The Trade-offs of Privatizing Benefit Distribution: Evidence from Mississippi WIC*

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Abstract

We examine how distribution mechanisms affect participation, targeting, and costs in a large federal nutrition program. Using a difference-in-differences design, we study the transition of Mississippi's Women, Infants, and Children's (WIC) program from state-run warehouses to retail-based food distribution. We find that retail distribution reduced participation by 12–14%, with the largest declines among children and disadvantaged groups, while lowering per-participant costs by 32% through the elimination of state-run warehouses. Further analyses suggest increased shopping burden as the mechanism, rather than administrative burden or travel costs. These findings highlight the trade-offs of privatizing public benefit distribution while maintaining service quality and access.

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1 Introduction

The design of anti-poverty programs involves not only determining benefit levels and eligibility criteria but also how benefits are distributed. Distribution methods——whether benefits are transferred directly to participants, provided at public distribution sites, or redeemed through authorized vendors——can significantly impact program reach and effectiveness. In cash transfer programs, for example, access may be constrained by financial infrastructure, such as the need for a bank account (Bennett and Werner 2022). In in-kind programs, physical distribution sites are often required, and the location and administration of these sites can influence take-up, targeting, and costs (Dong et al. 2024; Meckel 2020; Brown 2024). Despite the importance of distribution systems, there is limited empirical evidence on their effects within U.S. programs.

One factor limiting research is that changes in distribution methods are rare, making quasi-experimental identification difficult.[1] We study a unique, large-scale shift in benefit distribution in Mississippi's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). During 2021, Mississippi transitioned approximately 80,000 WIC participants from receiving food at government-operated warehouses to purchasing WIC-approved products at authorized grocery stores through a county-by-county rollout. Under the prior system, the state procured food directly from wholesalers and distributed it at state-run warehouses; under the new system, authorized retailers were reimbursed at retail prices for participant purchases. We use this shift to study how distribution mechanisms affect participation, targeting, and costs in a large federal nutrition program.

To analyze the effects of this transition, we compile monthly administrative data on WIC participation and costs from the Mississippi State Department of Health (MSDH) and the US Department of Agriculture (USDA), covering FY 2019 to FY 2024. This allows us to observe trends two years before and three years after the reform. Participation data are available

[1] There is more evidence from developing countries, where several large programs have changed their distribution methods in recent decades (Banerjee et al. 2023; Jiménez Hernández and Seira 2022; Muralidharan, Niehaus, and Sukhtankar 2023).

at the county level and disaggregated by category (infants, pregnant women, postpartum mothers, and children). Cost data, including food and administrative expenditures, are reported at the state level. We supplement these sources with Vital Statistics birth records, which contain county identifiers and provide an alternative measure of WIC participation based on self-reported usage during pregnancy.

Our empirical strategy relies on difference-in-differences (DiD) models. For county-level WIC participation, we exploit the staggered, county-level rollout of retail distribution, using neighboring states as never-treated controls. Given concerns about bias in standard two-way fixed effects models under staggered treatment, we implement the de Chaisemartin and D'Haultfoeuille (DCDH) estimator to account for heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille 2020; De Chaisemartin and d'Haultfoeuille 2024). For state-level program costs, we use a DiD framework comparing Mississippi's trends before and after the reform to those in neighboring states. Our preferred specifications control for local unemployment rates and state-level Medicaid policies.

We find that the transition to retail distribution led to a sustained 12–14 percent decline in overall WIC participation, with the largest reductions among children (-17 percent). There is no evidence of pre-existing divergent trends, and results remain robust across several specifications, including models that truncate the sample before the 2022 infant formula shortage and control for pandemic-related policy variation. We validate our finding of a decline in participation among pregnant women using birth certificate data.

We next turn to the targeting properties of the reform. Although WIC is a means-tested program, the value of benefits is based solely on household composition. We first document that participation declines were larger among households with smaller food packages, suggesting that the shift may have improved targeting efficiency by discouraging those with lower benefit levels (as in Nichols and Zeckhauser 1982). However, declines were also larger in high-poverty counties, suggesting a reduction in targeting by income level. Additionally, among pregnant women, participation declines were more pronounced among Black and

unmarried mothers, historically disadvantaged groups.

As for program costs, we estimate that per-participant expenditures initially rose during the transition but ultimately declined by 32 percent in the post-reform period, driven entirely by a 44 percent reduction in food procurement and distribution costs, with no significant change in administrative expenditures. Disaggregating food-related costs using state procurement contracts, we find that the decline was entirely due to the elimination of state-run warehouses, while the cost of benefit packages remained stable. This stability is somewhat surprising given the structural differences between competitive bidding under direct distribution and market-based pricing under retail distribution.

We next examine the mechanisms underlying the participation decline. The sharpest declines occurred among children, suggesting that new barriers under retail distribution deterred experienced participants, as WIC households typically enroll during pregnancy or infancy. This makes it unlikely that the decline was driven by information frictions or enrollment barriers, which primarily affect new applicants. Additionally, since clinic procedures remained unchanged and per-participant clinic expenditures did not change, hurdles associated with quarterly clinic appointments and recertification are unlikely explanations.

Instead, we consider the most likely mechanisms to be related to the shift in how and where participants obtained WIC foods. One factor that changed was the travel burden associated with WIC shopping. However, the transition expanded the number of food sites from 95 distribution centers to 292 grocery stores, reducing the average shopping distance by 1.5 miles (-30 percent). Since shorter travel distances should increase rather than decrease access, travel burden is unlikely to explain the participation decline.

We then examine whether shopping effort and stigma played a role. Surveys of WIC participants consistently identify grocery store shopping——searching for WIC-approved foods, dealing with checkout errors, and stockouts that require multiple trips——as one of the most burdensome aspects of program participation (WIC 2017; Barnes et al. 2023; USDA 2023). Stigma at checkout is also reported, though less frequently.

To compare these experiences with pre-reform WIC distribution centers, we assemble a dataset of hundreds of old Google reviews of WIC distribution centers, as well as a state-commissioned report describing shopping experiences at a few centers. These sources describe a structured and efficient shopping process, where staff were perceived as helpful and supportive. However, they also had limitations, including limited inventory and restricted hours.

To further assess this mechanism, we examine grocery shopping time among likely WIC-eligible households in Mississippi using the American Time Use Survey. Relative to control states, these households became more likely to have gone grocery shopping or used social services in the past 24 hours, with time spent on these activities increasing by 3.3 minutes (75%). No similar changes are observed among a high-income comparison group.

Overall, our qualitative and quantitative evidence lends support to the hypothesis that increased shopping burden contributed to the participation decline. The structured, one-stop nature of distribution centers may have mitigated logistical and cognitive burdens compared to the more complex and independent retail grocery shopping process.

Our study contributes to several strands of literature on the design and delivery of anti-poverty programs. First, our paper is related to a large body of research on incomplete program take-up, which finds that information costs, transaction costs, and provider interactions influence participation (see, for example, Currie 2004; Kleven and Kopczuk 2011; Herd and Moynihan 2018; Finkelstein and Notowidigdo 2019). Recent work highlights the role of procedural hurdles that arise during enrollment and re-certification, such as burdensome application processes, re-certification requirements, and wait times (Deshpande and Li 2019; Wu and Meyer 2023; Homonoff and Somerville 2021). Our findings contribute to this literature by demonstrating that benefit distribution systems can impose frictions that meaningfully affect participation.

We contribute to the literature on contracting out public service delivery, which examines the effects of shifting government functions to private entities. While privatization can improve efficiency, it may also reduce access when cost-cutting incentives lead to lower-quality

service (Hart, Shleifer, and Vishny 1997; Duggan 2004; Kuziemko, Meckel, and Rossin-Slater 2018). Our findings are broadly aligned with this literature, showing that while transferring food provision to private retailers lowered government costs, it also introduced frictions that discouraged participation by diminishing service quality——specifically, the shopping experience.

The remainder of the paper is structured as follows. Section 2 provides background on the WIC program and the transition from direct to retail distribution in Mississippi. Section 3 describes the data. Section 4 outlines the empirical strategy. Section 5 presents the main results on participation and program costs. Section 6 explores potential mechanisms driving the observed effects. Section 7 concludes.

2 Institutional Background

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a federal assistance program administered by the United States Department of Agriculture (USDA) with the goal of safeguarding the nutritional well-being of low-income women and their young children. Participants include pregnant and postpartum women, as well as infants and children under the age of five. To qualify for WIC, individuals must live in households with annual incomes below 185 percent of the federal poverty line (currently $51,338 for a family of four) or participate in Medicaid.[2] Participants must also be deemed "at nutritional risk," though this requirement rarely binds (IOM 2000).

WIC benefits are designed to address nutritional deficiencies and improve health outcomes. These benefits include the provision of specific nutritious foods, health screenings, nutrition education, and referrals to other social services. In 2023, WIC served approximately 6.6 million individuals, operating with a program budget of $6.7 billion.[3] Evidence suggests that WIC participation significantly improves outcomes such as infant health, maternal health, breastfeeding rates, and access to other social services (Bitler and Currie 2005;

[2]Source for income cut-off: https://liheapch.acf.hhs.gov/profiles/povertytables/FY2023/popstate.htm.

[3]Information about WIC program participation and funding is available here: https://www.fns.usda.gov/pd/wic-program.

Currie and Rajani 2015; Hoynes, Page, and Stevens 2011; Rossin-Slater 2013).

A distinguishing feature of WIC among US anti-poverty programs its use of fixed-quantity benefits rather than value-based transfers, which are used in programs like the Supplemental Nutrition Assistance Program (SNAP). For instance, a pregnant woman enrolled in WIC is eligible to receive a monthly food package that includes the following quantities: 4 gallons of milk, 36 ounces of breakfast cereal, 48 ounces of whole wheat bread, one dozen eggs, 10 ounces of canned fish, 64 ounces of juice, and a choice between 64 ounces of canned or dried beans or 18 ounces of peanut butter. Tables A.1 and A.2 detail the current maximum food packages for women, children, and infants under one year of age.

WIC is a widely used program. In 2021, 39% of infants, 23% of children aged one to four, and 20% of pregnant and postpartum women nationwide participated in the program. Despite its broad reach, participation rates are relatively low, with only 51.2% of eligible individuals enrolling (Gray et al. 2021). Prior work highlights various barriers to participation, including distance to clinics, burdensome documentation requirements, and hurdles involved in the shopping process (Bitler, Currie, and Scholz 2003; Swann 2007; Rossin-Slater 2013; Barnes et al. 2023; Meckel 2020).

2.1 Distribution Systems

Although WIC is primarily federally funded, state and local governments have significant autonomy in its administration. Historically, states have chosen among three delivery systems: retail distribution, direct distribution, and home delivery. Under retail distribution, participants use food instruments (paper vouchers or electronic cards) to purchase WIC-approved items at grocery stores. In direct distribution, state programs procure food through competitive bidding and distribute it via government-run warehouses ("distribution centers"). Home delivery involves state-procured food being delivered directly to participants' homes.

Since WIC's inception in 1974, retail distribution has been the predominant model. A 1976 survey found that 65% of WIC clinics used retail distribution, 17% used home delivery, and 7% relied on direct distribution, while 11% employed a mix of methods (Bendick 1976).

Early funding formulas incentivized retail distribution by allocating states more administrative funds when food costs were higher, as retail prices exceed wholesale costs.[4] By 2020, only Mississippi and Vermont continued to use direct distribution and home delivery, respectively.

2.2 Mississippi WIC and the Transition from Direct to Retail Distribution

In FY 2019, Mississippi WIC served 79,192 participants, representing 1.2% of all WIC participants nationwide.[5] Using U.S. birth certificate data from 2018–2022, Table 1 compares WIC participation rates among pregnant women in Mississippi to national rates and examines demographic differences between WIC participants in Mississippi and those nationwide. In Mississippi, 44% of births are to WIC participants——nearly 40% higher than the national average of 32%——likely reflecting the state's lower median household income (Engel and Posey 2024). Among pregnant WIC participants in Mississippi, 59% are Black, more than double the national share of 24%. Mississippi's WIC participants are less likely to be married or and more likely to have attended college compared to the national average.

Enrollment in Mississippi WIC takes place at clinics located throughout the state, with approximately one clinic per county.[6] Participants must visit these clinics in person every three months for nutritional counseling and health screenings, and every six months for recertification.[7] Quarterly clinic visits are required to receive benefit vouchers, which cover the subsequent three months. Under the direct distribution model, benefits were provided as paper vouchers, printed and distributed at the clinic. In contrast, under the retail distribution model, participants receive electronic benefit cards, which are automatically reloaded after each appointment, with the initial card mailed to their home. Failure to redeem benefits for two consecutive months results in automatic removal from the program, and unused benefits do not roll over.

Under the direct distribution model, participants redeemed benefits at one of 96 WIC

[4] As noted by Bendick (1976), states could maximize staff salaries by choosing retail distribution.

[5] Source: https://www.fns.usda.gov/pd/wic-program.

[6] Information about Mississippi WIC was collected through communications with MS WIC staff, the MS WIC website, and (Simon and Leib 2011).

[7] Pregnant women are certified for the duration of their pregnancy as well as 6 weeks postpartum.

distribution centers across the state. These centers typically operated on weekday business hours (e.g., 8 AM to 5 PM or 9 AM to 6 PM). During the initial months of the COVID-19 pandemic, distribution centers remained open but restricted access to no more than two WIC participants at a time. County health centers, the site of most WIC clinics, remained open during normal business hours.[8]

The Healthy, Hunger-Free Kids Act of 2010 mandated that all state WIC programs transition to electronic benefit transfer (EBT, or "eWIC") as the method for delivering food benefits by October 1, 2020. For Mississippi, this mandate effectively required a shift from direct distribution to a retail-based system. EBT replaces paper vouchers with a plastic smart card that electronically stores a household's WIC benefits and dates between which the benefits can be redeemed. Although the federal deadline for this transition was October 2020, implementation in Mississippi was delayed due to the COVID-19 pandemic.

Mississippi adopted a phased rollout of EBT across counties, detailed in Figure A.1 and Table A.3. The process began with a pilot phase in February 2021 in Forrest, Lauderdale, and Lee counties, followed by three additional rollout phases between April and June 2021. Participants began receiving EBT cards during their regularly scheduled tri-monthly clinic appointments starting on their county's rollout start date. As a result, all participants in a given county received EBT cards within the first three months of retail distribution. Correspondingly, warehouses remained operational for three months after each county's rollout began, allowing participants who had received paper vouchers before the transition date to continue redeeming them. Participating stores in each county were required to start accepting EBT on the rollout start date.

Figure A.2 maps the 95 WIC distribution centers in FY 2020 and 292 WIC-authorized grocery stores in FY 2022. Counties are shaded by poverty rates (subfigure a) or urbanicity (subfigure b).[9] While distribution centers were relatively evenly spaced——roughly one per

[8]Source: https://www.wjtv.com/news/msdh-announces-operation-changes-amid-coronavirus-outbreak/.

[9]Data on distribution centers and authorized grocery stores covering FY 2019–2023 were obtained from the Mississippi State Department of Health (MSDH) through an Open Records Request. This dataset includes the name, address, and, for distribution centers, the hours of operation for each location.

county——WIC stores are more concentrated in urban areas like Jackson (the state capital) and the Gulf Coast (including Gulfport and Biloxi), where poverty rates are lower. In contrast, the Mississippi Delta——a predominantly rural, high-poverty region in the northwest——has much sparser WIC store coverage.

To analyze the types of grocery stores participating in Mississippi's WIC program, we link our WIC store data to historical records on all SNAP-authorized retailers, which include store type classifications.[10] Table A.4 shows that among Mississippi WIC-authorized grocers in FY 2022, 56.2% were classified as superstores and 39.7% as supermarkets, indicating relatively little variation in store size.

3 Data on Participation and Program Costs

3.1 WIC Participation

We analyze WIC participation in Mississippi using data obtained from the Mississippi State Department of Health (MSDH), covering the period from January 2019 to September 2024. These data, provided in response to an Open Records Request, report monthly participation counts by county of residence and participant type (pregnant women, postpartum breastfeeding women, postpartum non-breastfeeding women, infants, and children). For comparison, we incorporate state-level monthly participation data from the USDA for Mississippi's neighboring states–Alabama, Arkansas, Louisiana, and Tennessee–covering the same period.[11] These data, which are similarly disaggregated by participant type, serve as a control group for participation trends in Mississippi.

In these data, a participant is defined as an individual who receives WIC food instruments during a given month.[12] Because WIC participants receive food benefits at quarterly

[10]The data are publicly available at https://www.fns.usda.gov/snap/retailer/historical-data.

[11]The data are available here: https://www.fns.usda.gov/pd/wic-program.

[12]From WIC Program Regulation 7 CFR 246.2: "Participation means the sum of the number of persons who have received supplemental foods or food instruments during the reporting period and the number of infants breastfed by participating breastfeeding women (and receiving no supplemental foods or food instruments) during the reporting period." Details are available at https://www.fns.usda.gov/wic/certification-and-monthly-food-benefits-issuance-cycles-and-reporting-monthly-participation-fns-798. We verified this definition with MS and USDA WIC staff.

WIC clinic appointments, monthly participation totals reflect the number of individuals who attended their most recent appointment.

Figure 1 compares monthly WIC participation trends in Mississippi to trends in neighboring states. Before Mississippi's transition to retail distribution began in February 2021, participation trends in the state were generally similar to those of its neighbors. However, during the rollout period (indicated by vertical red dashed lines), Mississippi experienced a pronounced decline in participation, while neighboring states' participation remained stable. This divergence persists after the rollout, as Mississippi's participation levels do not return to pre-rollout levels.

Two important events–the COVID-19 pandemic and the 2022 infant formula shortage–could potentially confound our analysis of participation trends. Figure A.3 overlays participation trends with the timing of these events. Figure A.3A shades the period of the COVID-19 pandemic, while Figure A.3B shades the time frame of the 2022 infant formula shortage. These figures show that neither event coincides with the transition to retail distribution, and that they do not appear to be have had important effects on WIC participation.

Figure A.4 further examines WIC participation trends by county groups corresponding to each rollout phase. The figures show a sharp decline in participation immediately after the rollout start month for each group, with these declines largely persisting in the post-transition period.

To complement our analysis of administrative WIC participation counts, we use individual-level Vital Statistics Natality data for Mississippi and the neighboring states from 2018 to 2022. These data cover the universe of birth certificates for these states and provide an alternative measure of WIC participation, based on whether the mother reported receiving WIC foods during pregnancy. This allows us to validate that the changes observed in administrative records reflect actual shifts in benefit usage, rather than mechanical reporting effects. Additionally, the Natality data include detailed demographic information including maternal county of residence. However, the data have two key limitations: (1) they capture

only one category of WIC participants (pregnant women), and (2) the WIC participation indicator spans a nine-month period (the duration of pregnancy), which complicates the precise assignment of treatment timing. Appendix Section A.1 provides further details on data cleaning procedures and presents summary statistics.

3.2 Program Costs

We use monthly, state-level cost data for Mississippi WIC and its neighboring states from October 2018 to September 2023 (Figure 2). These data, provided by the USDA, categorize WIC program costs into two components: Food Costs and Nutrition Services and Administration (NSA) Costs.[13] Under direct distribution, Food Costs encompassed not only the wholesale cost of food but also expenses related to warehousing and distribution, such as staffing, leasing, and maintaining distribution centers. In contrast, under the retail distribution model, Food Costs reflect only the reimbursements paid to grocery retailers for WIC-approved food.

NSA Costs, which make up the remainder of program expenditures, cover administrative expenses related to clinic operations, including participant certification, nutrition education, breastfeeding support, and staff salaries. They also fund outreach activities, compliance monitoring, and the development of educational materials.

To separate food benefit costs from warehousing expenses under direct distribution, we utilize data from Transparency Mississippi, a state-managed website that provides detailed records of government expenditures, contracts, and payroll.[14] Specifically, we collect purchasing contract data from MSDH for grocery wholesalers during the direct distribution period.[15] These contracts reveal that MSDH procured food through a competitive bidding process, typically involving two or three wholesalers, selecting vendors based on the lowest prices for specified products. Contracts detailed product quality, quantities, packaging, and delivery

[13]The data are available here: https://www.fns.usda.gov/pd/wic-program.

[14]Transparency Mississippi is operated by the Mississippi Department of Finance and Administration. See https://www.transparency.ms.gov/about.aspx.

[15]The following contract numbers were provided by MSDH: Supervalu Holding (#8200051302) – Food; Bimbo Food (#8200051274) – Bread; Sunrise (#8200045731) – Produce; MS Fruit (#8200051464) – Produce; Mead Johnson (#8200052008) – Standard infant formula.

schedules to WIC distribution centers. We aggregate these payments at the year-month level for the duration of the direct distribution period.

To construct a consistent time series of food benefit costs for Mississippi, we combine contract-derived food cost data from the direct distribution period (pre-February 2021) with USDA-reported Food Costs data from the retail distribution period (February 2021 onward). We also use USDA Food Costs data for neighboring states, which used retail distribution throughout.

4 Identification Strategy

To estimate the causal effects of the transition from direct to retail distribution in Mississippi WIC, we employ three complementary identification strategies. The first two strategies rely on variation in the timing of the rollout across counties in Mississippi while incorporating state-level data from neighboring states (Alabama, Arkansas, Louisiana, and Tennessee) as never-treated controls. These strategies differ in their estimation approach: the two-way fixed effects (TWFE) model and the de Chaisemartin and D'Haultfoeuille estimator (DCDH), which addresses biases in TWFE models under heterogeneous treatment effects (De Chaisemartin and d'Haultfoeuille 2020; De Chaisemartin and d'Haultfoeuille 2024). The third strategy, applied at the state level, uses a standard difference-in-differences (DiD) framework to compare Mississippi (the treated unit) to neighboring states.

4.1 Two-Way Fixed Effects Estimator

Our primary strategy exploits the staggered rollout of EBT across Mississippi counties, using neighboring states as a "never-treated" control group. We estimate the following model for a given outcome Y_{gt}:

$$Y_{gt} = \alpha + \beta Post_{gt} + \gamma_g + \mu_t + \Gamma' Z_{gt} + \epsilon_{gt} \tag{1}$$

where g represents a geographic unit–either Mississippi county or surrounding state–and t is year-month. The variable $Post_{gt}$ is an indicator equal to 1 if county g has transitioned to retail distribution by time t (so this variable is always 0 when g represents a neighboring

state). γ_g and μ_t are fixed effects for geographic units and time, respectively. Z_{gt} includes state-level controls for unemployment rates and Medicaid policies.[16] The error term ϵ_{gt} is clustered at the level of geographic unit (county/state). Since EBT benefits were rolled out over a three-month period (with approximately one-third of county residents transitioning per month), we also estimate an alternative specification that splits $Post_{gt}$ into two indicators: one for the first three months after the transition began and another for subsequent months.

To assess treatment dynamics and test for pre-trends, we estimate event-study versions of this specification, replacing $Post_{gt}$ with indicators for event time relative to the transition. Specifically, we include 18 leads and 18 lags, balancing the sample within this symmetric, 36-month window.

Given the potential for bias in two-way fixed effects DiD models with staggered treatment (De Chaisemartin and d'Haultfoeuille 2020; Sun and Abraham 2021; Goodman-Bacon 2021; Callaway and Sant'Anna 2021; Borusyak, Jaravel, and Spiess 2024), we implement the DCDH estimator proposed by De Chaisemartin and d'Haultfoeuille (2024), which accounts for treatment effect heterogeneity and avoids negative weighting issues.

Our identifying assumption is that there are no unobserved, time-varying factors correlated with the timing of the rollout. Under this assumption, β captures the causal effect of the transition on WIC participation in treated counties, relative to other (TWFE) or not-yet-treated (DCDH) counties and neighboring states.

Lastly, we apply the inverse hyperbolic sine transformation to the participation outcome variable to account for differences in magnitude and variation across Mississippi counties and the control states.

[16] These Medicaid controls, motivated by the existence of adjunct eligibility between Medicaid and WIC, are indicators for: (1) postpartum coverage extensions, adopted by Louisiana and Tennessee in April 2022, Alabama in January 2023, and Mississippi in December 2023; (2) work requirements, enforced in Arkansas from June 2018 to November 2021; and (3) expanded eligibility for immigrants within the five-year waiting period, implemented for children and pregnant women in Arkansas in January 2018 and for children in Louisiana in April 2019.

4.2 State-Level Difference-in-Differences

For analyses conducted at the state level, we employ a standard DiD framework comparing Mississippi to neighboring states. For an outcome Y_{st}, measured at the state s-month t level, we estimate:

$$Y_{st} = \alpha + \beta(\mathit{AfterJan2021}_t \cdot \mathit{MS}_s) + \rho_s + \lambda_t + \Gamma' Z_{st} + \epsilon_{st}, \tag{2}$$

where $\mathit{AfterJan2021}_t$ is an indicator equal to 1 for months after January 2021, the month before the start of the rollout in Mississippi, and MS_s is an indicator for Mississippi. State fixed effects (ρ_s) and time fixed effects (λ_t) account for unobserved variation at these levels, while Z_{st} controls for the state-level covariates described above. The error term ϵ_{st} is clustered at the state-date level (i.e., at the level of variation).

We extend this specification by estimating event-study models, replacing $\mathit{AfterJan2021}_t \cdot \mathit{MS}_s$ with event-time indicators. Additionally, in some specifications, we include separate indicators for the rollout period (February–July 2021) and the post-rollout period (August 2021 onward) to allow for heterogeneous treatment effects over time.

5 Results

5.1 Participation

We begin by examining the impact of the transition on WIC participation, leveraging the staggered rollout across Mississippi counties in a difference-in-differences framework (Eq. 1). As discussed above, the traditional two-way fixed effects (TWFE) estimator can produce biased estimates in the presence of heterogeneous treatment effects. Visual evidence from the raw data (Figure A.4) suggests that treatment effects may vary over time (e.g., due to a gradual adjustment to the new scheme) as well as across county groups (e.g., due to differences in WIC offices or retail markets). Consistent with this, a diagnostic test reveals that 18% of the weights in the TWFE model are negative, highlighting the need for alternative estimation methods (De Chaisemartin and d'Haultfoeuille 2024). Therefore, we use the de

Chaisemartin and D'Haultfoeuille (DCDH) estimator as our preferred approach.

Figure 3, Panel A, presents event-study estimates from the DCDH method, with coefficients plotted relative to the pre-treatment baseline ($t = -1$). The outcome variable is the inverse hyperbolic sine of total WIC participants. The absence of significant pre-treatment trends supports the validity of the parallel trends assumption. Following the implementation of retail distribution, participation declines over the three-month period corresponding to the phased distribution of EBT cards in each county, then stabilizes at a significantly lower level.

Table 2, Columns (1)-(3), presents the regression estimates from Eq. 1, comparing results across different estimators. Column (1) reports the DCDH estimate, which indicates an 12.7% overall decline in participation, statistically significant at the 1% level. Column (2) provides the TWFE estimate, which is similar in magnitude and significant at the 1% level. In Column (3), distinguishing between the three-month rollout period ("During Rollout") and the post-rollout period ("After Rollout"), the TWFE estimate for the post-rollout period is -13.5%, while the estimate during the rollout is -11.0%.

State-level DiD estimates based on Eq. 2 are reported in Columns (4)-(5) of Table 2. Column (4) estimates a 13.9% decline in participation, statistically significant at the 1% level. In Column (5), separating the statewide rollout period (February–July 2021) from the post-rollout period (August 2021 onward), we find a larger post-rollout decline of 17.8%, also significant at the 1% level.

Taken together, these estimates imply that the transition to EBT cards reduced WIC participation by approximately 10,500 to 13,800 participants per month, compared to the pre-rollout mean of 77,665 participants per month.[17]

[17] These figures are calculated using the post-rollout coefficients reported in Table 2, Columns (3) and (5), which estimate participation declines of 13.5% and 17.8%, respectively.

5.2 Robustness

Table A.5 presents robustness checks of our preferred specification. Column (1) shows the baseline county-level estimate of a 12.7% decline in participation. To address potential confounding from the 2022 infant formula shortage, which began in May 2022, Column (2) restricts the sample to data through April 2022, yielding a slightly smaller but statistically similar decline (-10.8%). Column (3) removes control variables, including Medicaid eligibility changes and unemployment rates, producing an estimate nearly identical to the baseline (-12.9%). Column (4) adds controls for the expiration of SNAP Emergency Allotments, which varied by state, and finds a comparable decline (-12.5%).[18] Lastly, Column (5) replaces the transformed outcome with raw participation counts, yielding a similar precise, negative effect (-10,170.4), corresponding to a 13.1% decline.

We use birth certificate data to validate the patterns observed in the administrative records. While administrative data capture all WIC participants, birth certificates are limited to pregnant women but provide detailed demographics and county identifiers for Mississippi and neighboring states. The outcome is a binary indicator for WIC receipt during pregnancy, reflecting a nine-month participation period. Treatment status is assigned based on the start of the second trimester (conception + 14 weeks), consistent with evidence that most pregnant women enroll by this time (USDA-FNS 2020). Column (1) of Table A.6 estimates a 2.5 percentage point (pp) decline in WIC participation (-5.6%), smaller than the 9.7% reduction from administrative data (reported in Table 3) but within its confidence interval. This attenuation likely reflects the longer participation window in birth certificate data and imprecision in assigning treatment timing, which biases estimates toward zero.

5.3 Targeting Properties of the Reform

We examine two dimensions of the reform's targeting properties: variation by participant benefit levels and variation by socioeconomic status. WIC benefit packages are determined

[18] Emergency Allotments were introduced nationwide in March 2020 and should be accounted for by date fixed effects. Expiration dates by state are reported in Pukelis (2024) (Figure 3).

primarily by participant type (e.g., pregnant women, postpartum women, infants, and children) rather than adjusted for household income, and there is substantial variation in benefit value across categories. For example, a 2018 report using national data found that, on average, monthly benefits were worth $138.64 for infants and $31.78 for children (USDA 2020).

Table 3 presents estimates from administrative data of Eq. 1 using the DCDH estimator. The results indicate that children experienced the largest participation decline (-16.9%), followed by women (-10.2%) and infants (-6.9%), with all estimates statistically significant at the 1% level. Among women, postpartum non-breastfeeding participants exhibited the largest decline, although differences across subgroups of women are not statistically significant. These declines suggest a potential relationship between benefit value and participation– if participants weigh the value of their benefits against the costs of participation, we would expect larger declines among those with smaller benefit packages, consistent with the targeting framework of Nichols and Zeckhauser (1982). This relationship would imply that the reform shifted program dollars toward participants with greater nutrition needs.

To formalize this relationship, we assume that participants value continued participation based on their total expected benefits until their next recertification, reflecting the idea that recertification serves as a decision point where they reassess participation.[19] We approximate the time remaining in a participant's certification period by assuming that, on average, participants are at the midpoint of their certification (e.g., an infant certified for 12 months is assumed to have 6 months of benefits remaining). Figure 4 plots estimated participation declines by participant type against their average continuation value, showing an increasing relationship: participant groups with larger benefit packages experienced smaller participation declines.[20] Although inference is somewhat limited by power, this evidence suggests that the reform shifted participation toward individuals receiving larger benefit amounts due to greater nutritional need.

[19]This approach assumes that enrollment and recertification costs are similar.

[20]The footnotes to the figure provide the relevant calculations. We exclude breastfeeding mothers because we do not have data on breastfeeding share, making it difficult to impute their benefits.

Next, we examine heterogeneity in participation effects by socioeconomic status. Table 4 presents estimates of participation declines by county poverty level, defined as above or below the median poverty rate (weighted by low-income households). Poorer counties experienced much larger declines, with participation dropping by 17 percentage points in above-median poverty counties compared to 8 percentage points in below-median counties—nearly half as large. This suggests that the reform disproportionately reduced participation in higher-poverty areas, shifting program access away from those with greater financial need.

We also examine heterogeneity by demographic characteristics from birth certificate data. In Table A.6, participation declines were larger among Black and unmarried mothers but not among mothers with lower education levels. These patterns suggest potential negative targeting effects, as these groups tend to be more socioeconomically disadvantaged, though the differences are generally not statistically significant.

In sum, while the reform reduced participation overall, its targeting effects were mixed. It disproportionately discouraged participation among those receiving lower benefit amounts, suggesting improved targeting efficiency with respect to nutritional need, but also among lower-income and socioeconomically disadvantaged groups, weakening targeting by financial need.

5.4 Costs

This section examines the impact of the transition to retail distribution on WIC program costs using the state-level difference-in-differences (DiD) framework specified in Eq. 2. Event-study estimates for total program costs per participant are presented in Figure 5, Panel A, with the rollout period shaded in gray. The results show a temporary increase in costs during the rollout, followed by a sustained decrease in the post-rollout period. While the pre-period estimates exhibit some noise, there is no evidence of differential trends before the transition.

Panel B of Figure 5 breaks down the estimates by cost category, showing that the decline in total costs is driven by a decline in the costs of food procurement and distribution ("Food Costs"), which account for 73 percent of total program costs. The costs of clinic operations

("NSA Costs"), which make up the remaining 27 percent, remain relatively stable in the post-rollout period but increase slightly during the rollout, likely reflecting short-term adjustment costs in clinics, such as the purchase and installation of EBT card readers.

Regression estimates for total program costs per participant are reported in Table 5, Columns (1)–(2). The transition leads to a decrease of $5.8 per participant, representing a 6.5 percent reduction relative to the pre-rollout cost in MS, though this estimate is imprecise. Column (2) disaggregates the effects into the rollout and post-rollout periods, finding a temporary increase during the rollout of $47.0 per participant, followed by a significant decline of $28.9 per participant in the post-rollout period, both statistically significant at the 1 percent level. The long-run decline represents a 32 percent reduction relative to the pre-rollout mean.

Table 5, Columns (3)–(6), provides separate estimates for Food and NSA Costs. As seen in the figures, the changes in per-participant costs are fully explained by changes in Food Costs. The long-run decline of $30.0 per participant reflects a 44 percent reduction in Food Costs. In contrast, the effects on NSA Costs during the rollout and post-rollout periods are small and imprecise, with an estimated increase of approximately $1 per participant in both periods.

As noted in the participation results, lower-benefit-value participants were more likely to drop out. This suggests that the changes in costs could reflect compositional as well as causal effects (with higher-value packages over-represented, partially offsetting direct savings). A back-of-the-envelope calculation estimates composition effects increased costs by just 0.6%, confirming minimal impact on savings.[21]

To determine the source of the decline in Food Costs, we distinguish between two com-

[21] We use estimates of food package costs per participant type from USDA (2020, ("post-rebate" costs from Table 4.1)). We multiply these cost estimates by pre-rollout shares of participant types from Table 3, generating an average per-participant cost of $36.21. We then adjust participant shares using our estimated participation declines by participant type (Table 3) and recalculate the weighted average cost. This generates an adjusted per-participant cost of $36.44, implying that compositional shifts increased per-participant costs by only 0.6%. As a result, the overall cost decline, after adjusting for compositional changes, is 45.0% instead of 44.4%.

ponents: (1) the direct cost of food benefits and (2) the operational costs of warehousing and distribution under the direct distribution system. To isolate the impact on food benefit costs, we use a constructed measure incorporating direct distribution food contracts from Transparency Mississippi (as described in Section 3.2). Event-study estimates in Figure A.6 show a temporary increase in per-participant food benefit costs during the rollout, followed by a return to baseline. Table A.7 confirms that the long-run increase is just $1 per participant and statistically insignificant, indicating that the overall cost decline in Table 5 was driven by reductions in warehousing and distribution costs, such as leases, staff, and storage.

The stability of per-participant food benefit costs post-transition is notable given structural differences between the systems. Competitive bidding under direct distribution may have lowered food benefit costs, while market competition among retailers could have had a similar effect under retail distribution. Additionally, retail distribution offers more choice and allows benefits to be redeemed across multiple shopping trips throughout the month. However, these factors appear to have had minimal impact or offset each other.

In sum, the transition substantially reduced per-participant costs, primarily by eliminating warehousing and distribution expenses, with little evidence that participant composition, clinic operations, or food benefit costs contributed to the overall decline.

6 Mechanisms

In this section, we evaluate the mechanisms driving the decline in participation. Figure 3 shows that participation began declining immediately after the rollout began, with a sharp drop over the first three months. This pattern reflects the staggered issuance of EBT cards: participants received their card after completing their required clinic appointment, meaning roughly one-third transitioned each month. Since WIC participation is recorded for all individuals with active benefit instruments, regardless of redemption, this immediate decline suggests that some pre-reform participants or potential enrollees chose not to attend their scheduled clinic appointments or enroll under the new system. The particularly large decline

among children suggests that much of this short-run dropout came from pre-reform enrollees electing not to continue.[22]

Several factors could explain this short-run decline. One possibility is short-term adjustment costs, such as clinic congestion caused by staff training and participant education on new procedures. The increase in clinic ("NSA") costs in Figure 5 during the rollout period is generally consistent with this explanation, but it is small ($1.14/participant) and not statistically significant, as reported in Table 5. Another possibility is that some pre-reform participants——particularly those nearing the end of their eligibility, such as households with children——decided that the cost of navigating a new system outweighed the benefits of continued participation.

It is unlikely that participants were unaware of the upcoming transition to retail distribution. The change was widely publicized across the state through news coverage (WLOX News 2020; Jackson Free Press 2020) and social media outreach. The rollout was originally scheduled for 2020 but was postponed due to the COVID-19 pandemic.

However, the long-run stabilization at a lower participation level suggests that costs persisted beyond the transition period. To explore these persistent barriers, Figure A.7 outlines three stages of WIC participation——initial enrollment, ongoing clinic appointments, and food shopping——along with associated participation barriers at each stage. Arrows indicate whether each barrier increased, decreased, or remained unchanged post-reform, with question marks marking areas of uncertainty.

6.1 Initial Enrollment

We consider three potential barriers associated with initial enrollment: lack of information about the program, travel costs, and administrative requirements. While the transition to retail distribution did not alter traditional outreach efforts, it may have influenced program visibility. Increased WIC shopping in grocery stores could have raised visibility, while declin-

[22]Initial enrollment in WIC occurs mostly during pregnancy or infancy (Bitler et al. 2023; USDA-FNS 2020).

ing participation may have reduced awareness. However, travel to in-person clinic visits and enrollment requirements——including documentation of income, identity, and eligibility——remained unchanged.

Moreover, the disproportionately larger drop among children——who are generally existing participants——suggests that barriers at initial enrollment are unlikely to drive the participation decline.

6.2 3-Month Clinic Appointments

Under retail distribution, WIC clinic requirements—maternal and child health assessments, nutrition education, and referrals—remained unchanged. However, benefit issuance shifted from in-person voucher printing to automatic EBT card loading by a third-party processor.[23] This change may have shortened appointment duration, which would be expected to reduce participation costs and potentially increase, rather than decrease, enrollment.

Despite this, Figure 5 shows no long-run change in clinic (NSA) costs, suggesting that the reform had minimal impact on administrative and operational demands at clinics. In Table 5, the long-run effect on costs is small ($1.04) and noisy.

6.3 Benefit Shopping

Since the transition altered the food distribution model, this is where we expect the most significant changes to occur. Here, we discuss four potential barriers: travel distance, shopping effort, limited food choice, and stigma.

6.3.1 Distance Costs

We first examine whether the shift to retail distribution affected travel distance for WIC shopping. To quantify changes, we estimate the distance to the nearest WIC food site—distribution centers in 2020 or WIC grocery stores in 2022—for low-income households, using block group centroids as proxies for residential locations. Table A.8, Column (1) shows that, on average, low-income households experienced a 1.5-mile (29%) reduction in distance, from a baseline

[23] Following each clinic appointment, cards were electronically updated with three months of benefits.

of 5.3 miles to the nearest distribution center.[24]

Distance reductions were smaller in high-poverty block groups and rural areas, reflecting the concentration of WIC grocery stores in urban, lower-poverty areas (Figure A.2). Nevertheless, all area subsets saw improvements: distance declined by 2.3 miles in below-median poverty areas, 1.4 miles in above-median poverty areas, 1.8 miles in urban areas, and 1.3 miles in rural areas.[25] These estimates suggest that travel distance is unlikely to explain the decline in WIC participation following the transition to retail distribution.

However, distance-based measures do not account for trip frequency or the relative locations of WIC food sites and clinics, both of which shape overall travel burdens. While retail distribution allows participants to combine WIC shopping with routine grocery trips, some distribution centers were located near WIC clinics, potentially allowing for combined trips in the pre-reform period. To better assess these trade-offs, we estimate total travel distances over a three-month period, reflecting WIC's quarterly clinic visit requirement. The results, described in Section A.2, show that total travel distances declined by approximately 50% under retail distribution. This reduction was driven by the increased number of WIC-authorized stores, the ability to consolidate WIC shopping with regular grocery trips, and the fact that clinic and distribution center co-location was rare.[26]

6.3.2 Shopping Effort and Stigma

> *One thing we heard loud and clear is that shopping with WIC is difficult, time-consuming, and embarrassing. The WIC program dictates precise items, sizes, and brands that make the shopping experience into something like a treasure hunt, which can be both time-consuming and stigmatizing.*
>
> — From *In Their Own Words: Parents Help Us Understand Barriers to Accessing WIC* (Code for America 2019)

[24] See table footnotes for additional details on the data and methodology.

[25] Similarly, Table A.9 examines zip codes, which adjust in size based on population density. The likelihood of having a WIC food site in one's zip code increased by 31 percentage points (a 69% increase).

[26] Only 2 of 87 distribution centers shared an address with the nearest WIC clinic, and just 5 were within 250 feet.

Mississippi WIC imposes over 100 purchasing restrictions, requiring participants to navigate detailed rules on eligible foods, brands, sizes, and ingredients.[27] Unlike SNAP, which allows most grocery items, WIC limits choices to a frequently changing, highly specific list. Participants must follow strict guidelines-—pasta must be 100% whole wheat and exactly 16 oz., milk brands vary by retailer, and juice sizes depend on the recipient's age. Many WIC foods are allocated by weight, requiring careful selection of package combinations to stay within limits. For example, as illustrated in Figure A.8, cereal purchases must total no more than 36 oz. Even small mistakes—-such as selecting a 20 oz. jar of peanut butter instead of the allowed 16-18 oz. size—-result in checkout rejection. These complexities create significant cognitive and logistical burdens, particularly given Mississippi's low literacy and numeracy rates (Leone et al. 2022; NCES 2023).

Importantly, these challenges persist even for experienced participants. Frequent updates to the approved product list and inconsistent shelf labeling require ongoing adaptation (Barnes et al. 2023).[28] Because the list is too extensive to print and changes often, participants rely on the Mississippi WIC app to verify eligibility.[29] However, even when participants select approved items, checkout rejections may still occur due to discrepancies between store inventory and the state-maintained Approved Product List (APL).[30] Additionally, strict product requirements can lead to stockouts, forcing participants to visit multiple stores or make repeated shopping trips.

Participants must also adjust as their household's WIC benefits evolve. A major transition occurs when a child turns one, shifting from an infant food package to standard WIC foods. Formula is replaced with whole milk, and infant cereals and purees are swapped for WIC–approved grains, dairy, and produce. Some of these changes introduce new restrictions, such

[27]See the Vendor Food Guide for MS: https://msdh.ms.gov/page/resources/11709.pdf. These rules are similar in complexity to those in other states.

[28]For example, between January and February 2025, 26 new product codes were added—-including 20 cereals, 3 bread products, and 3 yogurts—-while 30 were removed.

[29]The app allows recipients to scan barcodes with their smartphone to confirm eligibility.

[30]Retailers and WIC systems must regularly update APLs, but delays can cause eligible items to be incorrectly rejected. See participant reports on Reddit: https://www.reddit.com/r/WIC/comments/1eoup58/foods_werent_covered_by_the_store/ and https://www.reddit.com/r/WIC/comments/1iq8z9n/wic_items/.

as eligibility rules for whole milk, yogurt, and juice, that even mothers who participated in WIC during pregnancy may not have encountered before.

Indeed, surveys and academic research reveals that WIC participants frequently cite grocery shopping as one of the most burdensome aspects of the program (Leone et al. 2022; Barnes et al. 2023). The 2023 Multi-State WIC Participant Satisfaction Survey found that nearly all participants encountered difficulties, with confusion over eligible items, stockouts, and checkout errors being the most common complaints (USDA 2023). Similarly, a large Texas survey identified WIC shopping as the most challenging aspect of participation, ranking it ahead of customer service and clinic wait times (WIC 2017). In Texas, 62% of participants reported being sent back at checkout due to unauthorized item selection, while 54% encountered stockouts. Checkout rejections and item shortages may also contribute to stigma, with 20% of Texas respondents reporting discomfort at checkout.

To compare the retail shopping experience to that in WIC distribution centers, we draw on three sources: photos, administrative reports, and online reviews. First, Figure A.9 displays images of a distribution center that operated in Hinds County.[31] These images highlight clear signage, structured product groupings, and multilingual labels, which likely reduced cognitive burden compared to grocery stores. However, they also reveal trade-offs, including limited inventory and restricted operating hours.

An MSDH-commissioned report on barriers to WIC participation further supports these observations (MPHI 2023). Site visits to seven distribution centers described efficient, structured shopping experiences. In five of the seven centers, shopping was noted to take 15 minutes or less, with staff actively assisting participants in selecting items and ensuring compliance with food package rules. Some centers also provided additional services, such as carrying groceries to participants' cars or offering play areas for children.

Google reviews of WIC distribution centers in Mississippi provide another view of participant experiences.[32] On average, WIC distribution centers received a rating of 4.1 out

[31] Additional images: https://uconnmsobesity.weebly.com/jackson-medical-mall.html.

[32] We collected reviews of 84 of the 96 WIC distribution centers, supplemented with reviews from social

of 5.0 across 754 reviews, comparing favorably to other social service providers in Mississippi (Table A.13). Figure 6A presents a word cloud of text-based reviews, where "helpful," "friendly," "people," and "nice" appear most frequently. Sentiment analysis in Figure 6B and Table A.15 confirms that positive reviews dominate, with only 14.7% of reviews classified as negative.

Three reviews, written after the transition, explicitly compare distribution centers to retail WIC shopping:

> *I miss picking up my WIC [at distribution centers]. Grocery stores are not as easy. WIC is very limited on items at the stores.* (Melissa 2023)

> *The WIC benefits are difficult now, and the little 12 oz they pay for is always unavailable in every store I come to. I hate the program changed because it's no good.* (Tabb 2023)

> *I miss the location being open & the helpful lady that worked there. This location is now closed.* (Butler 2022)

Finally, we analyze American Time Use Survey (ATUS) data to measure changes in grocery shopping and using social services. If WIC shopping became more burdensome post-reform, we would expect an increase in time spent on these activities in Mississippi relative to comparison states.

The ATUS does not measure WIC participation, so we proxy for WIC-eligible households using income-eligible households with infants, who have high participation rates.[33] We pool data from 2015–2023 and expand the control group to include additional Southern states (Texas, Oklahoma, Kentucky) to increase statistical power.

service locations compiled by Li, Shang, and McAuley (2022). Most reviews were written before 2022 and appear to reflect participant experiences. Appendix Section A.3 details methodology and sample statistics.

[33] In 2019, 84% of eligible infants participated in WIC: https://www.fns.usda.gov/research/wic/eligibility-and-program-reach-estimates-2021. ATUS provides income ranges categories–we code households as income-eligible if the midpoint of their income range exceeds 200% of the FPL, which is the cut-off for infants on Medicaid, given that WIC is adjunct eligibility with Medicaid. A supplement to the ATUS - the Eating and Health Module - records WIC participation for a subsample of households, but there are very few participants in Mississippi (0 in some years), limiting its usefulness for our purposes.

Figure A.10 compares time spent on grocery shopping and social services pre- and post-reform for Mississippi and comparison states, with Table A.10 reporting difference-in-differences estimates. Mississippi WIC-eligible households show a 0.05 percentage point increase in grocery/social service participation and a 3.3-minute increase in time spent on these activities relative to control states, though the latter estimate is imprecise.[34] Reassuringly, these results do not appear in a high-income sample of households, as reported in Table A.10.

This collection of qualitative and quantitative evidence suggests that increased shopping burden likely contributed to the WIC participation decline. Distribution centers provided a structured, simplified, and supportive environment, while retail shopping likely increased cognitive and logistical burdens, as well as stigma.

7 Conclusion

This paper provides new evidence on how distribution mechanisms affect participation, targeting, and costs in a large federal nutrition program. We examine the transition of Mississippi's WIC program from a state-run distribution system to a retail-based model. Using a difference-in-differences approach that exploits the staggered rollout across county groups and never-treated neighboring states, we find that this shift significantly reduced participation, particularly among children. Examining the reform's targeting effects, we find that it discouraged take-up among individuals with lower benefit amounts but also among historically disadvantaged groups. We then document a substantial decrease in per-participant program costs, achieved entirely through the elimination of state-run warehouses, rather than changes in costs of administering the program or food benefits themselves.

The participation decline was unlikely to be driven by information frictions, adminis-

[34]It is unlike that this increase is due to compositional shifts in WIC participation. A back of the envelope calculation implies that even if all infants who exited WIC post-reform increased shopping time by one standard deviation (20 minutes), the implied effect would be at most one minute. The calculation is given as follows: 84% WIC participation rate × decrease in participation of 6.9% (Table 3) implies 5.9% of our sample exits WIC. If all of these increase shopping time by 20 minutes, then they would contribute 1.1 minutes to the average increase. Further, exiting WIC should reduce shopping complexity, potentially lowering shopping time.

trative hurdles, or travel burdens, as clinic procedures remained unchanged and shopping distances decreased on average. We hypothesize that shopping-related burdens——such as difficulty locating WIC-approved products, checkout errors, and stockouts——were key drivers of the decline. Qualitative evidence from online reviews and state reports provides support for this hypothesis, highlighting the structured and supportive nature of WIC distribution centers in contrast to the more complex and independent shopping experience at grocery stores. We also analyze data on time use, which suggests WIC participants in Mississippi spent more time after the reform, relative to their neighbors, in activities related to WIC participation.

These findings contribute to broader debates on the privatization of public service delivery and the role of transaction costs in shaping access to anti-poverty programs. While retail distribution reduced program costs and expanded the number of food sites, it also introduced new participation barriers and reduced access among disadvantaged groups. Our results highlight the importance of distribution systems as a core component of program design, with direct implications for participation, targeting, and cost-effectiveness.

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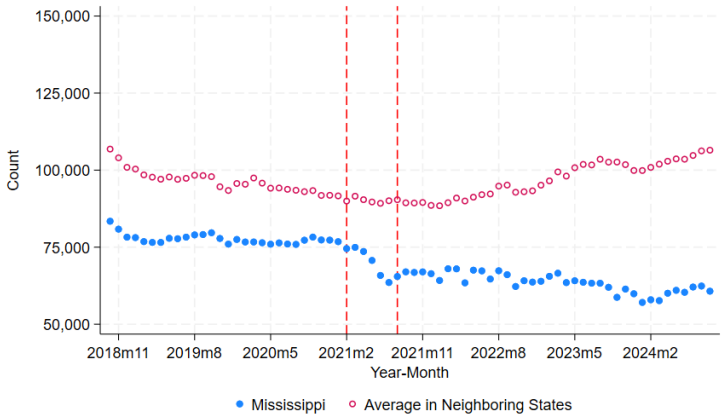
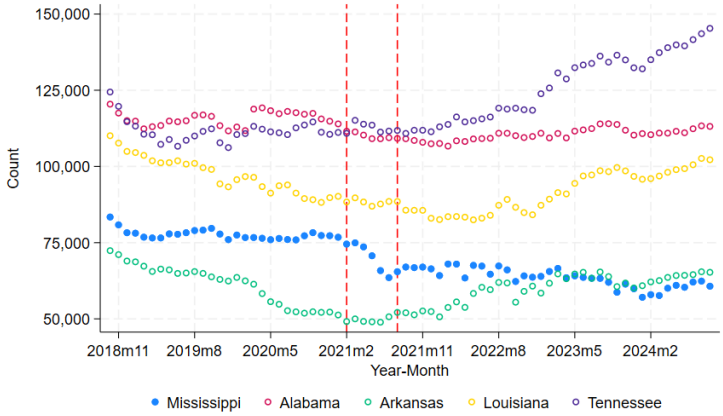
Figures

Figure 1: Time-Series Graphs for WIC Participation

(a) MS vs. Neighboring States



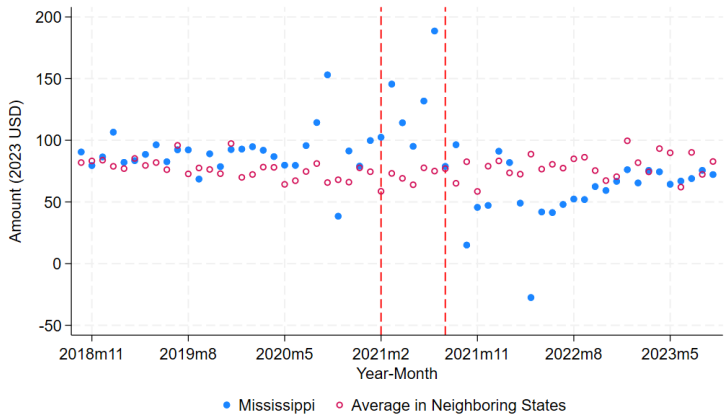
(b) By State



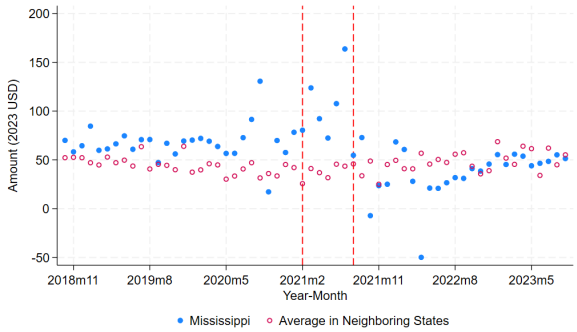
Notes: Figure 1 displays time series graphs of WIC participation in Mississippi (MS) and its four neighboring states (i.e., Alabama, Arkansas, Louisiana, and Tennessee). The data are from the USDA, covering the period from October 2018 to September 2024. The numbers on the x-axis correspond to calendar years and months. In both figures, the blue dots represent the number of participants in Mississippi. In Figure 1A, the red dots represent the average number of participants in the four neighboring states. In Figure 1B, the dots in different colors represent the number of participants in each of the four neighboring states, respectively. The two vertical red dashed lines in each figure indicate February 2021 and August 2021, denoting the rollout period for the transition from direct distribution to retail distribution.

Figure 2: Time-Series Graphs for WIC Program Costs

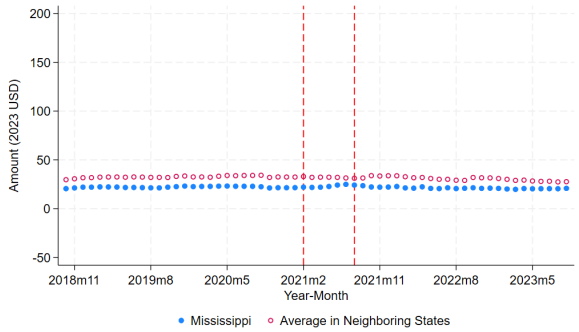
(a) WIC Program Costs (per participant)



(b) WIC Program Costs by Category (per participant)



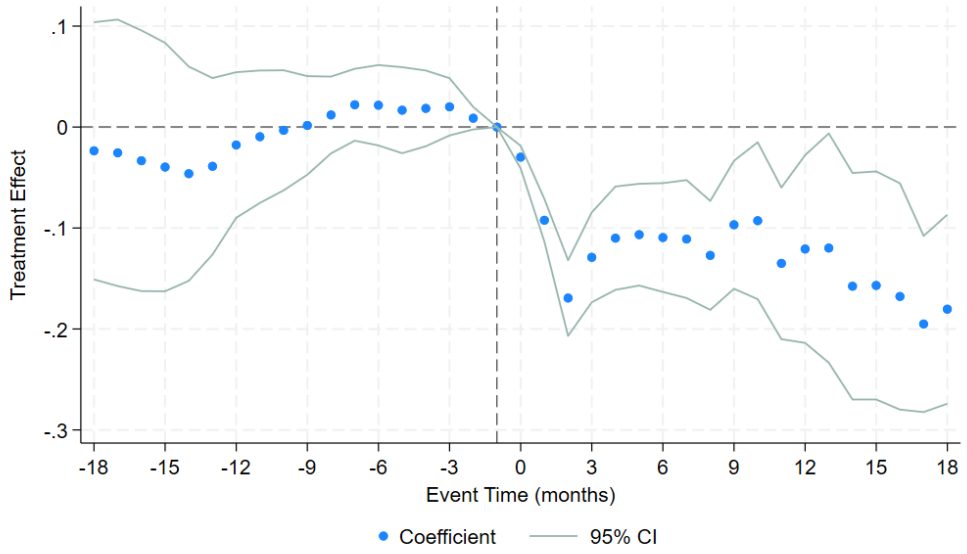
(b)-1. Food Procurement and Distribution (73%)



(b)-2. Clinic Operations (27%)

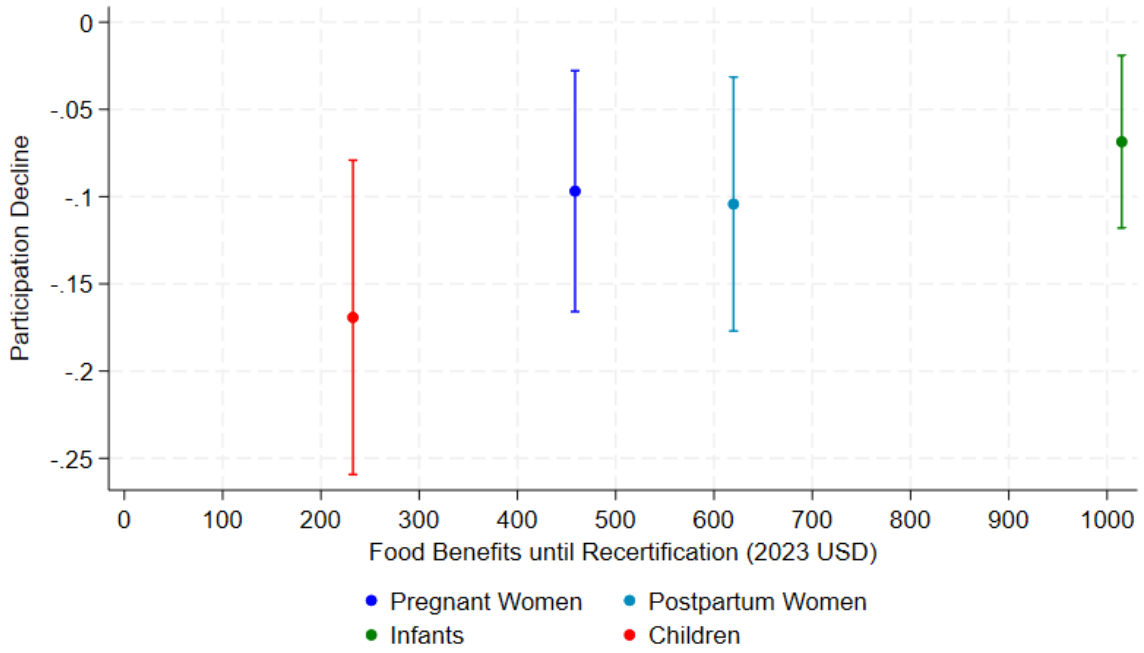
Notes: Figure 2 displays time series graphs of WIC program costs (in 2023 dollars) in Mississippi and its four neighboring states (i.e., Alabama, Arkansas, Louisiana, and Tennessee). Figure 2A shows the trend for per-participant total WIC program costs. Figure 2B shows the trend for per-participant WIC program costs by category: costs for food procurement and distribution (i.e., Food Costs) and clinic operations (i.e., Nutrition Services and Administration, or NSA, Costs). The data are from the USDA, covering the period from October 2018 to September 2023. The numbers on the x-axis correspond to calendar years and months. In all figures, the blue dots represent the average costs per participant in Mississippi, while the red dots represent the average costs per participant in four neighboring states. The two vertical red dashed lines in each figure indicate February 2021 and August 2021, denoting the rollout period for the transition from direct distribution to retail distribution.

Figure 3: Effects of Transition to Retail Distribution on WIC Participation



Notes: Figure 3 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi (MS) on WIC participation using the event study framework of the DCDH estimator based on Eq. 1. The outcome is an inverse hyperbolic sine of total WIC participants. The data are from Freedom of Information Act (FOIA) requests for MS and the USDA for the four neighboring states, covering the period from January 2019 to September 2024. The numbers on the x-axis correspond to months past the transition of the distribution system (negative numbers for pre-intervention placebo effects). Standard errors are clustered at the county (for MS) and state level (for neighboring states). The 95% confidence intervals are shown in light green lines. State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

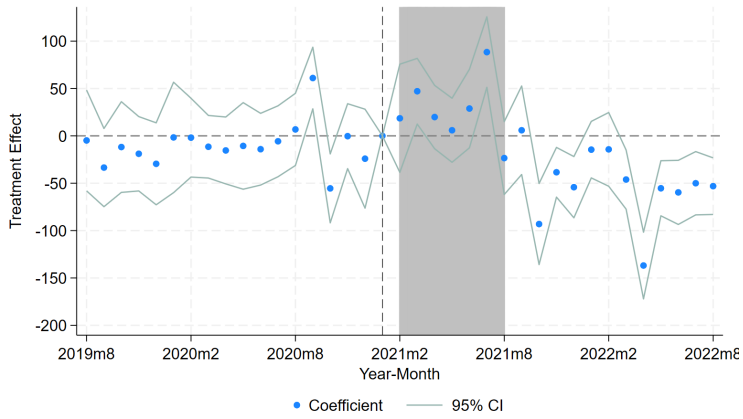
Figure 4: Relation between the Decline in Participation and Average Food Package Cost



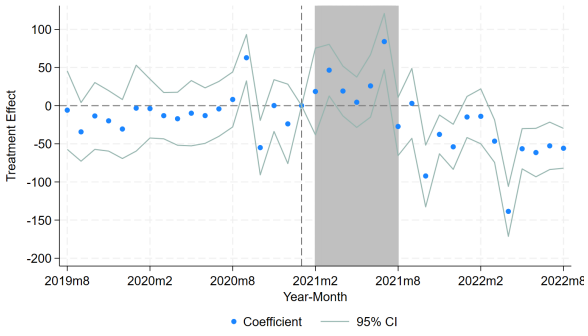
Notes: Figure 4 presents the relation between the impact of the transition from direct distribution to retail distribution in Mississippi on average food package costs (in 2023 dollars) and WIC participation by participant type. The x-axis shows a per-participant WIC pre-rebate food cost in FY 2018 by participant type, which is adjusted for inflation to 2023 dollars. The food cost is calculated as the sum of benefits until the participant's next recertification appointment. The y-axis shows the magnitude of the decline in participation by type using the DCDH estimator based on Eq. 1. The outcome is an inverse hyperbolic sine of WIC participants by type. The data are from Freedom of Information Act (FOIA) requests for MS and the USDA for the four neighboring states, covering the period from January 2019 to September 2024. Standard errors are clustered at the state level. The 95% confidence intervals are shown as vertical lines. State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Figure 5: Effects of Transition to Retail Distribution on WIC Program Costs

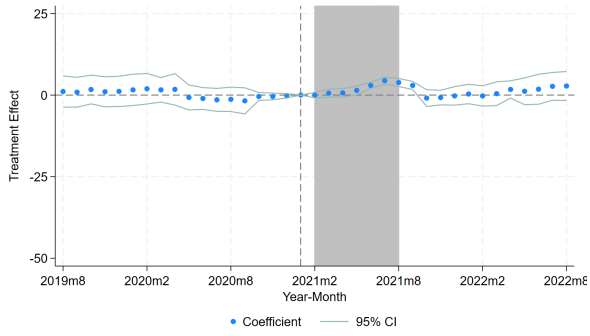
(a) WIC Program Costs (per participant)



(b) WIC Program Costs by Category (per participant)



(b)-1. Food Procurement and Distribution (73%)



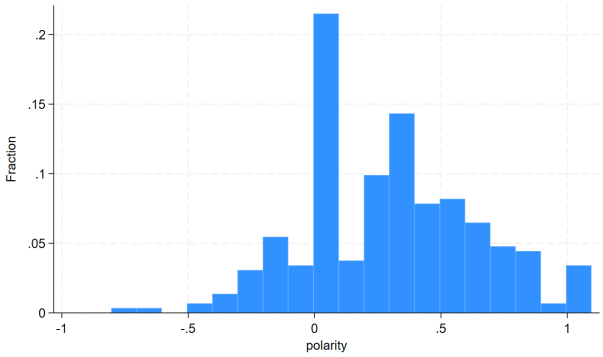
(b)-2. Clinic Operations (27%)

Notes: Figure 5 presents the estimation results of the impact of the transition from direct distribution to retail distribution in Mississippi on WIC program costs (in 2023 dollars), using the event study framework of the DCDH estimator based on Eq. 2. Figure 5A shows the results for per-participant total WIC program costs. Figure 5B shows the results for per-participant WIC program costs by USDA category: costs for food procurement and distribution (i.e., Food Costs) and clinic operations (i.e., Nutrition Services and Administration, or NSA, Costs). The data are from the USDA, covering the period from October 2018 to September 2023. The numbers on the x-axis correspond to calendar years and months. The gray shade in each figure covers February 2021 to July 2021, denoting the rollout period for the transition from direct distribution to retail distribution. Standard errors are clustered at the state-date level. The 95% confidence intervals are shown in light green lines. State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Figure 6: Google Reviews of WIC Distribution Centers

(a) Word Cloud

(b) Polarity Score from Sentiment Analysis



Notes: Figure 6 presents analyses of user-generated ratings and written feedback from Google reviews of WIC distribution centers in Mississippi. The dataset includes reviews for 84 of 96 total centers, all of which had at least one review as of June 3, 2024. Of 754 total reviews, 293 contain text, while 461 are numeric star ratings on a 1-to-5 scale. Additional details on data collection are in Appendix Section A.3. Figure 6A shows a word cloud of the 293 text-based reviews, with word size reflecting relative frequency. Common function words—including pronouns, articles, prepositions, conjunctions, and auxiliary verbs—are removed for clarity. Figure 6B presents the distribution of polarity scores from sentiment analysis using TextBlob, a Python-based natural language processing tool. Scores range from -1 to 1, where positive values indicate positive sentiment, negative values indicate negative sentiment, and zero indicates a neutral statement.

Tables

Table 1: Descriptive Statistics: Birth Certificate

	(1) All	(2) Mississippi
A. Demographics of WIC Births		
Age	27.126	25.638
White	0.671	0.386
Black	0.242	0.588
Other Race	0.055	0.017
No High School Diploma	0.215	0.163
High School Diploma	0.406	0.401
Some College or Above	0.366	0.435
Married	0.291	0.246
Observations	5,883,740	77,923
B. WIC Participation, All Births		
WIC	0.324	0.439
Observations	18,344,746	177,793

Notes: Table 1 displays average characteristics for all births from the restricted-use birth certificate data, covering the period from 2018 to 2022. Averages are shown separately for two groups: all births (column 1) and births in Mississippi (column 2). In Panel B, WIC participation is defined as having received WIC foods at least once during pregnancy.

Table 2: Effects of Transition to Retail Distribution on WIC Participation by Method

	DCDH	TWFE		DiD	
	(1)	(2)	(3)	(4)	(5)
Post	-0.127***	-0.121***		-0.139***	
	(0.033)	(0.031)		(0.023)	
During Rollout			-0.110***		-0.013
			(0.025)		(0.029)
After Rollout			-0.135***		-0.178***
			(0.042)		(0.022)
Geographic Unit	county	county		state	
Pre-Period Mean (MS)	964.059	964.059		77,664.5	
Observations	5,788	5,788		360	

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table 2 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi (MS) on WIC participation using different econometric techniques. The outcomes are the inverse hyperbolic sine of the number of participants. Column (1) shows the DiD estimate using the DCDH estimator based on Eq. 1. Columns (2) and (3) show the DiD estimate using the TWFE estimator based on Eq. 1. Columns (4) and (5) show the DiD estimate using the DiD estimator based on Eq. 2. Columns (3) and (5) show the DiD estimates, separately for the rollout period and the post-rollout period. The data are from the Freedom of Information Act (FOIA) requests for MS (columns 1-3), covering the period from January 2019 to September 2024, and the USDA for the four neighboring states (also for MS in columns 4-5), covering the period from October 2018 to September 2024. Standard errors are clustered at the county (for MS) or state level (for neighboring states). State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Table 3: Effects of Transition to Retail Distribution on WIC Participation by Type

				Type of Women Participants		
	(1)	(2)	(3)	(4)	(5)	(6)
Type	Women	Infants	Children	Pregnant	Breastfeeding	Postpartum
Post	-0.102***	-0.069***	-0.169***	-0.097***	-0.098**	-0.104***
	(0.026)	(0.025)	(0.046)	(0.035)	(0.040)	(0.037)
Pre-Period Mean (per MS county)	212.651	279.444	464.001	79.496	38.094	95.062
Observations	5,788	5,788	5,788	5,788	5,788	5,788

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table 3 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi (MS) on WIC participation by type, using the DCDH estimator based on Eq. 1. The outcomes are the inverse hyperbolic sine of the number of participants. Each column reports the DiD estimates for each type of WIC participant. The data are from the Freedom of Information Act (FOIA) requests for MS and the USDA for the four neighboring states, covering the period from January 2019 to September 2024. Standard errors are clustered at the county (for MS) or state level (for neighboring states). State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Table 4: Effects of the Transition to Retail Distribution on WIC Participation by Poverty

		Poverty Share	
	(1)	(2)	(3)
	Total	Above Median	Below Median
Post	-0.127***	-0.174***	-0.080**
	(0.033)	(0.041)	(0.034)
Pre-Period Mean (MS)	964.059	756.347	1171.772
Observations	5,788	3,028	3,036

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table 4 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi (MS) on WIC participation by poverty level, using the DCDH estimator based on Eq. 1. The outcomes are the inverse hyperbolic sine of the number of participants. Column (1) shows the DiD estimate from our preferred specification, reported in column 1 of Table 2. Columns (2) and (3) show the DiD estimates for different subsamples on poverty share: MS counties where the share of households below the poverty line is above the median (column 2) and below the median (column 3). The data are from the Freedom of Information Act (FOIA) requests for MS and the USDA for the four neighboring states, covering the period from January 2019 to September 2024. Standard errors are clustered at the county (for MS) or state level (for neighboring states). State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Table 5: Effects of Transition to Retail Distribution on WIC Program Costs

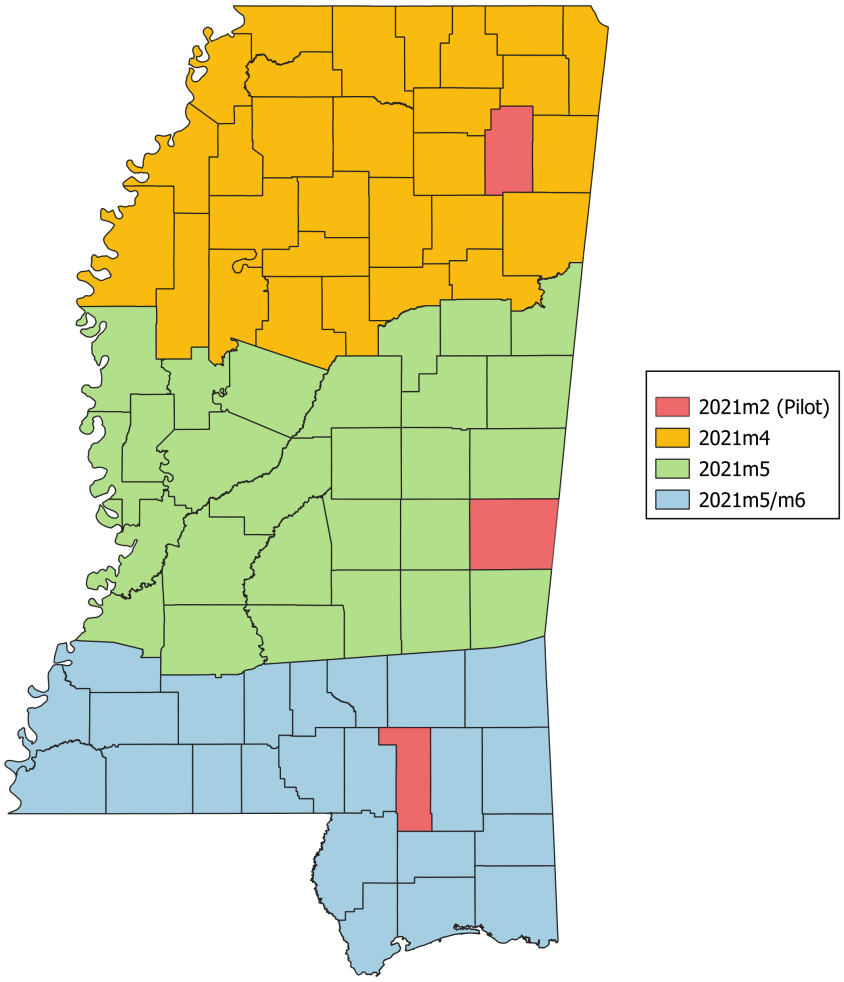
	Category of Program Costs					
	Total		Food Procurement and Distribution (73%)		Clinic Operations (27%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Post	-5.810		-6.878		1.069**	
	(9.578)		(9.499)		(0.485)	
During Rollout		47.019***		45.877***		1.142
		(11.094)		(10.725)		(0.810)
After Rollout		-28.929***		-29.966***		1.037*
		(7.772)		(7.704)		(0.540)
Pre-Period Mean (MS)	89.536		67.424		22.112	
Observations	300		300		300	

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table 5 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi on WIC program costs (in 2023 dollars) using the DCDH estimator based on Eq. 2. Columns (1) and (2) shows the DiD estimate on per-participant total WIC program costs. Columns (3)-(6) show the estimation results for per-participant WIC program costs by category: costs for food procurement and distribution (i.e., Food Costs) (columns 3 and 4) and clinic operations (i.e., Nutrition Services and Administration, or NSA, Costs) (columns 5 and 6). Columns (2), (4), and (6) show the DiD estimates, separately for the rollout period and the post-rollout period. The data are from the USDA, covering the period from October 2018 to September 2023. Standard errors are clustered at the state-date level. State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Appendix

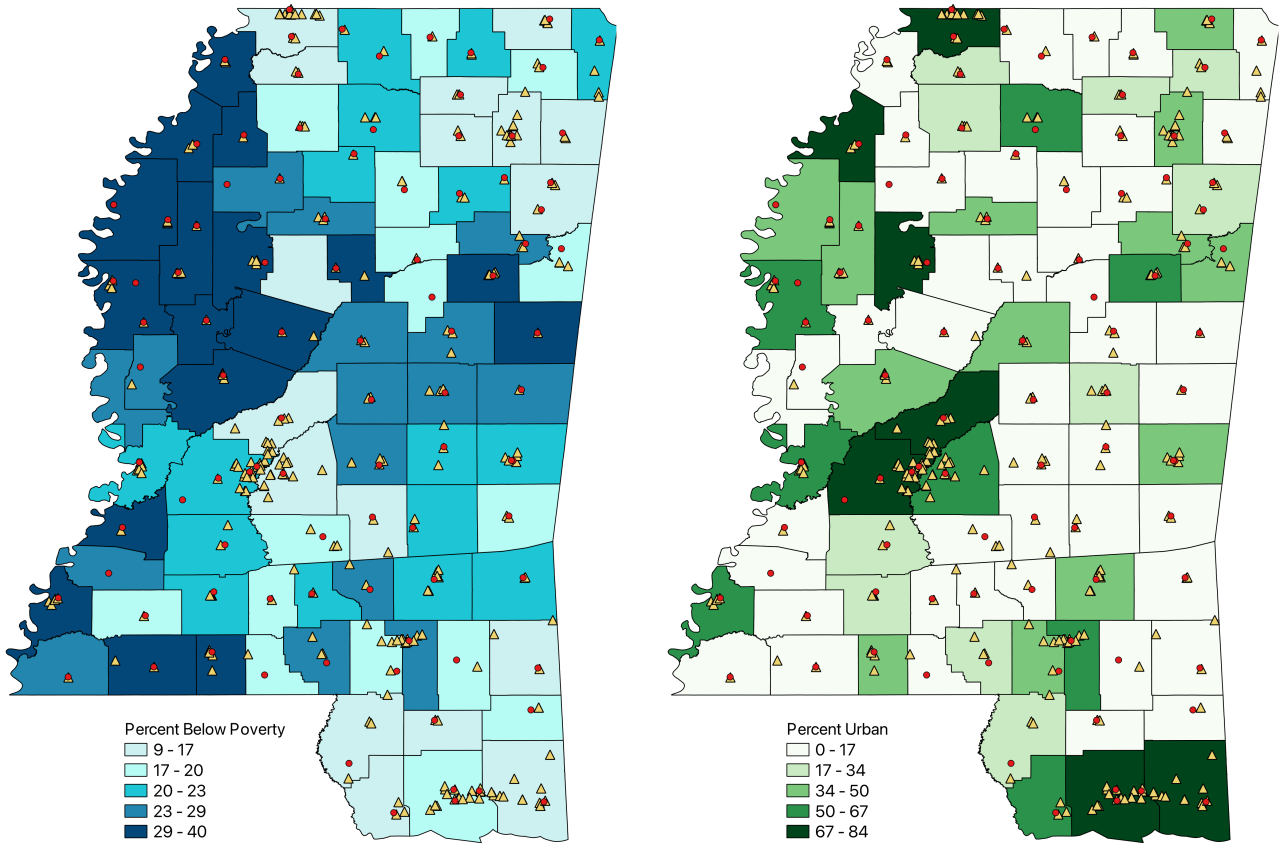
Figure A.1: Rollout Map of Transition to Retail Distribution



Notes: Figure A.1 displays a map of Mississippi, illustrating the timing of the transition of WIC distribution system to retail distribution from direct distribution. Each color represents a group of counties based on the month when each county began issuing EBT cards to a third of WIC participants over a three-month period, following the rollout schedule in Table A.3: Wave 1 (Feb 2021), Wave 2 (Apr 2021), Wave 3 (May 2021), and Wave 4 (May/Jun 2021).

Source: MSDH Vendor management transition plan provided by Food and Nutrition Service.

Figure A.2: Locations of WIC Distribution Centers and Grocery Stores

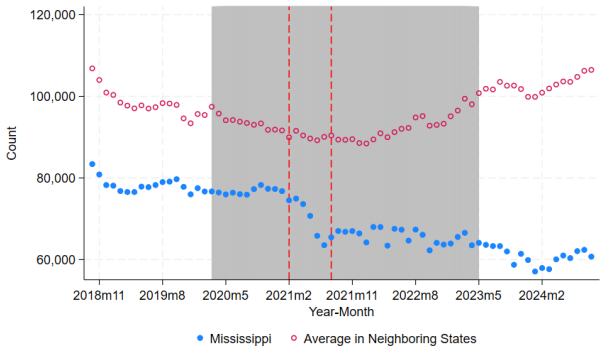


(a) (b)

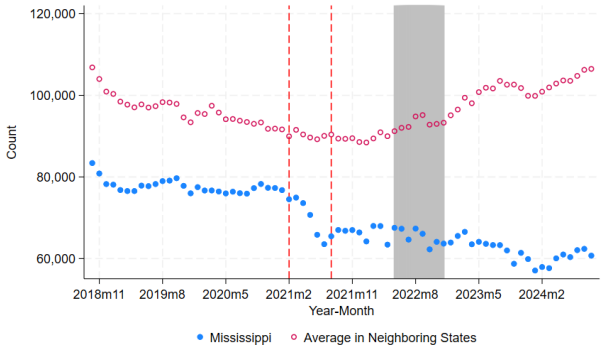
Notes: Figure A.2 displays the geographical distribution of WIC warehouses (red circles) that were active in fiscal year (FY) 2020 and WIC-authorized vendors (yellow triangles) active in FY 2022, illustrating the transition to retail distribution. Map (Figure A.2A) overlays county-level poverty rates (shown in blue shading), while map (Figure A.2B) shows the percentage of urban households by county (shown in green shading). We use the coordinates of WIC distribution centers and WIC-authorized stores from the Freedom of Information Act (FOIA) requests.

Figure A.3: Time-Series Graphs for WIC Participation with Confounders

(a) COVID-19 Pandemic



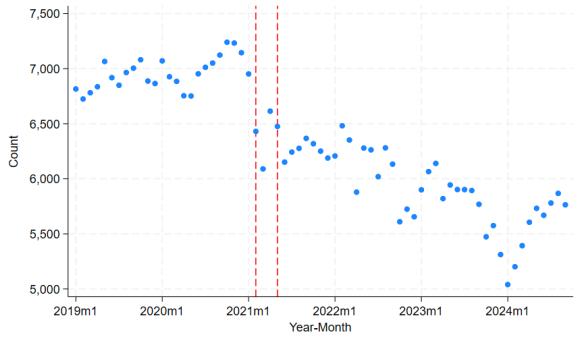
(b) Infant Formula Shortage



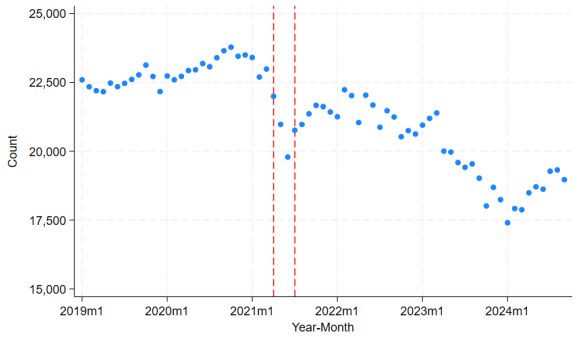
Notes: Figure A.3 displays time series graphs of WIC participation in Mississippi and its four neighboring states (i.e., Alabama, Arkansas, Louisiana, and Tennessee), accounting for potential confounders: COVID-19 and the infant formula shortage. Each figure shows the trend for WIC participants with specific elements: the gray-shaded period representing the COVID-19 pandemic from March 2020 to May 2023 (Figure A.3A) and the formula shortage beginning in May 2022 (Figure A.3B). The data are from the USDA, covering the period from October 2018 to September 2024. The numbers on the x-axis correspond to calendar years and months. In all figures, the blue dots represent the number of participants in Mississippi, while the red dots represent the average number of participants in the four neighboring states. The two vertical red dashed lines in each figure indicate February 2021 and August 2021, denoting the rollout period for the transition from direct distribution to retail distribution.

Figure A.4: Time-Series Graphs for WIC Participation by Timing of Transition

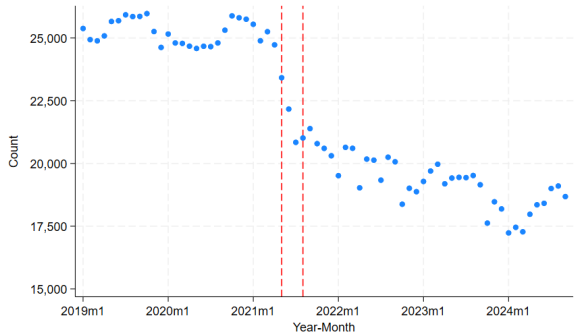
(a) Wave 1 (Feb 2021)



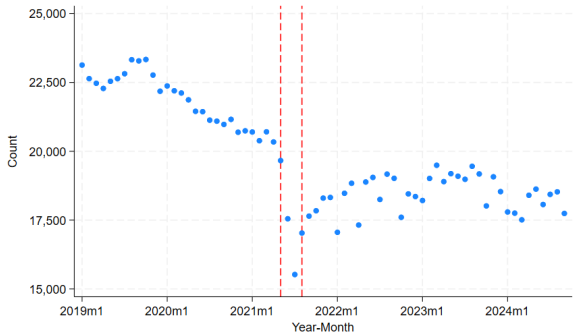
(b) Wave 2 (Apr 2021)



(c) Wave 3 (May 2021)



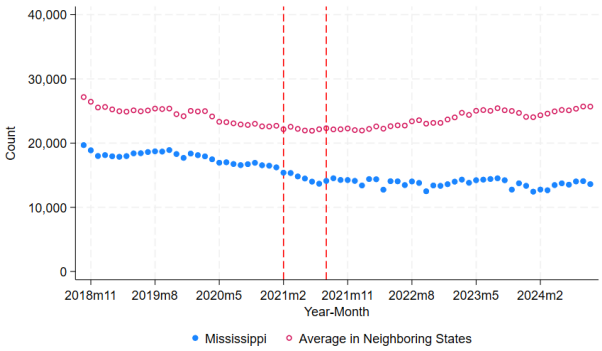
(d) Wave 4 (May/Jun 2021)



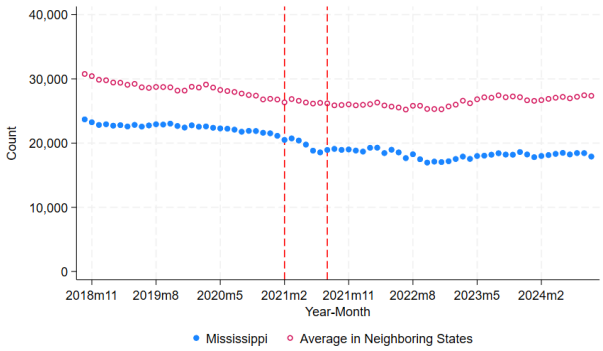
Notes: Figure A.4 displays time series graphs of WIC participation in Mississippi. Each figure shows the trend for total WIC participants in the counties for each wave, according to the rollout schedule in Table A.3: Wave 1 (Feb 2021), Wave 2 (Apr 2021), Wave 3 (May 2021), and Wave 4 (May/Jun 2021). The data are from the Freedom of Information Act (FOIA) requests, covering the period from January 2019 to September 2024. The numbers on the x-axis correspond to calendar years and months. The two vertical red dashed lines in each figure denote the three-month rollout period for the transition from direct distribution to retail distribution for each wave.

Figure A.5: Time-Series Graphs for WIC Participation by Type

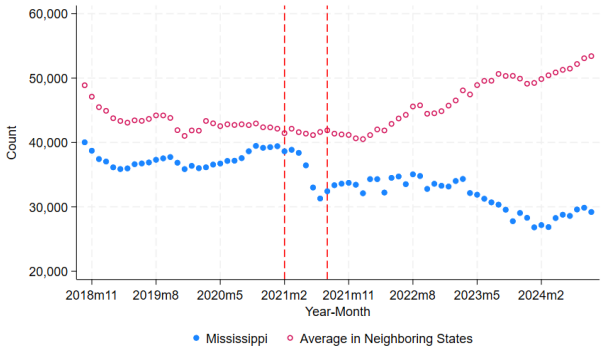
(a) Women (22%)



(b) Infants (29%)



(c) Children (49%)



Notes: Figure A.5 displays time series graphs of WIC participation in Mississippi and its four neighboring states (i.e., Alabama, Arkansas, Louisiana, and Tennessee). Each figure shows the trend for each type of WIC participants: Women (Figure A.5A), Infants (Figure A.5B), and Children (Figure A.5C). The data are from the USDA, covering the period from October 2018 to September 2024. The numbers on the x-axis correspond to calendar years and months. In all figures, the blue dots represent the number of participants in Mississippi, while the red dots represent the average number of participants in the four neighboring states. The two vertical red dashed lines in each figure indicate February 2021 and August 2021, denoting the rollout period for the transition from direct distribution to retail distribution.

Figure A.6: Event Study Graphs for WIC Program Costs: Food Benefits

Notes: Figure A.6 presents the estimation results of the impact of the transition from direct distribution to retail distribution in Mississippi on the costs of per-participant WIC food benefit (in 2023 dollars), using the event study framework of the DiD estimator based on Eq. 2. The data are from direct distribution food contracts of Transparency Mississippi as described in Section 3.2. The numbers on the x-axis correspond to calendar years and months. The gray shade in each figure covers February 2021 to July 2021, denoting the rollout period for the transition from direct distribution to retail distribution. Standard errors are clustered at the state-date level. The 95% confidence intervals are shown in light green lines. State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Figure A.7: Impact of Retail Distribution on Participation Barriers in the WIC Program

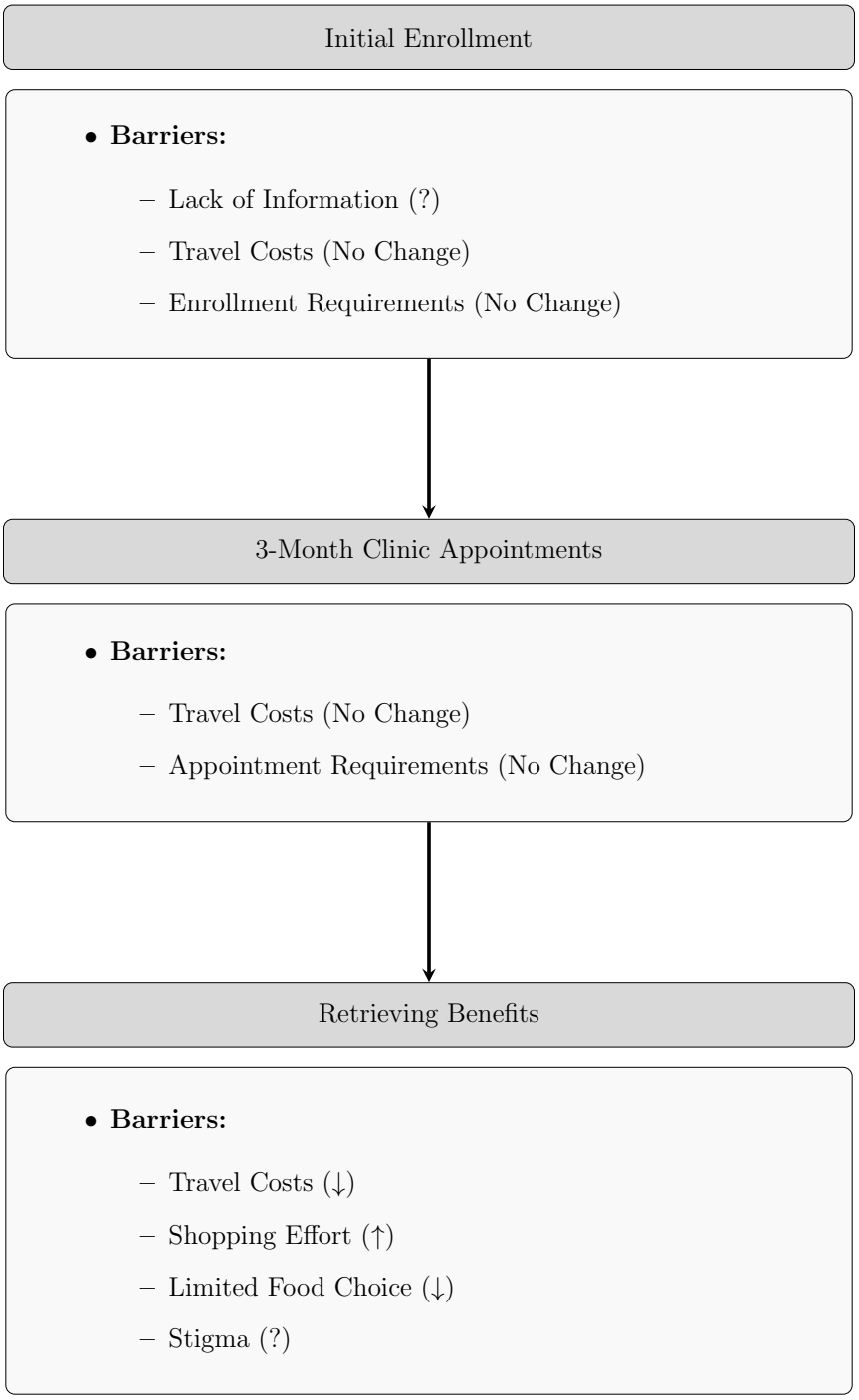


Figure A.8: MSDH WIC Cereal Redemption Rules

Notes: Figure A.8 illustrates the brands, flavors, and sizes of cereal combinations eligible for redemption through Mississippi WIC, as detailed on the Mississippi State Department of Health's website.

Source: https://msdh.ms.gov/page/resources/11709.pdf.

Figure A.9: Pictures of Jackson WIC Distribution Center

(a) Entryway

(b) Produce

(c) Cheese

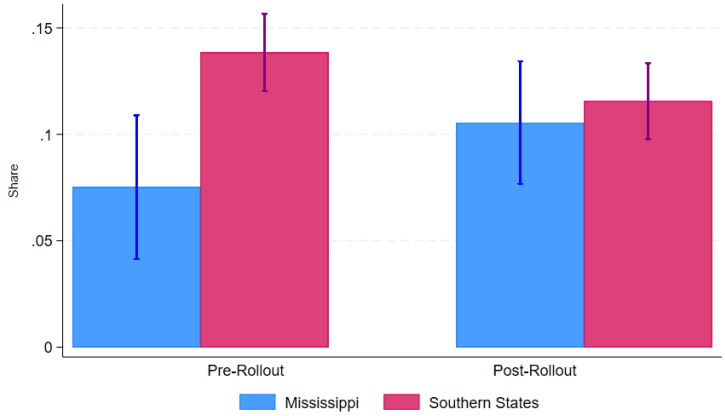
(d) Eggs, Rice, and Tortillas

Notes: Figure A.9 displays photos from the WIC Distribution Center in Jackson County, which was located in the Jackson Medical Mall.

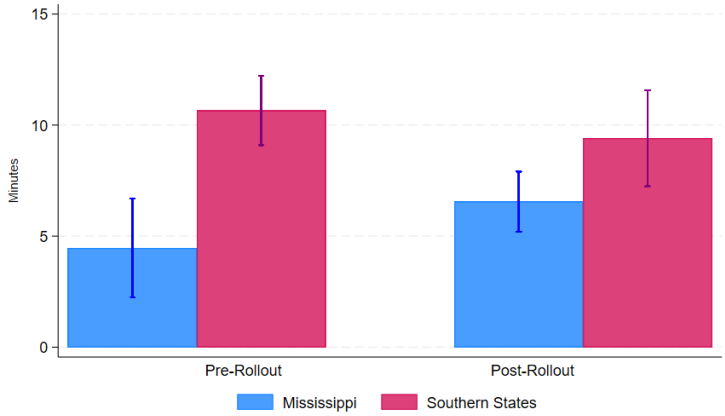
Source: https://uconnmsobesity.weebly.com/jackson-medical-mall.html.

Figure A.10: Time Spent Grocery Shopping or Using Social Services, WIC-Eligible Households with Infants

(a) Any Time Spent, Past 24 Hours



(b) Amount of Time Spent (in minutes), Past 24 Hours



Notes: Figure A.10 presents bar charts comparing time spent grocery shopping and using social services in the past 24 hours among WIC-eligible households with infants. The data source is the American Time Use Survey (ATUS), 2015–2023. WIC eligibility is proxied by restricting the sample to households with income below 200% of the Federal Poverty Level (FPL), with household income estimated by comparing the midpoints of ATUS income categories to the 200% FPL threshold, aligning with Medicaid adjunct eligibility and Mississippi's Medicaid cutoff for infants (199% FPL). A household is classified as having an infant if its youngest child is age 0. The time use measure includes time spent grocery shopping or using social services as well as associated waiting and travel time. Mississippi is compared to control states in the East South Central and West South Central Census regions (Alabama, Louisiana, Oklahoma, Texas, Arkansas, Kentucky, and Tennessee). ATUS statistical weights are applied, and standard errors are clustered at the state-year level. Vertical lines represent 95% confidence intervals.

Table A.1: Maximum Monthly Allowances in the WIC Food Packages - Children and Women

Type	**Children**	**Women**		
Foods	**Food Package IV** A: 12-23 months B: 2-4 years	**Food Package V** A: Pregnant B: Partially Breastfeeding (up to 1 year postpartum)	**Food Package VI** Postpartum (up to 6 months postpartum)	**Food Package VII** Fully Breastfeeding (up to 1 year postpartum)
Juice, single strength	64 fl. oz.	64 fl. oz.	64 fl. oz.	64 fl. oz.
Milk	A: 12 qt. B: 14 qt.	16 qt.	16 qt.	16 qt.
Breakfast cereal	36 oz.	36 oz.	36 oz.	36 oz.
Eggs	1 dozen	1 dozen	1 dozen	2 dozen
Fruits and vegetables (CVB)	$26	A: $47 B: $52	$47	$52
Whole wheat bread	24 oz.	48 oz.	48 oz.	48 oz.
Fish (canned)	6 oz.	A: 10 oz. B: 15 oz.	10 oz.	20 oz.
Legumes, dry or canned and/or	1 lb. dry/64 oz. canned	1 lb. dry/64 oz. canned	1 lb. dry/64 oz. canned	1 lb. dry/64 oz. canned
Peanut butter	18 oz.	18 oz.	18 oz.	18 oz.

Notes: Table A.1 displays the WIC food packages for women and children as of September 2024.

Source: https://www.fns.usda.gov/wic/food-packages/maximum-monthly-allowances.

Table A.2: Maximum Monthly Allowances in the WIC Food Packages - Infants

Type	**Fully Formula Fed**		**Partially Breastfed**		**Fully Breastfed**	
Food Packages	**I and III**	**II and III**	**I and III**	**II and III**	**I**	**II**
Foods	A: 0-3 months B: 4-5 months	6-11 months	A: 0-3 months B: 4-5 months	6-11 months	0-5 months	6-11 months
WIC Formula	A: Up to 806 fl. oz. B: Up to 884 fl. oz.	Up to 624 fl. oz.	A: Up to 364 fl. oz. B: Up to 442 fl. oz.	Up to 312 fl. oz.	N/A	N/A
Infant cereal	N/A	8 oz.	N/A	8 oz.	N/A	16 oz.
Baby food fruits and vegetables	N/A	128 oz.	N/A	128 oz.	N/A	128 oz.
Baby food meat	N/A	N/A	N/A	N/A	N/A	40 oz.

Notes: Table A.2 displays the WIC food packages for infants as of September 2024.

Source: https://www.fns.usda.gov/wic/food-packages/maximum-monthly-allowances.

Table A.3: Schedule of Transition to Retail Distribution in Mississippi

Rollout Start Date	County
Feb, 2021	Lee, Lauderdale, Forrest
Apr, 2021	De Soto, Marshall, Benton, Tippah, Alcorn, Tishomingo, Tunica, Tate, Coahoma, Quitman, Panola, Lafayette, Union, Prentiss, Pontotoc, Itawamba, Bolivar, Sunflower, Tallahatchie, Yalobusha, Calhoun, Chickasaw, Monroe, Leflore, Grenada, Carroll, Montgomery, Webster, Clay
May, 2021	Washington, Issaquena, Sharkey, Warren, Claiborne, Humphreys, Yazoo, Hinds, Copiah, Holmes, Madison, Rankin, Simpson, Attala, Leake, Scott, Smith, Choctaw, Oktibbeha, Lowndes, Winston, Noxubee, Neshoba, Newton, Jasper, Kemper, Clarke
May/Jun, 2021	Jefferson, Adams, Wilkinson, Franklin, Amite, Lincoln, Pike, Lawrence, Walthall, Jefferson Davis, Covington, Jones, Wayne, Marion, Lamar, Perry, Greene, Pearl River, Stone, George, Hancock, Harrison, Jackson

Notes: Table A.3 displays the schedule of transition of WIC distribution system to retail distribution from direct distribution in Mississippi. The table records the month in which each county began issuing EBT cards to a third of WIC participants each month over the three months period.

Source: MSDH Vendor management transition plan provided by Food and Nutrition Service.

Table A.4: Summary Statistics: WIC Stores

	FY 2021		FY 2022	
	(1)	(2)	(3)	(4)
Store Type	Frequency	Share (%)	Frequency	Share (%)
(i) Super Store/Chain Store	152	58.91	164	56.16
(ii) Supermarket	96	37.21	116	39.73
(iii) Large Grocery Store	7	2.71	8	2.74
(iv) Medium Grocery Store	0	0	1	0.34
(v) Combination Grocery/Other	2	0.78	2	0.68
(vi) Convenience Store	1	0.39	1	0.34
TOTAL	258	100	292	100

Notes: Table A.4 displays the number and share of WIC stores in Mississippi by store type, respectively in fiscal year (FY) 2021 and 2022. When assigning the store type, we follow the SNAP store type definitions of the USDA (https://www.fns.usda.gov/snap/store-definitions): (i) 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; (ii) 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; typically has ten or more checkout lanes with registers, bar code scanners, and conveyor belts; (iii) Large Grocery Store: A store that carries a wide selection of all four staple food categories, with food items as primary stock; (iv) Medium Grocery Store: A store that carries a moderate selection of all four staple food categories, with food items as primary stock; (v) Combination Grocery/Other: Primary business is sale of general merchandise but also sell a variety of food products (e.g., independent drug stores, dollar stores, and general stores); and (vi) 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.

Table A.5: Robustness Checks: Effects of Transition to Retail Distribution on WIC Participation

	County-Level DCDH				State-Level DiD
	(1) Baseline	(2) Formula Shortage	(3) No Controls	(4) EA	(5) Part. Count
Post	-0.127***	-0.108***	-0.129***	-0.125***	-10170.38***
	(0.033)	(0.024)	(0.034)	(0.035)	(1808.827)
CONTROLS					
Unemployment	YES	YES	NO	YES	YES
Medicaid Policies	YES	YES	NO	YES	YES
Expiration of EA	NO	NO	NO	YES	NO
Pre-Period Mean (MS)	964.059	964.059	964.059	964.059	77,664.5
Observations	5,788	3,360	5,788	5,788	360

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table A.5 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi (MS) on WIC participation with different controls, using the DCDH estimator based on Eq. 1 (columns 1-4) and the DiD estimator based on Eq. 2 (column 5). The outcomes are the inverse hyperbolic sine of the number of participants (columns 1-4) and participation counts (column 5). Column (1) shows the DiD estimate from our preferred specification, reported in column 1 of Table 2. Column (2) shows the DiD estimate using the data prior to the start of the infant formula shortage in May 2022. Columns (3) and (4) shows the DiD estimate with different state-level controls. The data are from the Freedom of Information Act (FOIA) requests for MS and the USDA for the four neighboring states (also for MS in column 5), covering the period from January 2019 to September 2024 (columns 1, 3, and 4), from January 2019 to April 2022 (columns 2), and from October 2018 to September 2024 (column 5). Standard errors are clustered at the county (for MS) or state level (for neighboring states) (columns 1-4) and state-date level (column 5). State-level controls include unemployment rates, Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period), and expiration of Emergency Allotments (EA) in SNAP.

Table A.6: Effects of the Transition to Retail Distribution on WIC Participation by Maternal Characteristics

		Maternal Characteristic			
	(1) Total	(2) Hispanic	(3) Black	(4) Low-Educated	(5) Unmarried
Post	-0.025**	-0.024	-0.041**	-0.026	-0.036**
	(0.010)	(0.044)	(0.019)	(0.016)	(0.016)
Pre-Period Mean (MS)	0.449	0.404	0.610	0.596	0.620
Observations	1,333,766	126,268	390,898	591,367	645,201

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table A.6 presents the estimation results of the impact of the transition to retail distribution from direct distribution in Mississippi on WIC participation rate by maternal characteristics, using the DCDH estimator based on Eq. 3. The outcome is whether the mother has ever received WIC foods during her pregnancy. Column (1) shows the DiD estimate for the entire sample of births. Columns (2)-(5) show the DiD estimates for different subsamples based on maternal characteristics. Low-Educated is defined as having high school diploma or less (column 4). The data are from the restricted-use birth certificate data, covering the period from 2018 to 2022. Standard errors are clustered at the county level. Individual level controls include age (5 groups - Age <20, Age 20-24, Age 25-29, Age 30-34, Age 35+), race (3 groups - white, black, others), marital status (2 groups - married or not), and educational attainment (3 groups - no high school diploma, high school diploma, some college or above). State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Table A.7: Effects of Transition to Retail Distribution on WIC Program Costs: Food Benefits

	(1)	(2)
Post	21.706***	
	(8.207)	
During Rollout		85.491***
		(11.342)
After Rollout		1.302
		(5.647)
Pre-Period Mean (MS)	45.535	
Observations	355	

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table A.7 presents the estimation results of the impact of the transition from direct distribution to retail distribution in Mississippi on the costs of per-participant WIC food benefit (in 2023 dollars), using the DiD estimator based on Eq. 2. Column (1) shows the DiD estimate on per-participant WIC food benefit costs. Column (2) shows the DiD estimates, separately for the rollout period and the post-rollout period. The data are from direct distribution food contracts of Transparency Mississippi as described in Section 3.2. Standard errors are clustered at the state-date level. State-level controls include unemployment rates and Medicaid policies (i.e., postpartum coverage extensions, work requirements, and expansion of eligibility for immigrants within the five-year waiting period).

Table A.8: Change in Distance to Nearest WIC Food Site Following Retail Distribution

	(1)	(2)	(3)	(4)	(5)	(6)
Year = 2022	-1.5428***	-2.2930***	-1.7524***	-3.0295***	-1.3319***	-1.7318***
	(0.1192)	(0.1899)	(0.1118)	(0.2137)	(0.2109)	(0.2843)
Year = 2022 × High Pov.		0.9262***		1.5274***		0.5103
		(0.2358)		(0.2470)		(0.3835)
Observations	4,512	4,512	2,058	2,058	2,454	2,454
Dep. Var. Mean (in 2020)	5.27	5.27	2.94	2.94	7.61	7.61
Sample	All	All	Urban	Urban	Rural	Rural

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table A.8 presents estimates of changes in distance to WIC food sites for low-income households, where food sites are defined as distribution centers in 2020 and WIC stores in 2022. The outcome variable is the distance (in miles) from the population-weighted block group centroid to the nearest WIC food site. A negative coefficient indicates that WIC stores were, on average, closer than distribution centers. To estimate these coefficients, we construct a dataset with two observations for each block group in Mississippi–one for 2020 and one for 2022. We then calculate the distance in miles from the block group population centroid to the nearest warehouse (2020) or WIC store (2022), denoted as $Distance_{bt}$ for block group b and year t. We estimate the regression model $Distance_{bt} = \alpha + \beta\, Year2022_t + \Gamma_b + \epsilon_{bt}$, where $Year2022_t$ is an indicator for 2022, Γ_b represents block group fixed effects, and standard errors are clustered at the block group level. Odd-numbered columns report estimates for β. Even-numbered columns estimate an extended model: $Distance_{bt} = \alpha + \beta\, Year2022_t + \delta(Year2022_t \times High\ Pov_b) + \Gamma_b + \epsilon_{bt}$, where $High\ Pov_b$ is an indicator for block groups with a household poverty rate above the median for Mississippi (0.16). Block groups are classified as urban or rural based on the majority of housing units: an urban block group has more than 50% of its housing units classified as urban, while a rural block group has less than 50% classified as urban. All regressions are weighted by the number of households per block group with income below the poverty level. Data on household poverty and urban classification at the block group level are from the 2020 Census.

Table A.9: Change in Within-Zip Access to WIC Food Sites Following Retail Distribution

	(1)	(2)
Year = 2022	0.3086***	0.4190***
	(0.0617)	(0.0936)
Year = 2022 × High Pov		-0.2199*
		(0.1181)
Observations	832	832
Dep. Var. Mean (in 2020)	0.45	0.45
Sample	All	All

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table A.9 presents estimates of changes in within-zip access to food distribution sites, defined as distribution centers in 2020 and WIC stores in 2022. we construct a dataset with two observations per zip code in Mississippi–one for 2020 and one for 2022. We define an indicator $Access_{zt}$ for whether a WIC distribution site exists in zip code z in year t. Column (1) estimates the regression model $Access_{zt} = \delta + \upsilon\, Year2022_t + \Psi_z + \epsilon_{zt}$, where $Year2022_t$ is an indicator for 2022, Ψ_z represents zip code fixed effects, and standard errors are clustered at the zip code level. Column (2) estimates an extended model: $Access_{zt} = \delta + \upsilon\, Year2022_t + \rho(\, Year2022_t \times High\ Pov_z) + \Psi_z + \epsilon_{zt}$, where $High\ Pov_z$ is an indicator for zip codes with a household poverty rate above the median for Mississippi (0.19). All regressions are weighted by the number of individuals per zip code with income below the poverty level. Data on household poverty per zip code are from the 2015-2019 American Community Survey 5-Year Estimates.

Table A.10: Analysis of Time Spent on Grocery Shopping and Social Services

	Any Time Spent, Past 24 Hrs.			Amount of Time Spent (in minutes), Past 24 Hrs.		
	WIC Eligible		High Income	WIC Eligible		High Income
	(1)	(2)	(3)	(4)	(5)	(6)
Post × MS	0.053**	0.046	-0.069	3.328*	2.114	-8.392
	(0.026)	(0.032)	(0.065)	(1.901)	(2.823)	(7.996)
Post	-0.023*	-0.015	-0.013	-1.241	-0.026	-0.834
	(0.013)	(0.023)	(0.009)	(1.363)	(2.489)	(0.777)
MS	-0.063***	-0.053**	0.007	-6.185***	-5.855***	5.266
	(0.020)	(0.023)	(0.055)	(1.386)	(1.627)	(7.393)
Control States	Southern	Neighbors	Southern	Southern	Neighbors	Southern
Pre-Period Mean (MS)	0.075	0.075	0.144	4.465	4.465	14.683
Observations	3,531	1,722	3,887	3,531	1,722	3,887

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Notes: Table A.10 presents estimates from an analysis of time spent grocery shopping and using social services in the past 24 hours. The data source is the American Time Use Survey (ATUS), 2015–2023. WIC eligibility is proxied by restricting the sample to households with income below 200% of the Federal Poverty Level (FPL), with household income estimated by comparing the midpoints of ATUS income categories to the 200% FPL threshold, aligning with Medicaid adjunct eligibility and Mississippi's Medicaid cutoff for infants (199% FPL). We define high income households as those with a midpoint-income above 500% of the FPL. A household is classified as having an infant if its youngest child is age 0. The time use measure, Y_{ist}, includes time spent grocery shopping or using social services as well as associated waiting and travel time. We estimate the differences-in-differences model implied by the analysis shown in Figure A.10, which is given as follows: $Y_{ist} = \alpha + \beta Post_t \times MS_s + \gamma Post_t + \rho MS_s + \epsilon_{ist}$, where $Post_t$ indicates the year is 2021 or later, and MS_s is an indicator for Mississippi. The control group of states is either the Census Southern Region (Alabama, Louisiana, Oklahoma, Texas, Arkansas, Kentucky, and Tennessee) or the subset of neighboring states (Alabama, Louisiana, Arkansas, and Tennessee). ATUS statistical weights are applied, and standard errors ϵ_{it} are clustered at the state-year level.

A.1 Birth Certificates

We use restricted-use Vital Statistics Natality data from 2018 to 2022, which covers the universe of U.S. births and provides detailed information on birth outcomes (e.g., gestation weeks and birth weight), maternal characteristics (e.g., county and state of residence, and demographics), and whether the mother received WIC foods during pregnancy.

To assign treatment timing, we define the start of the second trimester (14 weeks from conception), as the majority of pregnant women join WIC by this time (USDA 2020). Using reported birth dates and gestation weeks, we calculate each mother's estimated conception date and add 14 weeks. We restrict the sample to births between July 2017 and June 2022 to ensure a balanced panel around the timing of treatment.

Our empirical approach follows the difference-in-differences framework used in previous analyses. Specifically, we estimate the following specification for individual birth outcomes Y_{ict} in county c and year-month t of the start of the second trimester:

$$Y_{ict} = \alpha + \beta Post_{ct} + \gamma X_i + \delta_c + \mu_t + \epsilon_{ict} \tag{3}$$

where $Post_{ct}$ is an indicator for whether WIC recipients in county c are receiving EBT benefits in year-month t. X_i includes individual controls: maternal age (five groups: <20, 20–24, 25–29, 30–34, 35+), race (White, Black, Other), marital status (married or not), and educational attainment (no high school diploma, high school diploma, some college or higher). δ_c and μ_t are county and date fixed effects, and ϵ_{ict} is the error term, clustered at the county level.

A.2 3-Month Travel Distance Calculations

We estimate the travel burden associated with WIC participation by modeling the total travel distance for grocery shopping and WIC-related trips among WIC and non-WIC participants living in the same areas over a three-month period. We focus on three months because WIC participants in Mississippi are required to attend clinic appointments at this interval. Table A.11 outlines the framework used to model travel distance under both direct and retail distribution. Using this framework, we estimate the change in WIC-associated travel burden following the transition to retail distribution.

The unit of analysis is the Census tract, with household locations (WIC and non-WIC) proxied by tract centroids. For simplicity, we assume all households make one routine grocery shopping trip per month. Unlike non-WIC participants, WIC participants must visit a clinic every three months to receive benefits and nutrition education. Additionally, they must collect WIC foods either from state-run distribution centers (direct distribution) or from authorized grocery stores (retail distribution). Our framework accounts for two ways in which WIC participants may consolidate these trips:

- **Joint Clinic-Food Pickups**: For one of the three required WIC food pickups over a three-month period, participants may combine their clinic visit with a trip to a WIC food site (distribution center or WIC store), rather than making a separate trip from home. In these cases, we assume they travel the shorter of:
  - The distance from the WIC clinic to the WIC food site.
  - The distance from home to the WIC food site.
- **WIC Shopping at Usual Grocery Stores**: Under retail distribution, WIC participants whose nearest WIC-authorized store is also their usual grocery store do not require additional trips for WIC food pickup.[35] In these cases, no additional travel

[35]For each Census tract, we proxy the "usual grocery store" as the nearest SNAP-authorized superstore or supermarket. We use SNAP-authorized store data as a proxy for a grocery store census, as nearly all

burden is assigned beyond what a non-WIC participant would incur.

To calculate the additional travel burden associated with WIC participation, we use the letter labels in Table A.11 to represent the distances described in Table A.12. The total WIC-associated travel burden is given by:

$$3[B] + [C] + [D] + 2[E] - 3[A]$$

Since $3[A] = 3[B]$, these terms cancel, leaving:

$$[C] + [D] + 2[E]$$

We compute this sum separately for direct and retail distribution. Distances are weighted by the number of families below 185% of the federal poverty level (FPL) in each Census tract to align with WIC eligibility criteria. We perform these calculations for fiscal years (FY) 2019, 2020, and 2021 for the direct distribution system, and FY 2021 and 2022 for the retail distribution system.

Total WIC-related travel distance was 18.3 miles in 2020 under direct distribution and 8.6 miles in 2022 under retail distribution. Overall, WIC participants traveled approximately half as far for WIC benefits under retail distribution compared to direct distribution. This reduction was driven by: (1) the greater number of WIC-authorized grocery stores compared to distribution centers; and (2) the ability to combine WIC purchases with routine grocery shopping at SNAP-authorized stores.

supermarkets participate in SNAP (Dong et al. 2024). We then determine whether this store is also WIC-authorized. Data on SNAP stores, including addresses and store types, can be found here: https://www.fns.usda.gov/snap/retailer/historical-data.

Table A.11: Framework for Calculating 3-Month Travel Burden Associated with WIC Participation

		(1)	(2)	(3)
		Direct Distribution	**Retail Distribution**	
Household	**Trip Purpose**		**NOT Usual Store**	**Usual Store**
Non-WIC	[A] Routine Grocery Shopping (1/month)	Home to Grocery Store		
WIC	[B] Routine Grocery Shopping (1/month)	Home to Grocery Store		
	[C] WIC Clinic Visit (1/quarter)	Home to WIC Clinic		
	[D] WIC Food Shopping (1/quarter) (Joint Clinic-Food Pickup)	Shorter distance of: (i) WIC Clinic to WIC Distribution Center or (ii) Home to WIC Distribution Center	Shorter distance of: (i) WIC Clinic to WIC Grocery Store or (ii) Home to WIC Grocery Store	None
	[E] WIC Food Shopping (2/quarter)	Home to WIC Distribution Center	Home to WIC Grocery Store	None

Table A.12: Calculation of 3-Month Travel Distance (in miles)

Dist. System	Starting Point - Destination	(1) FY 2019	(2) FY 2020	(3) FY 2021	(4) FY 2022
Both	[C] centroid - health dept		5.993		
Direct	[D]-(i) health dept - dist center	1.650	1.662	2.024	
	[D]-(ii) centroid - dist center	5.453	5.464	5.804	
	Total Travel Distance	**18.307**	**18.342**	**19.358**	
Retail	[D]-(i) health dept - store			1.853	1.399
	[D]-(ii) centroid - store			4.170	3.928
	Total Travel Distance			**10.081**	**8.579**

Notes: Table A.12 reports the calculation of total travel distances at three-month interval under each distribution system. The distances are calculated for fiscal years (FY) 2019, 2020, and 2021 for the direct distribution system, and FY 2021 and 2022 for the retail distribution system. For each distribution system, first two rows show the minimum distance for each combination of a starting point to the destination, and the last row shows the total travel distance. We calculate the average of minimum distances for 878 Census tracts in Mississippi by weighting them with the number of families below 185% of poverty level in each Census tract, which is the income criteria used to determine WIC eligibility. Total travel distances are derived by calculating [C] + min{[D]-(i), [D]-(ii)} + 2 × [D]-(ii) where the notations [C], [D]-(i) and [D]-(ii) (equivalent to [E]) are the same as in Table A.11.

A.3 Google Reviews

We construct a dataset of Google reviews for WIC distribution centers and other service locations using two sources: (1) manual collection of reviews for WIC distribution centers in Mississippi, and (2) a database of Google reviews compiled by Li, Shang, and McAuley (2022). The first dataset provides a comprehensive review of WIC distribution centers, while the second allows comparison with other locations offering social service.

A.3.1 Manual Collection of Reviews of WIC Distribution Centers

Our dataset consists of manually collected star ratings and written reviews for WIC distribution centers in Mississippi. Of the 96 WIC distribution centers identified in administrative data (detailed in Section 3), we found 84 centers with at least one Google review as of June 2024. For example, the Forrest County WIC Distribution Center has 49 reviews with an average rating of 4.4 out of 5: https://g.co/kgs/dJUSWyM.

In total, we collected 754 reviews, of which 293 contain text, while 461 are numeric star ratings only (on a 1-to-5 scale, with 5 stars as the highest rating and 1 star as the lowest). Among the 84 centers with reviews, 57 (68%) have at least one text review. Since all WIC distribution centers closed in 2024, nearly all reviews were submitted before 2022, when the transition to retail distribution was completed.

Table A.13 presents summary statistics for the dataset. The average star rating is 4.1 out of 5.0 across all distribution centers. To analyze review content, we generate a word cloud (Figure 6A) from the 293 text-based reviews, where word size represents relative frequency. Table A.14 lists the 10 most frequently used words among 5,712 total words, excluding pronouns, articles, prepositions, conjunctions, auxiliary verbs, local adverbs (e.g.,"there"), and emphatic adverbs (e.g., "very").

While word frequency analysis provides useful insights, it may not fully capture overall sentiment, particularly in cases where negations (e.g., "not nice," "never open," or "no help") reverse the intended meaning. For example, a simple word count might misclassify "nice" in

"not nice" as a positive sentiment. To address this, we conducted a sentiment analysis using TextBlob, a Python-based natural language processing tool. TextBlob assigns each review a polarity score ranging from -1 to 1, where: positive values indicate positive sentiment; negative values indicate negative sentiment; and zero indicates a neutral sentiment.

Table A.15 summarizes descriptive statistics for sentiment scores, while Figure 6B presents a histogram of polarity scores, illustrating the distribution of positive, negative, and neutral reviews.

A.3.2 Google Reviews data from Li, Shang, and McAuley (2022)

The second source of data is the Google Local Database compiled by Li, Shang, and McAuley (2022). Based on Google Maps data as of September 2021, it includes business ratings, addresses, and names drawn from the full sample of Google Reviews. Whereas our manually collected data include WIC distribution centers only, this dataset enables comparison of WIC distribution center ratings with those of other locations in Mississippi. However, this database only covers subset of businesses on Google Maps. Specifically, the authors exclude text reviews shorter than five words or containing more than 10 images and remove users with only one review or whose image URLs have expired (Li, Shang, and McAuley 2022).

Table A.16 reports average ratings (ranging from 1 to 5), number of locations, and number of reviews used in the calculations. The number of WIC distribution centers in this database is about one-third of those in our manually collected dataset, but the average rating is similar (4.3 vs. 4.1 in our data).

In addition to WIC distribution centers, we collect reviews for food banks, social service organizations, and county health departments. Most businesses categorized under "social services" are government offices administering social benefits (e.g., Medicaid, SNAP, welfare, and child support), though the category also includes community centers, religious charities, and similar establishments. The footnotes to Table A.16 detail the exact text searches used to identify each category.

Table A.13: Summary Statistics for Google Reviews of WIC Distribution Centers

	(1)
Average Rating	4.056
# of Distribution Centers	84
# of Reviews	754

Notes: This table summarizes our manually collected dataset of Google reviews for WIC distribution centers in Mississippi. Ratings range from 1 to 5, with higher values indicating more positive reviews.

Table A.14: Top 10 Words from Google Reviews of WIC Distribution Centers

Rank	Word	Frequency	Share of Words (%)
1	always	49	0.9474
2	helpful	48	0.9281
3	friendly	46	0.8894
4	people	40	0.7734
5	nice	38	0.7347
6	wic	34	0.6574
7	staff	28	0.5414
8	get	28	0.5414
9	place	25	0.4834
10	clean	24	0.4640

Notes: Table A.14 presents the 10 most frequently used words from a total of 5,712 unfiltered word counts in Google reviews of WIC distribution centers in Mississippi. Common function words—including pronouns, articles, prepositions, conjunctions, auxiliary verbs, local adverbs (e.g., "there"), and emphatic adverbs (e.g., "very")—are excluded. The dataset consists of 293 manually collected Google reviews for 84 WIC distribution centers, gathered in June 2024.

Table A.15: Sentiment Analysis of Google Reviews of WIC Distribution Centers

(a) Descriptive Statistics

Measure	Value
Mean	0.276
Median	0.3
SD	0.339
N	293

(b) Number of Google Reviews by Sentiment

	Frequency	Share (%)
Positive	197	67.24
Neutral	53	18.09
Negative	43	14.68
TOTAL	293	100

Notes: Table A.15 presents sentiment analysis results for Google reviews of WIC distribution centers in Mississippi, using polarity scores from TextBlob. The polarity score ranges from -1 to 1, where positive values indicate positive sentiment, negative values indicate negative sentiment, and zero indicates a neutral statement. Table A.15A reports summary statistics for polarity scores, while Table A.15B categorizes reviews into positive, neutral, and negative sentiment groups. The dataset consists of 293 manually collected Google reviews for 84 WIC distribution centers, gathered in June 2024.

Table A.16: Google Ratings for Locations Providing Social Services in Mississippi

Category	(1) WIC Dist. Center	(2) Food Bank	(3) Social Service Org.	(4) County Health Dept.
Average Rating	4.321	4.612	3.835	2.773
# of Locations	26	20	178	10
# of Reviews	532	749	4,597	74

Notes: Table A.16 reports the average ratings of locations in Mississippi using the Google review database of Li et al. (2021). The numeric star ratings range from 1 to 5. We identify individual WIC distribution centers using our administrative data on these locations. For the other categories of establishments, we perform string searches of their name or Google-assigned category. In Column (2), "Food bank" locations are classified as those with "food bank" or "food pantry" in the category field. In Column (3), "Social services" locations are classified as those with "social services" in the category field. In Column (4), "County health department" locations are classified as those with "health department" in the name field.