by 2011. Thus, with little loss of generality, we followed Ellickson and Grieco (2013) in restricting our study to the types of markets that super stores had entered by 2015 (in our case), enabling us to avoid a restrictive identification strategy that may be applicable to national chains but not regional super stores. We acknowledge our results may not apply to entry in very dense market areas, such as parts of New York City, and other unique areas where super stores are not located.

Some studies of firm (store) entry examined the effects of entry over an event window comprising the pre- and post-entry periods and the entry year. In their study, Ellickson and Grieco (2013) examined food retail employment growth from 4 years before to 5 years after Walmart's entry in market areas up to 6 miles in diameter. We followed that same framework. Like Ellickson and Grieco (2013), we examined changes in a market area reflective of the catchment area of the super store across an event window comprising a reference period before super store entry, a post-entry period after super store entry, and the entry year.

Ellickson and Grieco (2013) found that labor growth at supermarkets was unchanged beyond 2 miles of a Walmart.[6] Thus, we examined 2.5-, 5.0-, and 7.5- kilometer (approximately 1.5-, 3.0-, and 4.5-mile) radii market areas to see how the number of stores and redemptions changed up to and beyond the super store market area boundary.

Ellickson and Grieco (2013) also found that the effects of super store entry dissipated after 3 years, making it necessary for the event window to include at least a 3-year post entry period. The event window also includes the entry year and a 2-year pre-entry reference period, leaving a 6-year event window.[7] The reference years provided a baseline against changes after super store entry could be contrasted. Tables 3a, 3b, and 4 illustrate changes in the number of stores and redemptions across the event window. Years -1 and -2 are the reference years that capture the retail environment before super store entry; year 0 is the super store entry year; years 1, 2, and 3 are the post-entry years.

[5]Each super store exists in the dataset in at least 1 year over 1992–2017. All 21,816 are never present in 1 year. The most super stores present in the data occurred in 2012 when there were 18,600 super stores, which is more than 3,000 less than the total number of stores ever to exist in the data; by 2017, the number of super stores dropped to 15,600 (table 2).

[6]If labor growth is changing, then either the number of retailers or the size of the stores is changing. Ellickson and Grieco (2013) found that super stores do not affect food retail labor growth after 2 miles, implying that there is no effect of super stores on the traditional stores after 2 miles.

[7]As we discuss later, one of the reference years is dropped due to the requirements of our economic model; thus, we use a 6-year event window in our analysis.

Super store selection

We examine the impact of super store entry on the number of existing stores and the value of their redemptions by estimating the change in stores or redemptions that occurs when only one super store enters a market over a period from 3 years before super store entry to 3 years after entry. Change is given by the difference in the number of stores and their redemptions over that period after accounting for other factors, such as the changes in State total SNAP benefits.

Because the data included more than 21,000 super stores, there were many super store entrants that fit the ideal conditions of no other super store entrant from 3 years before to 3 years after a single super store enters the market.

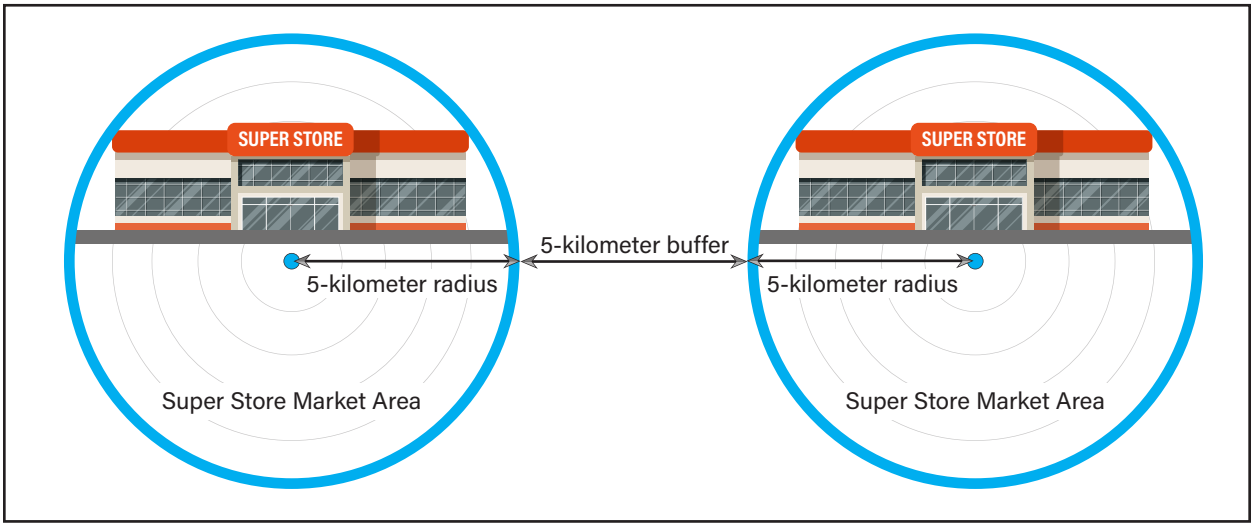
We used the following procedures to select super store entrants meeting our criteria. First, we used addresses to determine distances between each super store and each traditional store. We considered only stores that were within 20 kilometers (approximately 12 miles) of each other. These data provided a population of traditional and super stores that were in any super store's market area at any time over 1992–2017.

Our second step was to identify the super store entry year. Since we used time series data for all SNAP-approved stores, the entry year for any store was the first year it appeared in the data.[8] There were 21,814 super stores in the entire dataset. Because we used historical information to determine entry year, we dropped all super stores that existed in the first year of the data series (and with no historical information), which were all stores existing in 1992, leaving 17,006 super stores with known entry years.

In the third step, we determined if a super store entrant was unique to a market area by inspecting a market area with a 10-kilometer (approximately 6-mile) radius around each super store entrant over the event period. This 10-kilometer radius included a 5-kilometer (approximately 3-mile) radius marketing area of the super store plus a 5-kilometer (approximately 3-mile) outer ring that served as a buffer between adjacent super store entrants. The buffer was necessary because a supermarket that was on the extreme edge of a super store entrant's 5-kilometer market area would still be 5 kilometers away from the extreme edge of the market area of a competing adjacent super store entrant. Thus, the minimum distance between any two super-stores that enter during the same event years is 15 kilometers (approximately 9 miles) (figure 6).

[8]This was also the first year the store was authorized to accept SNAP benefits.

Figure 6
Five-kilometer super store market area of two adjacent super stores, with 5-kilometer buffer



Source: Author's representation (visualization) of the market area of selected entrant super stores.

We also examined 2.5- and 7.5-kilometer (approximately 1.5- and 4.5-mile) radii market areas. We followed a similar procedure for them, including a 5-kilometer buffer between adjacent super stores.

The number of unique super stores and the numbers of traditional stores varied with the size of the market area. Larger market areas saw fewer unique super store entrants but more traditional stores. Each market area contained 6 years of data—2 years before entry, 3 years after entry, and the entry year.[9] To accommodate this 6-year event window, we dropped super store entrants with entry years before 1994 or after 2015. Altogether, there were 2,434 unique 5-kilometer radius super store market areas, 3,006 unique 2.5-kilometer radius super store market areas, and 2,013 unique 7.5-kilometer radius super store market areas.

[9]The study period included the third year before super store entry. Analytical requirements made it necessary for us to drop this year from the study period.

Evidence of Change

Exits occur when a store is no longer SNAP-approved. This could either be an exit from the business of serving SNAP beneficiaries, a business failure, or some other cause that could prompt a store to no longer be able to accept SNAP benefits. Entry, by contrast, occurs when a store is approved to accept SNAP benefits. Redemptions are measured as the sum of all redemptions in a super store's market area.

Table 3a shows declines in the number of supermarkets of 0.40 to 0.50 stores, grocery stores of 0.10 to 0.40 stores, and convenience stores of 0.40 to 0.95 stores and an increase in the number of combination stores of 0.70 to 1.50 stores over 2.5-, 5-, and 7.5-kilometer radius market areas.

Table 3a

Number of stores in 2.5-, 5-, and 7.5-kilometer radii marketing areas of entrant super stores from 2 years before super store entry to 3 years after super store entry

Year from super store entry	All stores	Super-markets	Grocery stores1	Convenience stores	Combination stores
	Number of stores within 2.5-kilometer radius super store market area				
-2	6.47	1.72	0.84	3.20	0.72
-1	6.47	1.70	0.82	3.12	0.83
0	6.40	1.64	0.81	3.01	0.94
1	6.33	1.43	0.79	3.00	1.10
2	6.34	1.37	0.78	2.93	1.27
3	6.32	1.31	0.74	2.84	1.42
	Number of stores within 5-kilometer radius super store market area				
-2	12.85	2.87	1.80	6.89	1.29
-1	12.79	2.83	1.75	6.74	1.46
0	12.66	2.76	1.72	6.53	1.65
1	12.62	2.53	1.72	6.46	1.90
2	12.63	2.44	1.69	6.31	2.19
3	12.65	2.35	1.65	6.18	2.47
	Number of stores within 7.5-kilometer radius super store market area				
-2	16.31	3.39	2.19	9.21	1.52
-1	16.19	3.41	2.02	9.05	1.72
0	15.97	3.42	1.95	8.75	1.93
1	15.78	3.07	1.90	8.59	2.22
2	15.75	2.97	1.85	8.36	2.56
3	15.73	2.87	1.81	8.15	2.89

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Table 3b shows that redemptions at supermarkets and all stores together peaked 1 year before the super store entry year and never recovered even as redemption benefits grew. Redemptions at grocery stores and convenience stores also dropped but redemptions grew at combination stores. Redemptions at super stores more than compensated for the modest declines at the other stores.

Table 3b
Value of redemptions in 2.5-, 5-, and 7.5-kilometer radii marketing areas of super store entrants from 2 years before super store entry to 3 years after super store entry

Year from super store entry	All traditional stores	Super-markets	Grocery stores[1]	Convenience stores	Combination stores	Super stores
	2.5-kilometer radius super store market area, value of redemptions ($1,000)					
-2	745	659	34	35	18	0
-1	789	695	38	37	20	0
0	730	636	36	36	22	190
1	692	595	36	35	25	434
2	697	597	37	35	28	516
3	701	597	37	36	32	588
	5-kilometer radius super store market area, value of redemptions ($1,000)					
-2	1,333	1,153	72	76	32	0
-1	1,411	1,219	76	79	36	0
0	1,336	1,143	74	78	41	186
1	1,290	1,090	75	78	47	428
2	1,292	1,085	76	78	53	512
3	1,300	1,084	78	79	60	589
	7.5-kilometer radius super store market area, value of redemptions ($1,000)					
-2	1,676	1,436	92	107	40	0
-1	1,757	1,517	88	107	45	0
0	1,659	1,421	84	104	50	186
1	1,588	1,345	83	102	57	430
2	1,581	1,332	83	101	65	514
3	1,582	1,325	83	102	72	589

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

[1] Value of annual redemptions are deflated by the consumer price index to 1992 dollars

Super store SNAP redemptions grew rapidly after 1992 and, by 2005, super stores surpassed supermarkets as the dominant food retailer to SNAP beneficiaries (table 1). To see how this change in the market for SNAP redemptions may have affected the number of traditional stores and their redemptions differently, we split the sample into the pre-2005 and post-2004 years and examined the two periods separately (table 4). It indicates that, before 2005, the number of stores dropped by about 11 percent over the event window with supermarkets and convenience stores dropping by about 20 percent each and combination stores more than doubling. After 2004, the number of stores increased by 30 percent, led by combination stores, which rose 80 percent. The number of supermarkets continued their decline, dropping by 20 percent. Percent changes in redemptions before 2005 matched the changes in the number of stores; after 2004, however, the value of redemptions rose about 50 percent, supermarket redemptions grew about 25 percent, and convenience and combination store redemptions doubled.

Table 4

Number of traditional stores and the value of their deflated annual redemptions from 2 years before super store entry to 3 years after super store entry in a 5-kilometer radius marketing area of entrant super stores before 2005 and after 2004[1]

Year from super store entry	Before 2005					After 2004				
	Store type									
	All stores	Super-markets	Grocery stores	Conven-ience stores	Combi-nation stores	All stores	Super-markets	Grocery stores	Conven-ience stores	Combi-nation stores
	number of stores									
-2	13.51	3.17	2.01	7.61	0.73	11.11	2.09	1.27	5.01	2.74
-1	13.20	3.14	1.93	7.34	0.79	11.71	2.02	1.29	5.20	3.19
0	12.80	3.08	1.86	6.95	0.91	12.31	1.96	1.34	5.44	3.56
1	12.49	2.84	1.86	6.71	1.07	12.94	1.74	1.34	5.81	4.06
2	12.27	2.72	1.81	6.41	1.33	13.58	1.70	1.35	6.05	4.48
3	11.99	2.59	1.76	6.07	1.56	14.45	1.69	1.34	6.48	4.94
	Value of redemptions[2]									
-2	1,395	1,220	74	80	21	1,170	977	67	64	62
-1	1,466	1,287	75	82	22	1,267	1,043	77	73	74
0	1,351	1,180	71	76	24	1,300	1,048	83	83	86
1	1,256	1,088	70	71	26	1,379	1,094	89	95	101
2	1,209	1,043	70	66	30	1,513	1,197	91	108	116
3	1,152	989	69	62	32	1,705	1,343	102	125	136

[1] The year 2004 is about the midpoint in the time series of data.

[2] Value of redemptions are deflated by the consumer price index to 1992 dollars.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

These data provide some evidence that super store entry brought about substantial changes in the retail environment. However, other economic forces likely affected the food retail sector as supermarkets adopted many of the innovations introduced by super stores, such as highly efficient distribution networks.

The Empirical Model

The entry of super stores could account for changes in the numbers of stores and values of SNAP redemptions shown in the data. However, technological changes, variations in the provision of SNAP benefits, and other factors may also affect the number of stores. We accounted for those other factors to more clearly associate super store entry with a change in the numbers of traditional stores or the value of their redemptions. Below, we used two econometric models (equations 1 and 2) to examine changes in the number of stores and the value of redemptions over an event window spanning from 2 years before super store entry to 3 years after entry using data covering 1994–2015. We then considered how the number of stores and redemptions change as the market area changes as well as over different periods of time.

The Econometric Model

We constructed two variations of a similar econometric model in which we examined the number of stores (equation 1) or redemptions (equation 2) in the market area of the super store. The dependent variables were the number of SNAP-approved stores in the market area of the super store ($TS_{i,t}$) and the value of their redemptions ($TSR_{i,t}$).

The equations are below. Description of the variables and their justification and purpose follow the equations.

$$TS_{i,t} = \alpha_0 + \sum_{w=1}^{w} \theta_w \boldsymbol{E_{w,i,t}} + \sum_{r=1}^{r} \sigma_r \boldsymbol{RU_{r,i,t}} + \delta R_{s,t} + \pi T_t + \rho LTS_{i,t-1} + \sum_{o=1}^{o} \gamma_o \mathbf{ISS_{o,i,t}} + \sum_{n=1}^{n} \beta_n \boldsymbol{N_{n,i,t}} + \vartheta L_i + \varepsilon_{i,t}$$

We modified equation 1 to examine SNAP redemptions in equation 2 empirically. Specifically, we replaced the dependent variable—number of stores ($TS_{i,t}$)—with the annual value of total store SNAP redemptions ($TSR_{i,t}$). All the independent variables in equation 2 are identical to those in equation 1 except we replaced lagged total stores ($LTS_{i,\ t-1}$) with lagged total SNAP annual redemptions of other stores ($LTSR_{i,\ t-1}$).

$$TSR_{i,t} = \alpha_0 + \sum_{w=1}^{w} \theta_w E_{w,i,t} + \sum_{r=1}^{r} \sigma_r RU_{r,i,t} + \delta R_{s,t} + \pi T_t + \rho LTSR_{i,t-1} + \sum_{o=1}^{o} \gamma_o ISS_{o,i,t} + \sum_{n=1}^{n} \beta_n N_{n,i,t} + \vartheta L_i + \varepsilon_{i,t}$$

The descriptions and justification for the variables are provided below. Detailed definitions and mean values for all variables are in table 5.

Table 5
Definitions of variables

Var	Label	Definition	Mean	Min	Max
$TS_{i,t}$	Number of SNAP-approved stores (not including superstores).	All supermarkets and grocery, convenience, and combination stores together; or the number of supermarkets, or grocery, convenience, or combination stores individually in the super store entrant's market area.	11.0	1.0	807
$TSR_{i,t}$	SNAP redemptions at all SNAP-approved stores	Annual SNAP redemptions at all SNAP-approved supermarkets and grocery, convenience, and combination stores in the super store entrant's market area. Or redemptions at each store type separately. Values are in constant 1992 dollars.	$1.165*10^6$	0.0	$52.4*10^6$
$E_{1,it}$	Entry year	One for entry year of the super store; else zero.	0.17	0	1
$E_{2,it}$	Post entry year	One for all years after the entry year of the super store; else zero.	0.40	0	1
$RU_{1,i,t}$	Rural	One if the store's location falls in category 7, 8, or 9 on the rural-urban continuum; zero otherwise.	0.21	0	1
$RU_{2,i,t}$	Urban	One if the store's location falls in category 1, 2, or 3 on the rural-urban continuum; zero otherwise.	0.40	0	1
$N_{1,i,t}$	Mean median income	Mean median household income in tens of thousands of deflated dollars across all Census tracts of stores in super store marketing area. Values are in constant 1992 dollars.	2.09	0.62	18.44
$N_{2,i,t}$	Share households on public assistance	Mean share households on public assistance across all Census tracts of stores in super store marketing area.	0.045	0.00	0.26
$N_{3,i,t}$	Mean population per square mile	Mean population per square mile across all Census tracts in entrant super store's marketing area.	1009.9	0.92	21,846
$N_{4,i,t}$	Share labor force employed	Mean share of labor force that is employed across all Census tracts of stores in entrant super store's marketing area.	0.62	0.11	0.96
T_t	Trend	Current year minus 1992.	10.50	0.0	25.00
$R_{s,t}$	State SNAP redemptions	Sum of redemptions at all SNAP-approved super stores and traditional stores in the state in billions of dollars deflated by the consumer price index to constant 1992 dollars.	0.689	0.02	4.56
$LTS_{i,t-1}$	Lagged stores in market area	Lag of number of stores in entrant super store's marketing area.	11.10	1.0	803
$LTSR_{i,t-1}$	Lagged store SNAP redemptions in market area	Lag of store SNAP redemptions in entrant super store's marketing area.	$1.17*10^6$	0.0	$261*10^6$
$ISS_{1,i,t}$	Sum-super stores 0–5 kilometers	Number of existing super stores within 5 kilometers of entrant super store.	0.41	0.0	10
$ISS_{2,i,t}$	Sum super stores 5–15 kilometers	Number of existing super stores between 5 and 15 kilometers of entrant super store.	0.15	0.0	8

Notes: The super store's marketing area is a circle 5, 10, or 15 kilometers in diameter with the store's location at the center. Population and demographic data are mean values of Bureau of the Census tract data of all traditional stores in the super store market area.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Discussion of Variables in the Model

The SNAP-approved stores include all supermarkets and grocery, convenience, and combination stores. The value of redemptions is the annual value of SNAP-approved store redemptions at those stores. The main variables of interest are dummy variables that identify changes in the number of stores and value of redemptions. One dummy variable is defined as 1 for the year of super store entry and 0 otherwise; another variable for the post-entry period defined as 1 for the first, second, and third years after entry. The pre-entry period serves as a reference period against which the dummy variables for the event year and post-entry period were compared. The dummy variables indicate how the number of stores (value of SNAP-redemptions) varies over the event window. The variables are represented by the vector Ew, i, t .

Ellickson and Grieco (2013) observed that super stores with large food retailing components to their stores, such as Walmart stores, focused their distribution efforts on rural and suburban areas with ample parking for cars and other vehicles. For these reasons, we accounted for whether the geographic area is rural, urban, or suburban. In equations 1 and 2, type of geographic area is represented as a vector of dummy variables (RUr,i,t).

Data on urban areas come from the rural-urban continuum dataset at ERS.[10] The rural-urban continuum dataset classifies each county on a scale from 1 to 9; smaller numbers on the scale identify urban areas, and higher numbers represent rural areas. We defined urban areas as those with values of 1-3 on the rural-urban continuum; rural areas were defined as those areas with values of 7-9 on the rural-urban continuum; suburban areas were all other market areas.

The value of SNAP benefits provides stores with incentives to accept SNAP benefits. Because SNAP benefits are partly funded by State governments, and they have different rules and eligibility requirements (Stacy et al., 2018), government outlays for SNAP benefits vary across States. They also vary over time and with changes in the strength of the economy as household incomes fall or rise, determining their SNAP eligibility.[11] To control for variation in SNAP benefits across States and over time, we included a variable equal to redemptions in the State of the store ($R_{s,t}$ in equations 1 and 2).

The number of SNAP-approved stores and SNAP redemptions are also affected by broad technological changes, unique local effects, and government decisions about eligibility requirements to become approved to accept SNAP benefits. Ellickson and Greico (2013) asserted that food retailing experienced considerable technological change as stores improved their distribution networks and adopted other innovative technologies. At the same time, the number of combination stores—chain drug and dollar stores—that became authorized to accept SNAP benefits rose dramatically, perhaps because of a change in their business strategies (table 2). To account for the broad structural changes, we included a trend variable (Tt).

Tables 6 and 7 indicate that market areas have diverse capacities to support stores and redeem benefits. The number of SNAP stores varies from 0 to more than 800, and SNAP redemptions range from $0 to more than $50 million across 5-kilometer radius market areas. Tables 3a and 3b show that the number of stores and redemptions persist over time.[12] Thus, we included the lagged number of stores (LTSi,t) to accommodate the existing stock of stores (equation 1) and the lagged value of deflated redemptions (LTSRi,t) to account for the existing value of redemptions (equation 2).

[10]The rural-urban continuum can be found online at USDA's data products site.

[11]Individuals lose eligibility for SNAP benefits as their income rises above thresholds and gain eligibility when income falls below thresholds. SNAP data can be found online at the USDA, Food and Nutrition Service site,

[12]Small grocery stores accounted for most of the stores in market areas with a high volume of stores.

Haltiwanger et al. (2010) created a marketing area around each small, stand-alone retail store in the Washington, DC area and estimated how employment growth at these stores varied with the number of big box stores within 0–1 miles, 1–5 miles, and 5–10 miles. Following Haltiwanger et al. (2010), we accounted for the number of incumbent super stores ($ISS_{i,t}$) within 0–5 kilometers (approximately 0–3 miles) and 5–15 kilometers (approximately 3–9 miles) of the location of the entrant super store. Incumbent super stores are those existing before the first year of the event window, i.e., 3 years before entry.

Ellickson and Grieco (2013), Haltiwanger et al. (2010), and Schuetz (2014) demonstrated that demographic variables help explain food store location decisions. They used census data on household income and other economic attributes that account for the capacity of the market area to support food stores. Following their approach, we included a vector of demographic variables ($N_{i,t}$). Since different traditional stores may be in different census tracts even though they are in the same market area of a super store, we used the average of demographic information across all store census tracts. Although stores are in the super store market areas, parts of the census tracts in which the stores are located fall outside the super store market area. Thus, the area from which the demographic variables were drawn is somewhat larger than the market area of the super store.

Following Schuetz (2014), we used median income as a measure of income and population per square mile to measure population density. High population density implies the existence of a high number of consumers able to make food purchases. We also used the percent of households on public assistance to capture the availability of consumers able to redeem SNAP benefits and the share of labor force employed to account for the economic environment.

Unique local development policies, such as zoning restrictions, tax policies, road construction, and other factors can affect the number of stores and their SNAP redemptions (Ellickson and Grieco, 2013). Moreover, areas with congested streets and dense population stores offer vastly different food retail opportunities than sparsely populated areas with accessible transportation. We accounted for these unique local effects with a location-specific fixed effects variable (Li).

Econometric Methods

The data for both the number of stores and redemptions are clustered near zero and have very long tails, i.e. most locations have few stores, but some locations have hundreds of stores and hundreds of millions of dollars' worth of redemptions. There were no supermarkets in about one-tenth of the locations, no grocery stores in two-fifths of the locations, no convenience stores in one-tenth of the locations, and no combination stores in one-fourth of the locations. There are three supermarkets, one grocery store, five convenience stores, and two combination stores at the 50th percentile. These data can be approximated with a censored normal distribution. The structure of the redemptions data is like the store data (table 7). The maximum values for annual redemptions range from tens to hundreds of millions of dollars. The econometric method must, therefore, account for censored data and accommodate local effects with either a fixed or random effects model.[13] We used a fixed effects model to avoid making any strong assumptions about the correlation of observed and unobserved variables.[14] A Hausman test (Hausman, 1978) confirmed that a fixed effects model is preferred to a random effects model.[15]

Tobit models (Tobin, 1958) are generally used to estimate regressions of censored data.[16] However, the econometric method must accommodate fixed effects, and Neyman and Scott (1948) and Lancaster (2000) demonstrated that maximum likelihood estimation in the presence of fixed effects suffers from "incidental variable parameters problems," leading to inconsistent and biased estimates. Honoré (1992) overcame these biases by developing a conditional fixed effects tobit model. Marginal effects were estimated by multiplying the estimated coefficients by the proportion of unbounded observations in the sample. However, as with other nonlinear models, the coefficients of interaction terms cannot be interpreted as marginal effects (Norton et al., 2004). Linear fixed effects models give consistent parameter estimates that are easy to interpret but also have a heteroskedastic error term because the distribution is truncated at zero. Our approach used a linear fixed effects model to estimate models and use a conditional tobit regression to demonstrate the robustness of our results. We controlled for clustered standard errors because Cameron and Miller (2015) indicated that clustering occurs for individual observations in different time periods in a pooled dataset. They pointed out that failure to control for clustering can lead to misleadingly small standard errors.

[13]Local effects may include an advantageous location, a very densely populated area, unique zoning status, etc.

[14]Economists have accounted for unique effects with either random effects or fixed effects models. Allison and Christakis (2006) argued that unobserved variables are assumed to be uncorrelated with all observed variables in random effects models, whereas unobserved variables may or may not be correlated with the observed variables in fixed effects models. Chamberlain (1980) asserted that fixed effects models are most appropriate if (1) unobserved variables are constant over time and uncorrelated with the independent variables and (2) within-unit variation in the dependent variable is greater than cross-unit variation.

[15]Houseman tests are used to indicate whether a fixed effects or random effects model should be used in panel data.

[16]The number of stores is count data, but there can be more than 800 stores in a market area, and the variance is generally many times greater than the mean (table 6), making a Poisson regression inappropriate. Moreover, a negative binomial regression, a more general case of a Poisson regression, cannot be used in fixed effects models because it is estimated with maximum likelihood techniques leading to inconsistent estimates (Allison and Waterman, 2002).

Table 6

Statistics for number of store types in super store market area

Store type	Mean	Variance	Minimum	Maximum
	number of stores			
2.5-km radius market area				
All stores	5.7	30.3	1	85
Supermarket	1.4	1.6	0	11
Grocery	0.6	2.0	0	24
Convenience	2.7	11.8	0	52
Combination	1.0	2.1	0	12
5-km radius market area				
All stores	11.0	398	1	807
Supermarket	2.2	4.6	0	22
Grocery	1.5	165	0	633
Convenience	5.6	60	0	115
Combination	1.6	7.9	0	52
7.5-km radius market area				
All stores	12.7	185	1	210
Supermarket	2.5	6.8	0	24
Grocery	1.5	7.5	0	62
Convenience	7.0	8.6	0	120
Combination	1.7	8.0	0	28

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Table 7

Statistics for redemptions by store types in super store market area

Store type	Mean	Variance	Minimum	Maximum
	millions of dollars[1]			
5-km radius market area				
All stores	0.325	1.042	0	14.6
Supermarket	0.567	0.838	0	13.7
Grocery	0.031	0.015	0	3.1
Convenience	0.031	0.006	0	1.9
Combination	0.024	0.009	0	2.5
10-km radius market area				
All stores	1.165	4.05	0	52.5
Supermarket	0.985	2.46	0	26.4
Grocery	0.070	0.24	0	23.9
Convenience	0.068	0.027	0	5.1
Combination	0.045	0.019	0	2.8
15-km radius market area				
All stores	1.300	3.41	0	22.1
Supermarket	1.105	2.58	0	20.0
Grocery	0.068	0.031	0	3.06
Convenience	0.081	0.025	0	2.65
Combination	0.050	0.019	0	2.48

Notes: 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles, 15 km = approximately 9 miles.

[1] Value of redemptions are deflated by the consumer price index to 1992 dollars

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Results

We first examined all stores together and then separately, i.e., supermarkets, grocery, convenience, and combination stores alone. We also evaluated how parameter estimates change as we varied the size of the marketing area. Finally, we considered how the impact of super stores may have changed from the time before their share of redemptions exceeded those of supermarkets (before 2005) to the time when their share of redemptions exceeded those of supermarkets (after 2004). The key variables are the entry year, the post-entry period, and the interaction of the post-entry period with rural and urban dummy variables. The trend is noteworthy because it illustrates change in the number of stores due to technological changes such as improved logistics, industry consolidations, and changes in consumer preferences. The bottom rows of each table show the number of observations, the percentage of those observations that are censored, the number of entrant super stores, and the R2 values. The first row provides the mean number of stores.

Number of Stores

Table 8 shows results for all types of stores in a 5-kilometer (approximately 3-mile) radius marketing area. The entry variables show a modest first-year effect followed by a larger post-entry effect. The post-entry parameter indicates that entry reduces the number of SNAP-approved stores by about 0.30 stores—0.25 supermarkets and 0.05 combination stores. These amount to a decline of about 11 percent of supermarkets and 0.5 percent of other stores

Table 8

The impact of super store entry on the number of SNAP-approved stores in a 5-kilometer radius marketing area surrounding entrant super stores

Variables	Labels	All stores	Super markets	Grocery stores	Convenience stores	Combination stores
	Mean number of stores	11.03	2.22	1.51	5.64	1.66
		Parameter values for fixed effects linear regressions				
$E_{1,i\,t}$	Entry year	-0.073 (0.047)	-0.032 ** (0.014)	0.039** (0.017)	0.014 (0.036)	-0.055*** (0.018)
$E_{2,i,t}$	Post entry years	-0.295*** (0.083)	-0.247 *** (0.028)	0.055** (0.027)	-0.002 (0.063)	-0.057* (0.031)
$RU_{1,i,t}$	Rural	0.147 (0.177)	-0.006 (0.065)	0.026 (0.077)	0.010 (0.130)	0.044 (0.051)
RU2,i,t	Urban	-0.285 (0.181)	-0.043 (0.053)	-0.051 (0.056)	-0.124 (0.142)	-0.092** (0.046)
$E_{2,i,t}$* $RU_{1,i,t}$	Post entry year *Rural	-0.071 (0.071)	-0.064** (0.026)	-0.043 (0.025)	0.087* (0.053)	-0.082*** (0.025)
$E_{2,i,t}$* $RU_{2,i,t}$	Post entry year *Urban	0.125 (0.077)	0.020 (0.053)	0.020 (0.024)	0.079 (0.060)	0.025 (0.028)
$N_{1,i,t}$	Mean median Income (thousands $)	-0.188*** (0.034)	0.020*** (0.007)	-0.044*** (0.010)	-0.045* (0.026)	-0.099*** (0.011)
$N_{2,i,t}$	Percent households on public assistance	11.149*** (2.984)	1.274** (0.608)	4.11*** (0.966)	6.869*** (2.184)	0.474 (0.845)
$N_{3,i,t}$	Mean population per square mile	-0.0003 (0.0002)	-0.000006 (0.00004)	-0.00008 (0.00007)	-0.0002 (0.0002)	-0.00006 (0.00006)
$N_{5,i,t}$	Percent labor force employed	1.982*** (0.343)	0.304*** (0.113)	0.373 (0.111)	1.075*** (0.271)	0.166 (0.110)
T_t	Trend	-0.012 (0.023)	-0.023*** (0.007)	-0.027*** (0.007)	-0.108*** (0.017)	0.098*** (0.008)
$R_{s,t}$	State SNAP redemptions (billions $)	1.996*** (0.142)	0.132*** (0.026)	0.096** (0.038)	1.327** (0.102)	0.517*** (0.056)
$LTS_{i,t-1}$	Lagged stores in market area	0.642*** (0.020)	0.389*** (0.017)	0.586*** (0.068)	0.603*** (0.018)	0.637*** (0.018)
$ISS_{1,i,t}$	Sum super stores 0-5 kilometers	-0.110 (0.13)	-0.146*** (0.027)	0.020 (0.032)	0.133 (0.102)	-0.135** (0.055)
$ISS_{2,i,t}$	Sum super stores 5-15 kilometer.	0.317 (0.478)	0.015 (0.073)	0.065 (0.116)	0.071 (0.281)	0.218 (0.176)
	Constant	1.830*** (0.421)	1.384*** (0.114)	0.527*** (0.134)	1.613*** (0.296)	-0.433*** (0.117)
	R^2	0.98	0.89	0.99	0.85	0.87
	Observations	14,247	14,043	14,043	14,043	14,043
	Percent censored	0.00	18.0	48.0	11.0	41.0
	Number of entrant super stores	2,434	2,434	2,434	2,434	2,434

Note: 5 km = approximately 3 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level.

Results also show that rural areas were affected differently than suburban and urban areas. Rural areas in the post entry period (Post-entry years + Post-entry years * Rural) lost about 0.06 more supermarkets and 0.08 more combination stores than suburban and urban stores but gained about 0.09 convenience stores.

The trend variable suggests consolidation in all store types except combination stores. The number of combination stores grew by 0.098 stores per year, while the number of supermarkets dropped by about 0.023 stores, and grocery and convenience stores declined by 0.27 and 1.08, respectively, over the event window.[17] Results also showed an increased level of State redemptions positively affected the number of all types of stores, particularly convenience and combination stores. A 10-percent increase in annual redemptions raised the number of convenience and combination stores by about 0.09 and 0.036 stores, respectively. These were computed by multiplying the parameter value (table 8) times the mean value (table 5).

We also found it interesting that the parameter on the lag of the number of stores is much lower for supermarkets than for other stores. This result implies that supermarkets were least able of all traditional stores to remain in business over the event window.

Two demographic variables—percent of households on public assistance and percent of the labor force employed—have positive effects on the numbers of stores overall; supermarkets' population density (population per square mile) had no effects. The median income has a positive effect for supermarkets and negative effects for all other stores. For supermarkets, 10 percent increases in each of the 4 demographic variables increase the number of supermarkets by about 0.028 stores.[18]

Tables 9a and 9b show how parameter estimates change with the size of the market area. Results show that the number of store-exits for the 2.5-kilometer, 5-kilometer, and 7.5-kilometer (approximately 1.5-, 3-, and 4.5-mile) radii marketing areas in the post-entry period for all stores and supermarkets remained about the same—roughly 0.30 stores and 0.25 supermarkets. There was little or no additional change in the number of total stores in rural areas in the post-entry period in any market area, but there was a modestly greater drop in supermarkets in the two largest marketing areas of rural areas in the post-entry years. These results are consistent with Ellickson and Grieco (2013), who found little effect of Walmart entry on supermarket productivity beyond 2 miles of the super store. Other results reveal little or no trend, a larger parameter for State SNAP redemptions in the larger marketing areas, and a relatively constant lagged store effect (stock of existing stores).

[17]The number of stores affected by the trend is the parameter of the trend variable times the number of years from the beginning of the event window. This is 6 years by the end of the event window. For combination stores this is Event years * Trend or 6*0.098, or a 0.588 increase in stores by the third year after the recall. For supermarkets, it is a drop of 0.138 stores.

[18]This was computed as the sum of the parameter for each variable times the mean value (table 6) times 0.10. Positive contributions of 0.017, 0.020, and 0.011 came from median income, HH (households) on public assistance, and percent of the labor force employed. A negative contribution of -0.021 came from population per square mile.

Table 9a

The impact of super store entry on the number of SNAP-approved stores in 2.5-, 5-, and 7.5-kilometer radii marketing areas surrounding entrant super stores

Variables	Labels	All stores, radius of market area, in kilometers			Supermarkets, radius of market area, in kilometers		
		2.5	5	7.5	2.5	5	7.5
	Mean number of stores	5.70	11.03	12.74	1.37	2.22	2.53
		Parameter values for fixed effects linear regressions					
$E_{1,i\,t}$	Entry year	-0.068*** (0.027)	-0.073 (0.047)	-0.077 (0.058)	-0.045 *** (0.010)	-0.032 ** (0.014)	-0.026 (0.017)
$E_{2,i,t}$	Post entry years	-0.256*** (0.053)	-0.295*** (0.083)	-0.278*** (0.103)	-0.264 *** (0.022)	-0.247 *** (0.028)	-0.255*** (0.032)
$RU_{1,i,t}$	Rural	0.039 (0.114)	0.147 (0.177)	-0.030 (0.222)	-0.045 (0.053)	-0.006 (0.065)	-0.025 (0.069)
$RU_{2,i,t}$	Urban	-0.082 (0.096)	-0.285 (0.181)	-0.437* (0.259)	0.053 (0.041)	-0.043 (0.053)	0.084 (0.066)
$E_{2,i,t}$* $RU_{1,i,t}$	Post entry year *Rural	-0.132** (0.056)	-0.071 (0.071)	-0.024 (0.084)	-0.041* (0.023)	-0.064** (0.026)	-0.066** (0.027)
$E_{2,i,t}$* $RU_{2,i,t}$	Post entry year *Urban	0.034 (0.045)	0.125 (0.077)	0.006 (0.107)	0.048*** (0.018)	0.020 (0.053)	-0.008 (0.030)
N	Control for demographic	yes	yes	yes	yes	yes	yes
T_t	Trend	0.015 (0.013)	-0.012 (0.023)	0.042 (0.029)	-0.004 (0.005)	-0.023*** (0.007)	-0.027** (0.008)
$R_{s,t}$	State SNAP redemptions (billion $)	1.090*** (0.069)	1.996*** (0.143)	2.151*** (0.159)	0.087*** (0.018)	0.132*** (0.026)	0.133*** (0.027)
$LTS_{i,t-1}$	Lagged stores in market area	0.542*** (0.012)	0.643*** (0.030)	0.624*** (0.020)	0.429*** (0.011)	0.389*** (0.017)	0.370*** (0.015)
ISS	Control for local super stores	yes	yes	yes	yes	yes	yes
	R^2	0.91	0.98	0.95	0.82	0.89	0.89
	Observations	16,931	14,043	11,717	16,931	14,043	11,717
	Percent censored	0.00	0.00	0.0	27.0	18.0	17.0
	Number of entrant super stores	3,006	2,434	2,013	3,006	2,434	2,013

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level.

Table 9b

The impact of super store entry on the number of SNAP-approved stores in a 2.5-, 5-, and 7.5-kilometer radius marketing area surrounding entrant super stores

Labels	Grocery stores			Convenience stores			Combination stores		
	Radius of market area, in kilometers			Radius of market area, in kilometers			Radius of market area, in kilometers		
	2.5	5	7.5	2.5	5	7.5	2.5	5	7.5
Mean number of stores	0.89	1.51	1.47	2.68	5.64	6.99	0.80	1.66	1.75
Parameter values for fixed effects linear regressions									
Entry year	0.021** (0.010)	0.039** (0.017)	0.035** (0.018)	0.015 (0.020)	0.014 (0.036)	-0.014 (0.046)	-0.043*** (0.011)	-0.055*** (0.018)	-0.048** (0.022)
Post entry years	0.015 (0.018)	0.055** (0.027)	0.070** (0.032)	0.046 (0.036)	-0.002 (0.063)	0.032 (0.046)	-0.034* (0.020)	-0.057* (0.031)	-0.052 (0.036)
Rural	-0.014 (0.042)	0.026 (0.077)	0.085 (0.081)	-0.011 (0.076)	0.010 (0.130)	-0.222 (0.172)	0.052 (0.040)	0.044 (0.051)	0.057 (0.054)
Urban	0.035 (0.039)	-0.051 (0.056)	-0.090 (0.076)	-0.012 (0.073)	-0.124 (0.142)	0.183 (0.204)	-0.047 (0.032)	-0.092** (0.046)	-0.122** (0.053)
Post entry year *Rural	-0.042* (0.022)	-0.043 (0.025)	-0.054* (0.030)	-0.014 (0.039)	0.087* (0.053)	-0.154** (0.064)	-0.051** (0.021)	-0.082*** (0.025)	-0.085*** (0.028)
Post entry year *Urban	0.016 (0.015)	0.020 (0.024)	-0.013 (0.031)	-0.012 (0.032)	0.079 (0.060)	-0.054 (0.086)	-0.007 (0.018)	0.025 (0.028)	0.075** (0.036)
Control demographic	yes	yes	yes	yes	yes	yes	yes	yes	yes
Trend	-0.015*** (0.004)	-0.027*** (0.007)	-0.039*** (0.008)	-0.062*** (0.009)	-0.108*** (0.017)	-0.145** (0.024)	0.073*** (0.005)	0.098*** (0.008)	0.103*** (0.010)
State SNAP redemptions (billion $)	0.072** (0.021)	0.096** (0.038)	0.176*** (0.041)	0.620*** (0.047)	1.327** (0.102)	1.404*** (0.113)	0.320*** (0.029)	0.517*** (0.056)	0.467*** (0.059)
Lagged stores in market area	0.446*** (0.016)	0.586*** (0.068)	0.472*** (0.019)	0.524*** (0.013)	0.603*** (0.018)	0.609*** (0.025)	0.565*** (0.012)	0.637*** (0.018)	0.682*** (0.018)
Control other super stores	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.64	0.85	0.85	0.81	0.85	0.93	0.87	0.87	0.87
Observations	16,931	14,043	11,717	16,931	14,043	11,717	16,931	14,043	11,717
Percent censored	65.0	48.0	43.0	21.0	11.0	8.0	50.0	41.0	0.39
Number of entrant super stores	3,006	2,434	2,013	3,006	2,434	2,013	3,006	2,434	2,013

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level.

In table 10, we contrast parameter estimates of super store entry before 2005 with super store entry after 2004. The post-entry period parameter for supermarkets and combination stores was negative and significant. Urban and suburban areas lost about 0.20 supermarkets in the earlier period due to super store entry, while rural areas lost about 0.26 supermarkets due to super store entry.[19] In the period after 2004, suburban and rural areas lost about 0.372 supermarkets while urban areas lost only about 0.28 supermarkets. Combination stores were also affected by super store entry. Before 2005 the number of combination stores in rural areas rose by about 0.06 stores but dropped by 0.30 stores after super store entry in the post-2004 years. In urban areas, in contrast, the number of combination stores did not change in the pre-2005 years and dropped only modestly (0.04 a store) in the post-2004 years. Suburban areas lost about 0.20 combination stores in the later period and no stores in the earlier period.

[19]Suburban area loss is the value of the post-entry parameter; rural area and urban area losses are the post-entry parameter plus the parameter for the post-entry interactions with either rural or urban.

Table 10

Contrast of the impact of super store entry on the number of Supplemental Nutrition Assistance Program (SNAP)-approved stores before 2005 with the impact after 2004 in 5-kilometer radius marketing area surrounding entrant super stores

Vars	Labels	Store type							
		Supermarket		Grocery		Convenience		Combination	
		before 2005	after 2004	before 2005	after 2004	before 2005	after 2004	before 2005	after 2004
	Mean number of stores	2.49	1.56	1.65	1.18	5.86	5.12	0.89	3.50
		Parameter values for fixed effects linear regressions							
$E_{1,i\,t}$	Entry year	-0.016 (0.019)	-0.065*** (0.019)	0.038* (0.021)	0.052** (0.026)	0.007 (0.043)	0.001*** (0.072)	-0.059*** (0.017)	-0.073* (0.042)
$E_{2,i,t}$	Post entry years	-0.195*** (0.035)	-0.372*** (0.042)	0.053 (0.033)	0.054 (0.046)	0.042 (0.073)	-0.126 (0.123)	-0.023 (0.031)	-0.195*** (0.073)
$RU_{1,i,t}$	Rural	-0.042 (0.068)	0.149 (0.166)	-0.016 (0.088)	-0.016 (0.112)	-0.057 (0.149)	0.315 (0.287)	-0.014 (0.043)	0.178 (0.190)
$RU_{2,i,t}$	Urban	-0.023 (0.058)	0.118 (0.134)	-0.098 (0.062)	0.206* (0.113)	-0.093 (0.162)	-0.117 (0.198)	-0.107** (0.049)	0.058 (0.154)
$E_{2,i,t}$* $RU_{1,i,t}$	Post entry year *Rural	-0.069** (0.032)	-0.039 (0.044)	-0.033 (0.031)	-0.061 (0.118)	0.094 (0.063)	0.198** (0.093)	0.063** (0.028)	-0.119** (0.058)
$E_{2,i,t}$* $RU_{2,i,t}$	Post entry year *Urban	-0.012 (0.031)	0.089** (0.036)	0.046 (0.030)	0.005 (0.039)	-0.020 (0.070)	0.222** (0.103)	-0.018 (0.030)	0.159*** (0.062)
N	Control for demographic	yes	yes	yes	yes	yes	yes	yes	yes
T_t	Trend	-0.026** (0.011)	0.012 (0.010)	-0.015 (0.010)	-0.003 (0.014)	-0.122*** (0.025)	0.029 (0.034)	0.098*** (0.010)	0.174*** (0.023)
$R_{s,t}$	State SNAP redemptions (billion $)	0.087* (0.048)	0.100*** (0.034)	0.162*** (0.048)	0.020 (0.055)	0.865*** (0.126)	0.989*** (0.137)	0.655*** (0.051)	0.269*** (0.080)
$LTS_{i,t-1}$	Lagged stores in market area	0.378*** (0.021)	0.421*** (0.027)	0.603*** (0.073)	0.458*** (0.035)	0.551*** (0.020)	0.714*** (0.039)	0.591*** (0.024)	0.655*** (0.025)
ISS	Control for local super stores	yes	yes	yes	yes	yes	yes	yes	yes
	R^2	0.87	0.83	0.99	0.88	0.79	0.95	0.76	0.90
	Observations	9,882	4,161	9,882	4,161	9,882	4,161	9,882	4,161
	Percent censored	13.0	31.0	47.0	0.52	9.0	16.0	53.0	12.0
	Number of entrant super stores	1,706	728	1,706	728	1,706	728	1,706	728

Note: 5 km = approximately 3 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level.

SNAP Redemptions

Table 11 shows the results of the impact of the base model on annual SNAP redemptions at all stores combined and by supermarkets, grocery stores, convenience stores, and combination stores in a 5-kilometer (approximately 3-mile) radius marketing area of super store entrants. Results show that redemptions at all stores dropped by about $136,000 (calculated by multiplying the coefficient times $1 million) in the first year with about 90 percent of that coming from supermarkets. In the post-entry years, the reduction in the value of redemptions was about $191,000 per year, with about 90 percent still coming from supermarkets. The drop in the value of redemptions per store (never more than $6,000) also occurred in grocery and combination stores. The loss of SNAP redemptions was a sizeable share of all store redemptions, amounting to about 17 percent of redemptions at supermarkets and about 8 percent at other stores. Results showing the interaction of rural or urban area with the post-entry years is not significant and suggests that stores in all areas lost about the same amount of redemptions.

Results also show that redemptions at stores increased with State redemptions—a 10-percent increase in overall redemptions in the State raised the value of redemptions at traditional stores by about 3.3 percent or $38,700 per year with most of the change (80 percent) at supermarkets. The less than one-for-one match of a State's growth in redemptions to growth in redemptions at stores implies that traditional stores captured less than the full amount (about half of the $68.9 million increase) of the growth in State redemptions. An increase in past redemptions also led to greater redemptions in the current year. A value closer to one implies greater customer retention.

The demographic variables show that the percent of households on public assistance and percent of the labor force employed generated mostly positive effects on redemptions, while population density and median income generated modest negative effects. The combined effect of a 10 percent increase in the values of all the demographic variables, an increase in redemptions of $46,000, was quite small and matched the small effect on the number of stores.

Tables 12a and 12b show losses in the value of redemptions with increases in the size of the marketing area. Results show that the loss of redemptions was about the same for stores within a 5- and 7.5-kilometer (approximately 3- and 4.5-mile) radius market areas ($191,000); the loss of redemptions was about $156,000 for stores in the 2.5-kilometer (approximately 1.5-mile) market areas. Supermarkets accounted for about 90 percent of the decline in redemptions in all market areas. Results also indicate that the impact of State redemptions rises as the marketing area expands and that type of geographic area (rural or urban) did not matter.

Table 11

The impact of super store entry on SNAP redemptions of Supplemental Nutrition Assistance Program(SNAP)-approved stores in a 5-kilometer radius marketing area surrounding entrant super stores[1]

Variables	Labels	All stores	Super markets	Grocery stores	Conve-nience stores	Combination stores
	Mean redemptions (millions $)	1.165	0.982	0.070	0.068	0.045
		Parameter values for fixed effects linear regressions				
$E_{1,i\,t}$	Entry year	-0.136*** (0.011)	-0.125 *** (0.010)	-0.004*** (0.001)	-0.003*** (0.001)	-0.002* (0.001)
$E_{2,i,t}$	Post entry years	-0.191*** (0.016)	-0.176 *** (0.015)	-0.006*** (0.002)	-0.005*** (0.0016)	-0.004* (0.002)
$RU_{1,i,t}$	Rural	-0.031 (0.040)	0.021 (0.037)	-0.0002 (0.002)	-0.005 (0.003)	0.004 (0.003)
$RU_{2,i,t}$	Urban	0.003 (0.040)	0.014 (0.036)	-0.007* (0.004)	0.002 (0.003)	-0.003 (0.002)
$E_{2,i,t}$* $RU_{1,i,t}$	Post entry year *Rural	0.009 (0.013)	0.014 (0.012)	-0.003 (0.002)	0.001 (0.001)	-0.003* (0.0017)
$E_{2,i,t}$* $RU_{2,i,t}$	Post entry year *Urban	-0.007 (0.018)	-0.008 (0.016)	0.002 (0.001)	-0.002 (0.002)	0.001 (0.002)
$N_{1,i,t}$	Mean median income (thousand $)	-0.028*** (0.008)	-0.022*** (0.007)	-0.0015* (0.0008)	-0.002*** (0.0007)	-0.003*** (0.001)
$N_{2,i,t}$	Share households on pub-lic assistance	2.126*** (0.798)	1.979*** (0.678)	0.117 (0.080)	0.188** (0.081)	-0.131** (0.080)
$N_{3,i,t}$	Mean population per square mile	-0.0008 (0.00005)	-0.00006 (0.00004)	-0.000006 (0.000007)	-0.000005 (0.000006)	-0.0000007 (0.000006)
$N_{4,i,t}$	Share labor force em-ployed	0.678*** (0.069)	0.645*** (0.061)	0.029*** (0.008)	0.029*** (0.006)	-0.021*** (0.007)
T_t	Trend	0.005 (0.004)	0.002 (0.004)	0.0004 (0.0006)	-0.0006 (0.0005)	0.003*** (0.0006)
$R_{s,t}$	State SNAP redemptions (billion $)	0.562*** (0.045)	0.460*** (0.038)	0.029*** (0.004)	0.045*** (0.005)	0.034*** (0.004)
$LTS_{i,t-1}$	Lagged store SNAP re-demptions in market area (million $)	0.621*** (0.040)	0.602*** (0.037)	0.709*** (0.053)	0.661*** (0.046)	0.585*** (0.045)
$ISS_{1,i,t}$	Sum super stores 0-5 kilometers	-0.407 (0.258)	-0.337 (0.220)	-0.029 (0.022)	-0.007 (0.009)	0.029** (0.013)
$ISS_{2,i,t}$	Sum super stores 5-15 kilometers	0.331 (0.252)	0.269 (0.214)	0.026 (0.022)	0.009 (0.008)	0.021* (0.013)
	Constant	-0.267*** (0.080)	-0.226*** (0.073)	-0.011 (0.008)	0.019*** (0.007)	-0.002 (0.008)
	R^2	0.87	0.88	0.99	0.87	0.79
	Observations	14,043	14,043	14,043	14,043	14,043
	Percent censored	0.00	18.0	48.0	11.0	41.0
	Number of entrant super stores	2,434	2,434	2,434	2,434	2,434

Note: 5 km = approximately 3 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level.

[1] Value of redemptions are in millions of dollars deflated by the consumer price index to 1992 values.

Table 12a

The impact of super store entry on SNAP redemptions of Supplemental Nutrition Assistance Program (SNAP)-approved stores in a 2.5-, 5-, and 7.5-kilometer radius marketing area surrounding entrant super stores[1]

Variables	Labels	All Stores			Supermarkets		
		Radius of market area			Radius of market area		
		kilometers			kilometers		
		2.5	5	7.5	2.5	5	7.5
	Mean redemptions (millions $)	0.654	1.165	1.304	0.567	0.982	1,105
		Parameter values for fixed effects linear regressions					
$E_{1,i\,t}$	Entry year	-0.103*** (0.006)	-0.136*** (0.011)	-0.143*** (0.013)	-0.098*** (0.006)	-0.125 *** (0.010)	-0.133*** (0.011)
$E_{2,i,t}$	Post entry years	-0.154*** (0.011)	-0.191*** (0.016)	-0.187*** (0.020)	-0.146*** (0.010)	-0.176 *** (0.015)	-0.177*** (0.018)
$RU_{1,i,t}$	Rural	0.027 (0.026)	-0.031 (0.040)	-0.007* (0.046)	0.027 (0.024)	0.021 (0.037)	0.00006 (0.042)
$RU_{2,i,t}$	Urban	0.003 (0.021)	0.003 (0.040)	0.012 (0.046)	0.011 (0.019)	0.014 (0.036)	0.026 (0.041)
$E_{2,i,t}$* $RU_{1,i,t}$	Post entry year *Rural	0.005 (0.010)	0.009 (0.013)	0.003 (0.016)	0.008 (0.010)	0.014 (0.012)	0.010 (0.015)
$E_{2,i,t}$* $RU_{2,i,t}$	Post entry year *Urban	0.014 (0.010)	-0.007 (0.018)	0.057** (0.027)	0.014 (0.009)	-0.008 (0.016)	-0.050** (0.023)
N	Control for demographic	yes	yes	yes	yes	yes	yes
T_t	Trend	0.006** (0.003)	0.005 (0.004)	-0.005 (0.006)	0.005 (0.003)	0.002 (0.004)	-0.007 (0.005)
$R_{s,t}$	State SNAP redemptions (billion $)	0.285*** (0.022)	0.562*** (0.045)	0.645*** (0.053)	0.231*** (0.020)	0.460*** (0.038)	0.515*** (0.042)
$LTS_{i,t-1}$	Lagged store SNAP redemptions in market area (million $)	0.571*** (0.038)	0.621*** (0.040)	0.479*** (0.044)	0.580*** (0.040)	0.602*** (0.037)	0.475*** (0.042)
ISS	Control for local super stores	yes	yes	yes	yes	yes	yes
	R^2	0.85	0.87	0.78	0.86	0.88	0.79
	Observations	16,931	14,043	11,717	16,931	14,043	11,717
	Percent censored	0.0	0.00	0.0	0.27	18.0	0.17
	Number of entrant super stores	3,006	2,434	2,013	3,006	2,434	2,013
	Mean stores	5.70	11.03	12.74	1.37	2.22	2.53

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level.

1 Value of redemptions are in millions of dollars deflated by the consumer price index to 1992 values.

Table 12b

The impact of super store entry on SNAP redemptions of Supplemental Nutrition Assistance Program (SNAP)-approved stores in a 2.5-, 5-, and 7.5-kilometer radius marketing area surrounding entrant super stores[1]

Labels	Grocery stores			Convenience stores			Combination stores		
	Radius of market area			Radius of market area			Radius of market area		
	kilometers			kilometers			kilometers		
	2.5	5	7.5	2.5	5	7.5	2.5	5	7.5
Mean redemptions (millions $)	0.065	0.070	0.068	0.031	0.068	0.080	0.025	0.045	0.049
	Parameter values for fixed effects linear regressions								
Entry year	-0.003*** (0.001)	-0.004*** (0.001)	-0.005** (0.001)	-0.002 *** (0.0004)	-0.003*** (0.001)	-0.004 (0.001)	-0.002** (0.001)	-0.002* (0.001)	-0.002 (0.002)
Post entry years	-0.003** (0.001)	-0.006*** (0.002)	-0.004** (0.002)	-0.003*** (0.001)	-0.005*** (0.0016)	-0.004** (0.002)	-0.002 (0.002)	-0.004* (0.002)	-0.003 (0.003)
Rural	-0.002 (0.005)	-0.0002 (0.002)	-0.003 (0.004)	-0.0001 (0.002)	-0.005 (0.003)	0.004 (0.004)	0.002 (0.003)	0.004 (0.003)	0.004 (0.003)
Urban	-0.005* (0.003)	-0.007* (0.004)	-0.006 (0.004)	0.0006 (0.002)	0.002 (0.003)	-0.002 (0.005)	-0.002 (0.002)	-0.003 (0.002)	-0.003 (0.003)
Post entry year *Rural	-0.002 (0.002)	-0.003 (0.002)	-0.004 (0.003)	0.001 (0.001)	0.001 (0.001)	0.001 (0.002)	-0.003*** (0.001)	-0.003* (0.0017)	-0.004** (0.002)
Post entry year *Urban	0.001 (0.001)	0.002 (0.001)	-0.003 (0.003)	-0.002** (0.001)	-0.002 (0.002)	-0.007*** (0.003)	-0.0001 (0.001)	0.001 (0.002)	0.003 (0.003)
Control demographic	yes	yes	yes	yes	yes	yes	yes	yes	yes
Trend	-0.0003 (0.0003)	0.0004 (0.0006)	-0.0005 (0.0006)	-0.00002 (0.0002)	-0.0006 (0.0005)	-0.001** (0.0005)	0.002*** (0.0004)	0.003*** (0.0006)	0.003*** (0.0007)
State SNAP redemptions (billion $)	0.014*** (0.003)	0.029*** (0.004)	0.032*** (0.004)	0.018*** (0.002)	0.045*** (0.005)	0.049*** (0.005)	0.018*** (0.003)	0.034*** (0.004)	0.033*** (0.005)
Lagged store SNAP redemptions in market (million $)	0.687*** (0.048)	0.709*** (0.053)	0.637*** (0.045)	0.551*** (0.074)	0.661*** (0.046)	0.565*** (0.056)	0.531*** (0.067)	0.585*** (0.045)	0.622*** (0.041)
Control other super stores	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.91	0.99	0.90	0.86	0.87	0.83	0.78	0.79	0.78
Observations	16,931	14,043	11,717	16,931	14,043	11,717	16,931	14,043	11,717
Percent censored	65.0	48.0	43.0	21.0	11.0	8.0	50.0	41.0	0.39
Number entrant super stores	3,006	2,434	2,013	3,006	2,434	2,013	3,006	2,434	2,013
Mean stores	0.89	1.51	1.47	2.68	5.64	6.99	0.80	1.66	1.75

Note: 2.5 km = approximately 1.5 miles; 5 km = approximately 3 miles; 7.5 km = approximately 4.5 miles.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

*** Significant at 99 percent level; ** significant at 95 percent level; * significant at 90 percent level.

[1] Value of redemptions are in millions of dollars deflated by the consumer price index to 1992 values.

Table 13 shows how the impact of super store entry changed over time in the 5-kilometer (approximately 3-mile) radius marketing area. Results show the effect of super store entry on SNAP redemptions is much stronger in the later period. Supermarket losses in the market area rose about 50 percent, rising from $143,000 (14.6 percent of total redemptions) in the earlier period to $217,000 (22.0 percent of total redemptions) in the later period. The decline in redemptions at other store types went from about $4,000 in losses in redemptions per store (2.7 percent of total redemptions) in the earlier period to a combined total loss of about $28,000 in SNAP redemptions (10.6 percent of total redemptions).

Table 13

Contrast of the impact of super store entry on SNAP redemptions of Supplemental Nutrition Assistance Program (SNAP)-approved stores before 2005 with the impact after 2004 in 5-kilometer radius marketing area surrounding entrant super stores[1]

Vars	Labels	Store type							
		Supermarket		Grocery		Convenience		Combination	
		before 2005	after 2004	before 2005	after 2004	before 2005	after 2004	before 2005	after 2004
	Mean redemptions (millions $)	0.981	0.986	0.063	0.083	0.061	0.085	0.025	0.095
		Parameter values for fixed effects linear regressions							
$E_{1, i, t}$	Entry year	-0.100*** (0.011)	-0.128*** (0.024)		-0.004 (0.003)	-0.003*** (0.001)	0.0009 (0.003)	-0.002** (0.001)	-0.005 (0.004)
$E_{2, i, t}$	Post entry years	-0.143*** (0.016)	-0.217*** (0.032)	-0.002 (0.002)	-0.016*** (0.005)	-0.004** (0.002)	-0.005 (0.005)	-0.001 (0.002)	-0.012** (0.006)
$RU_{1, i, t}$	Rural	0.016 (0.040)	-0.104* (0.061)	-0.003 (0.006)	-0.023** (0.0119)	0.003 (0.004)	-0.00001 (0.004)	0.007* (0.004)	-0.0006 (0.005)
$RU_{2, i, t}$	Urban	0.038 (0.037)	-0.024 (0.064)	0.0001 (0.003)	-0.003 (0.005)	0.005 (0.004)	-0.004 (0.00)	-0.001 (0.004)	-0.005 (0.005)
$E_{2, i, t}$* $RU_{1, i, t}$	Post entry year *Rural	0.018 (0.016)	0.018 (0.019)	-0.003 (0.002)	0.001 (0.004)	0.003* (0.002)	0.003 (0.002)	-0.003 (0.002)	-0.004 (0.003)
$E_{2,i,t}$* $RU_{2,i,t}$	Post entry year *Urban	-0.042** (0.020)	0.065** (0.025)	-0.0001 (0.00)	0.009** (0.004)	-0.005** (0.002)	0.005* (0.003)	-0.003 (0.003)	0.006 (0.004)
N	Control for demographic	yes	yes	yes	yes	yes	yes	yes	yes
T_t	Trend	0.011** (0.005)	0.056*** (0.011)	0.002*** (0.0007)	0.003* (0.002)	0.0013** (0.0006)	0.001 (0.002)	0.0012** (0.0006)	0.006*** (0.002)
$R_{s,t}$	State SNAP redemptions (billion $)	0.582*** (0.050)	0.184*** (0.040)	0.024*** (0.004)	0.023*** (0.006)	0.041*** (0.006)	0.034*** (0.008)	0.014*** (0.005)	0.035*** (0.005)
$LTS_{i,t-1}$	Lagged store SNAP redemptions in area (million $)	0.410*** (0.040)	0.836*** (0.035)	0.672*** (0.095)	0.757*** (0.004)	0.494*** (0.083)	0.780*** (0.066)	0.549*** (0.074)	0.605*** (0.052)
ISS	Control for local super stores	yes	yes	yes	yes	yes	yes	yes	yes
	R^2	0.76	0.91	0.99	0.92	0.81	0.87	0.81	0.79
	Observations	9,882	4,161	9,882	4,161	9,882	4,161	9,882	4,161
	Percent censored	13.0	31.0	47.0	0.52	9.0	16.0	53.0	12.0
	Number of entrant super stores	1,706	728	1,706	728	1,706	728	1,706	728
	Mean number of stores	2.49	1.56	1.65	1.18	5.86	5.12	0.89	3.50

Notes: 5 km = approximately 3 miles. *** Significant at the 99 percent level; ** significant at the 95 percent level; * significant at the 90 percent level. [1] Value of redemptions are in millions of dollars deflated by the consumer price index to 1992 values.

Source: USDA, Economic Research Service estimates based on Store Tracking and Redemption System data from USDA, Food and Nutrition Service.

Post-entry effects in rural areas were little different from the base case (suburban area), but supermarkets and convenience stores saw a larger decline in redemptions in the pre-2005 years. In the post-2004 years, supermarkets, grocery stores, and convenience stores showed a positive urban effect (Post entry year * Urban), giving them a less severe loss in the post-2004 years than rural or suburban and rural stores. Supermarkets in rural and suburban areas lost $217,000 in redemptions per store because of super store entry in the post-2004 years, whereas supermarkets in urban areas lost only $152,000 in redemptions. Despite the loss of redemptions, mean redemptions per store (first row) rose for all stores across the two periods.

Other results show that stores are less responsive to increases in State SNAP redemptions after 2004. The effect of lagged SNAP redemptions after 2004 (existing redemptions), however, was higher than before 2005. This suggests supermarkets retained more of their customers after 2004, perhaps signaling that customers after 2004 were more loyal than those before 2005.

Conclusion

This paper examined the impact of super store entry on the numbers and SNAP redemptions of supermarkets and grocery, convenience, and combination stores accepting SNAP redemptions in a 5-kilometer (approximately 3-mile) radius marketing area between 1994 and 2015. Using a fixed effects linear econometrics model, we found that over 1994–2015 there was a loss of one supermarket for every four super store entries. Loss of other stores was smaller—1 store for every 20 new super stores. This amounted to about 11 percent of supermarkets and 0.5 percent of other traditional stores in a super store's market area. Store losses were modestly higher in rural areas. Traditional stores include supermarkets and grocery, convenience, and combination stores. We also found that traditional stores in each market area lost about $191,000 in the value of SNAP redemptions as SNAP-beneficiaries shifted their purchasing preferences to super stores. The loss of redemptions was substantial for traditional stores, amounting to about 16 percent of supermarket and 8 percent of other traditional store redemptions. The results did not vary across rural, urban, and suburban areas.

Consolidation and other changes in the food retail sector appeared to play a larger role than super stores in changes in the numbers of stores. Using trend variables to account for consolidation, changes in consumer preferences, and technological changes, such as improved logistics, we found that the number of supermarkets dropped by about 0.14 stores, and grocery and convenience stores declined by 0.16 and 0.65, respectively, over the 6-year event window surrounding super store entry. We also found the number of combination stores grew by 0.59 stores.

We also examined the impact of super stores on traditional stores and their SNAP redemptions in various sizes of market areas to learn the total extent of the effect of super store entry. We found that the number of stores lost in the 2.5-, 5- and 7.5-kilometer (approximately 1.5-, 3-, and 4.5-mile) radius marketing areas were about the same overall and for the various types of traditional stores. One slight difference was for grocery stores, which lost modestly more stores as the market area grew. The effect of super store entry on redemptions was smaller for traditional stores in the 2.5-kilometer radius market area than for either the 5- or 7.5-kilometer radii market area; traditional stores in the 5- and 7.5-kilometer radii market areas experienced similar losses. Findings that the effects of super stores extend to about a 5-kilometer radius are consistent with Ellickson and Greico (2013).

To see if the impact on the number and redemptions of traditional stores changed over time as super stores came to dominate SNAP-redemptions (table 1), we split the study period in half and contrasted the period before 2005 with the period after 2004. Results show that the drop in the number of supermarkets went from about 0.19 stores per entrant before 2005 to about 0.37 stores per super store entrant after 2004; combination stores changed from no loss in stores during the earlier period to a loss of 0.20 stores after 2004. Urban areas after 2004 experienced fewer store losses than rural and suburban areas, losing only about 0.28 supermarkets and 0.04 combination stores. The losses in redemptions were also higher in the later period, dropping by nearly $245,000 in suburban and rural areas and $166,000 in urban areas.

The loss of redemptions at traditional stores was more than compensated for by growth at super stores. Table 3b shows the value of redemptions at super stores grew from $190,000 in the first year to $589,000 in the last year of the entry period across three market areas. These values exceeded the loss in redemptions at traditional stores, suggesting SNAP redemptions in the super store market area increased after super store entry.

The most current data provide the best picture of the effects of super store entry on store availability. Those results suggest a loss of about 0.57 traditional stores per super store entry. Since there was one super store entry, there was no net loss in stores that accept SNAP benefits. Note that these results apply only to food stores eligible to accept SNAP benefits and not all food stores.

Store entry and exits are disruptive to consumers. The results presented here suggest most consumers with access to food stores before super store entry likely maintained access after its entry. However, there likely were a small number of SNAP beneficiaries who lost access to supermarkets after super store entry. For some of these access-challenged beneficiaries, internet delivery services may provide relief. Under current policies, SNAP beneficiaries can now order food through a delivery service. Because these delivery services are more available in urban areas and more accessible to those with internet services, it is likely any complete loss of access to supermarket foods today would be in rural areas not served by delivery services or lack internet service.[20]

Supermarkets carry a large variety of products, including a range of fruits and vegetables and other highly nutritious foods, so access to these stores is important for the health of SNAP beneficiaries. In the early 1990s, super stores may not have offered the same variety of foods, but in recent years that has changed. As indicated in the Food Research Atlas—which can be found online at USDA's data products site—super stores and supermarkets are now considered equivalent in terms of access to healthy and affordable food. Thus, the loss of less than one supermarket per super store may not impact access to specific types of food, like fresh meats and produce or perishable items.

A far greater source of any loss of store access in general, and access to healthy food specifically, is ongoing consolidation in the food retail sector. Changes in the supermarket industry, as reflected in the trend variable, have led to a loss of 0.023 supermarkets per year. This implies a loss of 0.55 supermarkets over the 24 years (1992–2015) this study reviewed.[21] A similar analysis for combination stores (trend is 0.098) suggests a growth of 2.25 combination stores.

The drop in SNAP redemptions at traditional stores implies a potential gain to SNAP beneficiaries because of potentially lower prices compared with traditional stores. Volpe and Lavoie (2008) found that Walmart super stores offer 6–7 percent lower prices on branded products and 3–8 percent lower prices on private label products than supermarkets. They also assert that Walmart prices are lower than their direct competitors (other super stores). Our results for the loss of redemptions at supermarkets and other traditional stores in a market area after super store entry in the post-2004 period is about $245,000 per year for all rural and suburban stores and $166,000 per year for urban stores, or about $213,000 per year per super store entrant over both rural and urban areas. If SNAP beneficiaries who shop at those stores saved 3 percent on their purchases, then all SNAP beneficiaries combined in a super store's market area would have saved $6,390 per year for each year over 2005–15. If all 2,434 super store entrants in our dataset experienced the same effect, then the savings for all SNAP beneficiaries served by those stores would be about $15.5 million per year. If the savings were applicable to all super stores that exist in a given year, then the savings would be an equivalent of $108.6 million per year for all beneficiaries at 2015 prices and super store numbers, which is about 0.15 percent of total SNAP benefits and costs (less than $1 per household).[22]

[20]Sharkey (2009) discusses the challenges rural communities face in accessing affordable food.

[21]This is computed as the parameter value of the trend times the year from 1992. For 2015, this would be 0.023 * 24, or 0.55 supermarkets.

[22]This value depends on findings from Volpe and Lavoie's 2008 study. The value now could be higher because the consumer price index tends to overstate food prices (Hausman and Leibtag, 2009), but the value could also be lower because of the entry of low-cost competitors, such as Aldi. A more precise measure of SNAP redemption loss at supermarkets could be possible if supermarkets, rather than super stores, were made the focal point. We leave that to future research. The Food Nutrition Service reports that total costs of the SNAP program (benefits plus costs) were $73.9 billion in 2015. See the national level data online at the Food Nutrition Service website under Supplemental Nutrition Assistant Program.

There are several caveats. First, we only examined super store entry in areas where there were no other super stores the previous 3 years. This accounted for only about one-seventh of all super stores. Stores we did not include may have entered before 1994 or after 2015. They also could have entered as a competitor to an existing super store.

The study also did not include stores that do not accept SNAP benefits. Thus, we cannot generalize our results beyond those authorized to accept SNAP. However, our results should apply to a large share of the market because most supermarkets and super stores are authorized to accept SNAP (see Rhone et al., 2017 for information on how STARS compares with proprietary directories of stores). We also acknowledge that demographic variables were drawn from a somewhat larger area than the market area of the super store. Finally, it is important to note that all households eligible for SNAP benefits do not participate in the SNAP program. Thus, the impact of super stores on low-income households is larger than the effect on SNAP beneficiaries alone.

The results also indicate several areas that need further study. Table 1 shows store growth occurred for both super stores and combination stores. This paper and many others examined super stores, but much less research has been devoted to studying the effects of dollar and other combination stores. The paper also considered the effects of super store entry on the number of traditional stores and their redemptions. A similar approach could be used to evaluate the impact of super store entry on food prices and nutritional quality.

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