

Hidden Costs of Efficiency: Understanding the Impact of EBT on WIC Recipient Behavior

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Abstract

By 2020, all states are required to distribute benefits using Electronic Benefits Transfer (EBT) for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). As of December, 2015, twelve states completed the transition and the remaining states are either in the planning or implementation stages. With this new EBT system, WIC recipients are no longer required to separate their WIC foods from their other purchases. The transaction can be rung all at once, potentially reducing the transaction costs and negative stigma associated with the original voucher system. Using a sample of weekly level transaction data of 17,714 WIC households that own a loyalty card at a larger grocer in Ohio, we test the impact that the EBT system has on general purchasing behavior. We find some evidence that WIC households spend more on non-WIC foods after the transition to EBT. Thus, while the transition to EBT does reduce transaction and potentially stigma costs, some costs are transferred to the recipient in terms of increased expenditures.

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Introduction

The Healthy, Hunger-Free Kids act mandates that by October 2020 all states in the Union must deliver benefits for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) through Electronic Benefit Transfer systems (EBT). This new system of benefit delivery has the potential to reduce transaction costs for WIC recipients, the stores where WIC foods are purchased, and for other shoppers waiting in line behind WIC recipients. In addition, it is possible that psychological stigma experienced by the WIC recipient decreases since other shoppers may have a more difficult time identifying a shopper as a WIC recipient. Given the reduction in transaction time and costs, and potentially the reduction in stigma, it is not unrealistic to expect that purchasing patterns of WIC recipients might change and even that more eligible individuals will enroll for the program (where funds are available).

One of the current challenges in measuring the impact of the transition of EBT on WIC recipient behavior is the lack of available data to study these questions, especially in the form of store level transaction records. In this current study, we analyze set of grocery purchase data for more than 17,000 WIC households tracked over a 75 week period and provide insights into the impact of EBT on WIC recipient behavior both with and without WIC benefits. Since currently only 16 of the 50 states in the Union currently use EBT to distribute WIC benefits, this research is very timely. Results from this research can inform policy makers of the benefits and challenges associated with WIC EBT, as well as potential improvements to benefit delivery.

WIC and EBT

In 2015, \$104.1 billion were delivered in food benefits through in-kind food assistance programs (Oliveira 2016). Despite the debate surrounding efficiencies of in-kind transfer programs in general, these types of programs may be able to effectively deliver specific benefits to intended recipients (see Cunha 2014; Ben-Shalom, Moffitt, and Scholz 2012; Currie and Gahvari 2008), and minimize the potential political ramifications of recipients utilizing benefits contrary to how tax payers think the benefits should be spent (Currie and Gahvari 2008).

The most well-known in-kind food assistance programs currently administered by the Federal government are the Supplemental Nutrition Assistance Program (SNAP), National

School Lunch Program (NSLP), WIC, and the School Breakfast Program (SBP). These programs account for 93% of total benefits delivered for food assistance nationally (Oliveira, 2016). The NSLP and SBP specifically target benefits to children enrolled in public school. WIC, on the other hand, provides food assistance for infants and children ages 1-4, making it an extremely valuable and consequential food assistance program.

In 2015, WIC accounted for 6% of federal dollars allocated to in-kind food assistance programs. These dollars benefitted 8 million lower income pregnant, post-partum, and breastfeeding women, infants in-utero, infants, and children ages 1-4 (Oliveira 2016).

Of the many acclaimed benefits attributed to the WIC program, the most widely accepted benefit is the improvement in birth weight among infants (Currie and Rajani, 2015; Rossin-Slater 2013; Hoynes, 2011; Bitler, 2005). There is some evidence that food insecurity is reduced (Kreider, Pepper, and Roy 2016; Metallinos et al., 2011; Black et al., 2004) with an improvement in dietary and health outcomes for women and children (Lee and Mackey-Bilaver, 2007). There is also limited evidenced on the cognitive benefit to children (Jackson, 2015) and even potential spill-over effects on older siblings of younger participants (Robinson, 2013).

One of the factors affecting the 40% of eligible people that do not participate, and that might result in WIC in benefits left on the table (Johnson et al., 2015) is the way in which benefits are delivered. When WIC began in 1972, recipients redeemed benefits through paper vouchers. To get specific food items using vouchers, beneficiaries follow a specific routine at the check-out line. They first separate WIC-eligible and WIC-non-eligible items and then present their vouchers to the cashier who verifies that the selected items are WIC-eligible and notes which benefits were redeemed. If the beneficiary does not redeem all items on the voucher, in some states, she can pick up those items at a later date. If a beneficiary mistakenly includes a non WIC-eligible item in the WIC-eligible pile, the cashier informs her and gives her the choice to either pay cash for the item in a separate transaction or to return it to the shelf. Because this part of the process slows down the check-out line and potentially embarrasses the WIC beneficiary, a beneficiary may face higher transaction and stigma costs when she redeems WIC benefits with paper vouchers.

In contrast to benefit redemption using paper vouchers, under EBT, store clerks electronically scan the Uniform Product Code label of all items all at once. The WIC beneficiary

then swipes her EBT card, which is like a debit card, enters her PIN, and the computer program automatically determines which items are WIC-eligible. Next, the computer deducts the dollar amount of the WIC approved items from the total bill and the recipient is responsible to pay the remainder out of her own pocket. Clearly EBT reduces transaction times with the new EBT system. In addition, fellow shoppers do not need to wait in line as long and WIC recipients may not feel stigmatized for participating in a federal food assistance program.

In addition to improving the efficiency of the WIC benefit redemption process, EBT systems also place more responsibility on WIC beneficiaries. Since the cashier is no longer validating the eligibility of selected items, it is up to the WIC recipient to make sure she selects the correct foods. If not, she either must pause the transaction to identify which foods are not covered, or pay for them out of pocket. This can be very challenging given the complex and burdensome foods list published by many states. In addition, foods are often not well marked in the stores increasing the difficulty of correctly selecting the appropriate foods.

The Present Research

In this study, we focus on the impact that the transition to EBT has on shopping behavior of WIC recipients. We utilize a set of transaction data from a major grocer in Ohio that tracks purchases of more than 17,000 WIC households across 56 counties over a 75 week period. At multiple points in this period, counties in Ohio transitioned from the traditional voucher based system to an EBT system. This variation in benefit transmission across counties in Ohio allows for use of difference in differences to identify the causal impact of EBT on WIC shopper behavior. Most importantly, we find some evidence that the transition to EBT results in an increase in non-WIC purchases, potentially improving the nutritional value of the basket of goods selected by the recipient.

Methods

Researchers have modeled a person's decision to enroll in (or to enroll one's eligible child) and redeem WIC benefits as a function of transaction costs and the stigma associated with participating in government assistance programs (see Manchester and Mumford, 2010, 2012; Currie 2004 for good discussions on stigma). These transaction costs for enrolling in and redeeming WIC benefits are costs borne by WIC recipients. These transaction costs are a

function of the effort required to enroll in the program (travel to clinic and fill out forms), the effort and time required to identify which food are part of the WIC program and properly select these foods, and the effort and time required to redeem benefits at the check-out line. Fixed costs include the effort to initially enroll in the program and the effort required to learn which foods are part of the WIC package. Variable costs include the time required to renew benefits every three months, the time required for mandatory visits (6 months for women, 1 year for children), and the time required to find the items in the store and redeem benefits at check-out.

In addition to transaction costs, WIC recipients might also pay stigma costs for participation in the program. We assume these psychological costs are borne by the recipient when someone else identifies the recipient as participating in the welfare program. This occurs with greatest accuracy at check-out when the recipient gives the cashier a paper voucher to redeem benefits. This clearly signals the recipient's participation in the program and shoppers behind the recipient may think of the person as lazy or a burden on society. The cashier might even show frustration or appear annoyed when s/he has to perform the steps necessary to determine whether or not the selected foods are WIC eligible and proceed with the transaction.

Both the transaction and stigma costs reduce the chance that a person will enroll in WIC and/or redeem all of their benefits. At the margin, the value of WIC benefits must equal or be greater than transaction and stigma costs combined for enrollment and/or benefit redemption to occur, holding income and other variables constant. On the other hand, an increase in the size of the benefit can increase the chance that a person enrolls and redeems benefits. This is most clearly demonstrated by recent statistics indicating that 60.2% of all eligible people enroll in WIC, where 84.4% of these enrollees are infants and 49.8% children ages 1-4 (Johnson et al., 2015). Most notable is the value of benefits from infant formula. Infant formula is costly and the flexibility it provides women who wish to return to work is also valuable, thus it is no surprise that a high percentage of infants are enrolled in the program. Thus it is no surprise that infants are enrolled at a very high rate. It would also not be surprising if benefit redemption for infants is also very high, relative to other benefit categories.

When EBT is introduced into the WIC benefits redemption process, the nominal value of benefits does not change, though transaction costs, and potentially stigma costs do change. Specifically, transaction costs fall because the recipient no longer needs to separate goods into

WIC and non-WIC food piles. Also, the cashier no longer verifies foods as WIC eligible using a paper voucher. Instead the computerized system determines which foods are WIC eligible and applies the appropriate benefits to these foods. Finally, shoppers behind the WIC recipient may not be able to identify the shopper as a WIC recipient, potentially reducing stigma costs.

Given the change in these costs as a result of EBT, the following predictions can be made:

1. Eligible people will be more likely to enroll in the program
2. Benefits redeemed will increase
 - a. It is conceivable that prior to EBT enrollees do not redeem all of their benefits in order to reduce transaction cost time, thus reducing the overall costs associated with program participation.

If enrollees mistakenly choose non-eligible foods and attempt to redeem them with their WIC benefits, the following predictions can also be made:

1. Expenditures on non-WIC foods will increase initially, but as WIC recipients learn about the process, these expenditures will reduce over time.
2. With expenditures on non-WIC foods increasing, the nutritional value of monthly food purchases will increase for a short time.

Notably, if WIC recipients were already making errors in selecting their foods, there is no reason this error rate will increase, but the cost of the errors will now be borne by the recipients, instead of the store. In other words, the recipient will need to pay for the additional goods out of pocket instead of the store cashier taking time to verify the eligibility of the food.

Identification Strategy

In order to identify the impact of EBT on WIC recipient shopping behavior we rely on variation in the rollout of EBT across the state of Ohio. Initial stages of the transition began on July 14, 2014 when Licking County piloted the first EBT system in the state. Subsequently, Greene County piloted EBT starting on August 4, 2014 and three more counties followed on October 19, 2014. The rollout continued on a county level basis in 2015 with 8 counties rolling out EBT on January 26, 16 counties rolling out EBT on March 23, 27 counties rolling out EBT on May 1, and the remaining 32 counties rolling out EBT on July 1. A table indicating the dates

and corresponding counties is found in Table 1. We exploit this variation in rollout across the state to identify the impact that EBT has on WIC behavior.

Enrolling in the WIC Program

To be eligible for WIC, state residents must fall within one of four general classifications, enroll at a WIC clinic, demonstrate that their income is less than or equal to 185% of the Federal poverty guideline (or participate in Medicaid, TANF, or SNAP), and be at nutritional risk. Though the last requirement would seem to be the most significant barrier for low income households, evidence suggests that, when WIC staff assess eligible applicants, they deem “virtually all” of them to be at risk.¹ Despite well documented nutritional benefits from WIC (Currie and Rajani 2015; Lee and Mackey Bilaver 2007) only 60.2% of WIC-eligible persons participated in 2013 (Johnson et al., 2015).

There are four general classifications that define WIC benefits: pregnant, postpartum, infant, and child age 1-4. Specific food baskets are assigned for people within each of these classifications. When people have specific nutrition needs, such as allergies, the baskets are modified to fit these needs. In addition, mothers can enroll their infants as strictly formula fed, partly formula fed, or strictly breast fed. Infants who are strictly formula fed receive the full allotment of infant formula and postpartum mothers are phased off WIC six months after childbirth. These infants begin receiving benefits for solid foods 6 months after birth, and the amount of formula they receive decreases accordingly until the infant’s first birthday, when formula is no longer part of the benefits package. Infants who are partially formula fed received a reduced amount of formula, relative to fully fed infants, and these children are again phased off formula after the first year. Finally, infants who are strictly breast fed receive no formula benefits but they do receive benefits for solid foods beginning at four months of age. Mothers who strictly formula feed their children receive benefits for six months after birth. Mothers who partially or strictly breast feed their infants receive benefits for one whole year, though mothers who only partially breast feed their infants receive a reduced package relative to those who strictly breast feed. Staff at WIC clinics determine these needs and assign benefits accordingly. Women and infants are required to return to the WIC clinic every six-months for evaluations and children ages 1-4 are required to return every year.

EBT in Ohio

The Healthy, Hunger-Free Kids Act of 2010 includes a clause requiring all states to transition to EBT benefit delivery by 2020. As of July 2016, 16 states have completely made the transition. Of the remaining states, 22 are in the implementation phase, 4 are in the pilot phase, and 8 are still in the planning phase (WIC EBT Activity, July 2016). For this current study, we will focus on the rollout of EBT in Ohio.

The transition to EBT began in Ohio in 2014 for 5 of the 88 total counties. The first county to implement the EBT transition was Licking County, and this began on Monday, July 14, 2014. On August 4, 2014, Greene County began the transition. Finally, during the week of October 19, 2014, Hocking, Meigs, and Putnam Counties all began the transition.

The remaining 83 counties all completed the transition during 2015. On January 26, 2015, 8 counties made the transition. On March 23, 2015, 16 counties made the transition. On May 1, 2015, 27 counties made the transition, and finally, on July 1, 2015, the remaining 32 counties converted to EBT for WIC. A table indicating the dates and corresponding counties is found in Table 1.

Data

Ideally, data for this study would include daily item level transaction records for WIC recipients where each item is flagged as being covered with WIC benefits or paid for out of pocket, both before and after the transition to EBT. In addition, the data would include the person's residence, or at least county where her WIC benefits are issued, demographic information, socio-economic data, and expenditures on food consumed away from home. Finally, health information, such as weight, height, and other health indicators would allow for testing the impact of EBT on changes in this

Unfortunately, the ideal data do not exist. Grocers are able to track household expenditures using loyalty card numbers and these data can provide down to the price and quantity purchased of specific product types. Yet these data nearly always lack demographic, socio-economic, place of residence, and health information. People are not required to provide this information in order to enroll in loyalty card programs. Plus, grocers do not track expenditures outside of the grocery store.

Data collected at WIC clinics include place of residence, health information, and other socio-economic data. In addition, state agencies administering the WIC program collect benefit redemption data for each participant. Unfortunately, prior to EBT, WIC benefit redemption data were collected only at the commodity level (at least in Ohio), such as amount of milk redeemed, with no specific brand or price. Since EBT automates the process and tracks benefits electronically, WIC redemptions can now be tracked at a product specific level. Yet, these data do not track expenditures on non-WIC foods.

Data for this study

Through a cooperative agreement with a large supermarket chain in the United States, we obtained weekly expenditure data for households participating in the WIC program for stores in Ohio. These households are taken from the grocer's database of 6 million households tracked through a loyalty card shopper program. Households enter into this panel if they hold a loyalty card, shop at one of the grocer's stores at least once every four weeks, and if they spend a certain amount each month and year. The grocer sets this minimum spending limit to make sure the households in the database represent regular shoppers in the store. Households enter this panel through the loyalty card program. This panel includes weekly expenditure data, both on WIC redemptions and non-WIC food expenditures, for 73,331 total households.

Data for this study spans from December 2013 to June 2015, a total of 75 weeks, and covers 56 of the 88 Ohio counties. This time frame includes all but one of the EBT transition phases for Ohio, the transition that occurred on July 1, 2015. Thus in this sample, stores in the counties scheduled to transition to EBT on July 1 redeemed voucher benefits only. In regards to the 32 missing counties, there is no store from the grocery chain in these counties, thus they are not present in the data. See Table 1 for specific counties that appear in the data.

While the data do include expenditures, these expenditures are aggregated at the weekly level for each household. In addition, the data are aggregated at the product category level. These product categories are: bakery, deli, deli packaged, floral, fresh prepared, fresh produce, general merchandise, grocery, health and beauty care, liquor, meat, natural foods, packaged produce, pharmacy, packaged meat, packaged seafood, seafood, and supplies. Expenditures for each of these categories are separated into WIC and non-WIC expenditures. In addition, expenditures are flagged as purchases using WIC vouchers or EBT. Since only certain foods are available for

WIC benefits, the following categories include WIC eligible foods: fresh produce, grocery, health and beauty care (infant formula), and packaged seafood.

Since household expenditures are only recorded when a purchase is made at one of the grocer's stores, the panel is unbalanced. We create a balanced panel by replacing the 867,306 missing weekly expenditures with zero. While we know which store where purchases were made, as well as the counties in which these stores reside, we do not have this information for the weeks when no purchases were logged in the system. In order to fill in stores and counties for these cases, we use the store and county where the household shopped the most frequently on the weeks when transactions were logged. If there were two or more stores or counties where a household shopped that were tied for highest frequency of household visits, we randomly selected one of the highest frequency stores and counties and used those as the store and county proxies.

Dealing with zeros in the data

It is not surprising that many households in the data have zero expenditures in multiple weeks throughout the 75-week period. Households may shop at other locations, or purchase enough food in one week so that they do not need to purchase groceries the next week. In the case of WIC benefit redemptions, a household may not enter the sample until later weeks because this is the time when the eligible household member enrolls in WIC. In summary, there are three key reasons why a household has zero expenditures recorded for WIC expenditures in any given week: 1) no household member is participating in the WIC program; 2) a household member is participating in the WIC program but redeemed WIC benefits at a different store; 3) a household member is participating in the WIC program but did not redeem WIC benefits that week.

In order to adequately measure WIC shopper behavior in this sample we focus on households that make a WIC purchase an average of once every month. We use an average of once every month for several reasons. First, this ensures, with high probability, that a household has WIC benefit redemption data recorded both before and after the EBT transition. Second, since WIC benefits are distributed at 3-month intervals, recipients have to show up at a clinic every three months to either pick up the new vouchers or have the benefits "loaded" onto the card. It is plausible that a household member on WIC does not visit a clinic at the beginning of

the cycle to retrieve the new vouchers or re-load the EBT card. As a result, there may be cases where WIC data are not recorded for a household for multiple weeks, but the household still has a member enrolled in the WIC program. Third, this ensures, with high probability, that a household is registered for the WIC program throughout the sample period. For the final sample, we keep households that redeem WIC benefits an average of once every four weeks, resulting in 17,714 (N=1,328,550) households in the final sample of data.

Characterizing specific groups of WIC recipients

Since the data do not include demographic information we rely on expenditure information to characterize (with error) different types of households in the data. First, we use data from the Consumer Expenditure Survey (CES) to characterize households as having one person, two people, up to five or more people. The CES average weekly food at home expenditure data for these different household sizes are the following: one person -- \$40.40; two people -- \$74.23; three people -- \$90.83; four people -- \$110.87; five people -- \$122.19.

In these grocery expenditure data, we characterize household size by taking the mid-point between the CES average expenditure for each household and using it as the upper bound for the smaller household and the lower bound for the larger household. For example, the upper bound (exclusive) on average weekly expenditures for households with one person is \$57.32, which is also the lower bound (inclusive) for households with two people. The lower bound for households with one person is generated using the “Thrifty Plan” from USDA’s Cost of Food at Home chart (Official USDA Food Plans). We use weekly cost for a one-year old child as a conservative lower bound for a one person household. We calculate the upper bound for a household with five or more people using the same USDA chart for a household with four people and add the food cost for a male child 14-18 years old. To be conservative with this upper bound, we use the “Liberal Plan”, which plan has the largest expenditures on the chart. In the data, we classify 2,648 one-person households, 3,727 two-people households, 2,678 three-people households, 1,906 four-people households, and 6,502 five or more people households.

We also use general WIC redemptions and WIC redemptions of infant formula to classify households as receiving certain WIC packages. In general, there are 7 different WIC packages available to enrollees. Eligible women, infants, or children for these specific packages are: 1) pregnant women, 2) postpartum women who fully breastfeed their child, 3) postpartum women

who partially breastfeed their child, 4) postpartum women who do not breastfeed their child, 5) infants who are 100% bottle fed, 6) infants who are partially bottle fed, and 7) children ages 1-4 years. Packages for pregnant and postpartum women and children ages 1-4 have many similar components. Packages for infants either 100% or partially bottle fed include infant formula.

We attempt to classify a household as having a first-time pregnant woman by relying on timing of WIC redemptions of infant formula and timing of other WIC redemptions. First, we make sure these households redeemed WIC benefits for infant formula more than 36 weeks after the first week of the sample period, *and* the number of weeks between the first time WIC benefits are redeemed for infant formula and the first time any WIC benefits are redeemed is less than 37 weeks. This reduces, but does not eliminate, the chance that we are capturing a pregnant woman with other children on WIC. On the other hand, it potentially includes pregnant women that may have signed up for WIC several weeks, or even months, after they figured out they were pregnant.

Using this subsample of women we then classify the pre-pregnant period as the time prior to any WIC benefit redemptions. The period during pregnancy is defined as the time between the first WIC benefit redemptions and the first benefit redemption for formula. Finally, the postpartum period is defined as the time after the first redemption of WIC benefits for infant formula. This set of exclusion rules results in 1,419 households that we classify as having a pregnant woman for the first time. If we use the household size restrictions, then 641 of these households are characterized as having a first-time pregnant woman. Recall, this particular subsample of the original data set does not include women who may have enrolled in WIC several months after the beginning of the sample period.

Notably this classification only approximates the truth of whether or not a woman is pregnant for the first time, and how long she bottle feeds her child. It is possible that she begins breastfeeding her child and then decides to switch to infant formula or she may decide to stop fully breastfeeding her child and visits a WIC clinic to receive benefits for some infant formula. Notably, it is estimated that in 2012, 73.1% of WIC recipients attempted to breastfeed their infant sometime during the child's first year and 15.6% of women exclusively breastfed their infant through 6 months (CDC National Immunization Survey). This indicates that there is switching from breastfeeding and formula feeding, though this is not specified in the data.

Finally, to account for cyclical expenditure patterns in shopping behavior, we sum household expenditure data in 18 different months. Since the data are at the weekly level, the months are rough calendar months. We created them by setting the first week as the week when the first day of the month occurred (the first week of the data includes January 1, 2014). With this structure we create some months with four weeks and some with five. While this means that by default some months will have more weeks of summed data than others, the fifth week is at the end of the cycle and tends to have lower expenditures. As a robustness check, we plan to construct months in four-week increments to see if the results are similar.

Other sources of variation

Another source of variation arises from the WIC cycle. WIC benefits are delivered on a 3-month cycle. Once these three months are up, the participant visits the clinic and receives another 3 months of benefits. In Ohio, benefits are renewed on the first of every month, so at the beginning of a new cycle, an enrollee can visit the clinic and receive the next three months of benefits.

The EBT transition occurs county by county, and not by WIC enrollees. As a result, it is possible for a county to transition to EBT and for WIC recipients to still be in the three month cycle, and have more vouchers to use. At this point, the recipient has in general two options: complete the cycle with voucher benefits and obtain the EBT card on the new cycle or visit a clinic sometime before the end of the current cycle and have the remaining benefits transferred to an EBT card. Unfortunately we do not know the month when a new cycle begins for the households in the data, though this can be estimated using WIC redemption patterns.

Dependent variables

For this study, we focus on food expenditure variables, food expenditure share variables, and shopping frequency variables. These are the primary outcome variables in the data and we hypothesize that each one is a function of the benefit delivery system. Expenditures and expenditure shares are a function of the benefit delivery system because the actual method changed, augmenting the cost structure of that market transaction. Shopping frequency is also a function of benefit delivery since the cost of acquiring goods might deter individuals from visiting the store with greater frequency. If the transaction becomes less costly, WIC recipients may visit the store more frequently.

We generated the food expenditure variables by using the WIC and non-WIC expenditures in the data. The total food expenditure variable is a summation of all food purchases and WIC redemptions made in the store during a given month. Benefits redeemed with WIC vouchers or EBT are combined to create the WIC benefit redemption variable. We also study expenditures and benefit redemptions for the following food categories: general grocery, fresh produce, health and beauty care as well as pharmacy, and dairy.

Descriptive Statistics

In Table 2, we present data on the counties in the sample, and group them by EBT transition. Notably, after the pilot phases, population density gradually increased by phase, indicating that larger, more population dense counties transitioned later. There was much less variation in the percentage of the county's population in poverty, with the highest percentage at 21.46% in the 7 counties that began the transition on January 26, 2015. Racial profiles, based on percentage of Caucasians in the county, were similar too, though Greene County had the lowest percentage at 86.60%. Finally, there was adequate variation in the percentage of the population with a college degree. Notably, on average 13.8% of the residents in the counties that transitioned on March 23, 2016 have a college degree while on average more than 1/5 of the residents of the counties that transitioned on May 1 and July 1, 2015 have a college degree.

Empirical Specification

To measure the impact of EBT on household shopping behavior we rely on an event-study approach (Binder 1998; Khotari and Warner 2006). The event-study approach allows us to utilize the staggered implementation of EBT across counties and convert it to a difference-in-difference design. In addition, this approach allows us to track behavior in relation to EBT implementation and to see how long behavior persists over time, if at all. For our empirical specification, we will set the month prior to implementation of EBT equal to zero and leave these months as the reference set. Then we will create a variable that equals one for the set of months immediately preceding the reference set, and a new variable that has the value of one for the set of months immediately following this reference set. Notably, the months coded as the first period after the reference set is the month in which the EBT transition occurred. We only use this set of three periods in our empirical specification because the transition on May 1, 2015 occurs during the last month of our sample period. Thus we have no additional months after this transition.

Our empirical model follows the form

$$y_{it} = \beta_0 + \beta_1 Event(-1) + \beta_2 Event(1) + \beta_3 Season + \beta_4 ExtraDays + \beta_5 ShareEBTDays + Household \Gamma + v_i \quad (1)$$

The $Event(-1)$ is a dummy variable that takes on the value of 1 for the month prior to the reference month (the reference month is the month immediately preceding the transition month), $Event(1)$ is a dummy variable that takes on the value of 1 in the month when the county made the transition, the matrix $Household$ contains a dummy variable that equals 1 for each household in the data. We do not include a county indicator in the variable since the household fixed effect is highly collinear. In other words many households in the sample shopped in the same county during the sample period. We also do not include a month indicator because this is collinear with the event-study variables. We do, however, include a variable attempting to capture seasonality in the data ($Season$), a variable accounting for the days outside of the calendar month that are included in the month specification ($ExtraDays$), and the share of days in an EBT transition month that land either on or after the transition date ($ShareEBTDays$). The random error term v_i is a white noise error term.

Results

Results for this study are presented in Tables 3-5. In Table 3 we report that total food expenditures increase by \$45.75 ($p < 0.001$) after EBT is introduced. Over half of this increase is attributed to general grocery foods, such as cereal, bread, and other packaged goods generally found in the center aisles of the store. Purchases of produce also increased by \$5.90 ($p < 0.01$).

We also find that total food purchases prior to the EBT transition increased. It is possible that this change is driven by a cyclical effect we did not pick up in our analysis. Also, expenditures on items such as lotion, soap, and makeup (health and beauty care) did not change after the transition. In addition, we find evidence of seasonality, based on our construct, in the data.

When we examine non-WIC purchases (Table 4), we again find evidence that expenditures increase after EBT by \$44.36. Incidentally, expenditures prior to EBT also increased, indicating a cyclical pattern in the data. Notably, expenditures on health and beauty care items increased, though not by as much as previous to the transition.

Finally, we find that general WIC redemptions did not increase after the transition to EBT. Interestingly, expenditures on general grocery and produce increased, both before and after the transition. Yet expenditures on infant formula decreased after the transition, despite the prior increase.

Discussion and Conclusions

Evidence from this study suggests that the transition to EBT did have an impact on WIC shopper behavior, though there appears to be a cyclical pattern that coincides with the event-study horizon. The increase in non-WIC expenditures suggests that enrollees are willing to pay the stigma cost when purchasing groceries and pay more out of pocket. While this has the chance to increase the nutritional value of the shopper's food bundle, it also requires additional financial resources the shopper may not have readily available.

There are several limitations with this research that provide avenues for additional research. First, our data are lacking in many ways. We do not have demographic information for households, limiting our ability to group households into specific groups. Yet we are able to exploit information in the expenditure data to impute certain household characteristics. In addition, the data are aggregated at the week and product category level. We do know how much households redeemed in WIC benefits, and how much they spent out of pocket, providing general information about spending behavior. Finally, we do not have any information about the household's WIC bundle, monthly cycle for WIC benefits, or county where WIC benefits are renewed. Again, the data do provide opportunity to impute these characteristics and we plan to do so.

This study is unique because we utilize transaction data from a grocer to study the impact of EBT on shopping behavior. This is the first study to attempt to empirically study this question with a set of unique transaction data. Given the national rollout of EBT this is a very timely research topic since WIC reaches some of the country's most vulnerable populations: pregnant and postpartum women, infants, and young children. Proper nutrition for pregnant women is essential to ensure a healthy birth, and children need an appropriate diet to develop well. We hope this research opens the door for a new set of questions that can be studied about the WIC program.

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Table 1: Timeline for WIC Electronic Benefits Transfer Transition in Ohio^a

July 14, 2014 ^b	August 4, 2014 ^b	October 19, 2014 ^b	January 26, 2015	March 23, 2015	May 1, 2015	July 1, 2015 ^c
Licking	Greene	Hocking Meigs Putnam	Athens Gallia Jackson Noble Pike Vinton Washington/Morgan	Belmont Carroll Coshocton Fairfield Guernsey Harrison Holmes Jefferson Lawrence Monroe Muskingum Perry Ross/Pickaway Scioto Tuscarawas	Adams/Brown Allen Champaign Clark Clermont Clinton Defiance Delaware/Morrow/Union Fayette Franklin Hancock/Hardin Highland Logan Lucas Madison Montgomery Ottawa Paulding Shelby Warren Williams Wood Wyandot	Ashtabula Auglaize Butler Crawford Cuyahoga Darke/Mercer Erie/Huron Fulton/Henry Geauga Hamilton Knox Lake Lorain Mahoning Marion Medina Miami Preble Portage/Columbiana Richland/Ashland Sandusky Seneca Stark Summit Trumbull Van Wert Wayne

- a. Bolded counties appear in the data.
- b. These are the three pilot phase dates. In the October pilot, the EBT transition occurred sometime during the week of the 19th.
- c. Data for this study precedes this rollout date

Table 2: County Demographics by WIC Electronic Benefits Transfer Rollout Date (standard deviation in parentheses^a)

EBT Rollout Date	Percent Caucasian	% with College Degree	Per Capita Income	% in Poverty	Population Density
July 14, 2014 ^b	92.90%	22.60%	\$27,082.00	13.50%	243.9
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August 4, 2014 ^b	86.60%	36.90%	\$30,629.00	13.20%	390.5
	--	--	--	--	--
October 19, 2014 ^b	96.83%	15.27%	\$22,136.67	15.97%	65.5
	(0.175)	(0.360)	(3564.617)	(0.366)	(7.250)
January 29, 2015	95.30%	14.71%	\$20,313.88	21.46%	67.8
	(0.212)	(0.354)	(2047.160)	(0.411)	(31.484)
March 23, 2015	95.03%	13.79%	\$21,980.69	16.68%	115.8
	(0.217)	(0.345)	(2258.433)	(0.373)	(59.384)
May 1, 2015	91.71%	20.29%	\$24,954.19	14.04%	314.2
	(0.276)	(0.402)	(4711.970)	(0.347)	(477.890)
July 1, 2015 ^c	91.05%	20.15%	\$25,083.97	14.04%	447.4
	(0.285)	(0.401)	(3325.461)	(0.347)	(595.480)

a. The first two rollouts in 2014 included one county each, thus there is no standard deviation

b. These are the three pilot phase dates. In the October pilot, the EBT transition occurred sometime during the week of the 19th.

c. Data for this study precedes this rollout date

Table 3: Regression Results for WIC and non-WIC Expenditures Combined

	Total Expenditures	General Grocery	Produce	Health and Beauty Care	Store Visits
Month Prior	56.49*** (2.62)	34.15*** (1.55)	3.588*** (0.27)	7.614*** (0.83)	1.917*** (0.08)
Month After	45.75*** (2.80)	25.29*** (1.65)	5.902*** (0.32)	1.455 (0.91)	2.274*** (0.09)
Mar-May	112.7*** (9.24)	74.08*** (5.39)	6.198*** (0.90)	13.43*** (2.87)	3.773*** (0.33)
Sep-Nov	48.12*** (7.64)	25.19*** (4.33)	4.118*** (0.75)	8.492*** (2.54)	1.687*** (0.26)
Dec-Feb	101.0*** (11.98)	67.02*** (7.28)	5.324*** (1.10)	10.58*** (3.35)	5.000*** (0.50)
Share of EBT Days	24.28** (11.95)	25.80*** (7.11)	-5.865*** (1.34)	10.84*** (4.03)	-0.973** (0.41)
Extra Days	17.07*** (0.80)	9.417*** (0.47)	1.526*** (0.08)	2.402*** (0.26)	0.810*** (0.03)
Constant	357.5*** (7.92)	190.5*** (4.51)	23.12*** (0.79)	67.85*** (2.64)	10.67*** (0.27)
N	33003	33003	33003	33003	33003

Results are from a household fixed effect model.

*p<0.1. **p<0.05. ***p<0.01.

Table 4: Regression Results for non-WIC Benefit Redemptions

	Total Expenditures	Share of Food Expenditures	General Grocery	Produce	Health and Beauty Care
Month Prior	49.69*** (2.43)	-0.00055 (0.00)	30.71*** (1.48)	3.069*** (0.26)	5.085*** (0.55)
Month After	44.36*** (2.62)	0.00747*** (0.00)	23.28*** (1.58)	5.434*** (0.30)	2.678*** (0.61)
Mar-May	102.4*** (8.45)	0.00935* (0.01)	66.95*** (5.07)	4.252*** (0.86)	12.45*** (1.82)
Sep-Nov	47.21*** (6.84)	0.0151*** (0.00)	24.83*** (4.04)	3.411*** (0.72)	8.909*** (1.57)
Dec-Feb	87.32*** (10.90)	0.000985 (0.01)	58.30*** (6.76)	3.422*** (1.03)	7.396*** (2.06)
Share of EBT Days	10.07 (11.07)	-0.0184** (0.01)	20.63*** (6.73)	- 6.874*** (1.23)	2.763 (2.48)
Extra Days	14.75*** (0.74)	-0.00078 (0.00)	7.887*** (0.45)	1.263*** (0.08)	2.006*** (0.17)
Constant	309.9*** (7.11)	0.854*** (0.00)	174.8*** (4.21)	19.92*** (0.76)	40.09*** (1.66)
N	33003	32861	33003	33003	33003

Results are from a household fixed effect model.

*p<0.1. **p<0.05. ***p<0.01.

Table 5: Unconditional Means for Outcome Variables by Electronic Benefits Transfer Rollout Phase

	Total Expenditures	Share of Food Expenditures	General Grocery	Produce	Infant Formula
Month Prior	6.900*** (0.74)	0.000549 (0.00)	3.499*** (0.30)	0.526*** (0.08)	2.616*** (0.61)
Month After	1.309* (0.79)	-0.00747*** (0.00)	1.949*** (0.33)	0.460*** (0.10)	-1.323** (0.66)
Mar-May	9.473*** (2.39)	-0.00935* (0.01)	6.556*** (0.96)	1.938*** (0.21)	0.341 (2.03)
Sep-Nov	0.257 (2.07)	-0.0151*** (0.00)	-0.194 (0.80)	0.791*** (0.18)	-0.614 (1.77)
Dec-Feb	12.70*** (3.03)	-0.00099 (0.01)	8.472*** (1.34)	1.768*** (0.29)	2.122 (2.44)
Share of EBT Days	14.40*** (3.82)	0.0184** (0.01)	5.364*** (1.55)	0.948** (0.44)	8.085** (3.16)
Extra Days	2.348*** (0.23)	0.000779 (0.00)	1.555*** (0.09)	0.265*** (0.03)	0.428** (0.19)
Constant	48.08*** (2.20)	0.146*** (0.00)	16.15*** (0.86)	3.131*** (0.20)	27.93*** (1.84)
N	33003	32861	33003	33003	33003

Results are from a household fixed effect model.

*p<0.1. **p<0.05. ***p<0.01.