Intensive Margin Participation Frictions: Evidence from WIC EBT

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Abstract

Participation frictions may operate equally on both the extensive and intensive margin. Using administrative data from the WIC program, we identify the effect of electronic benefit transfer (EBT) on extensive margin program participation, intensive margin utilization of benefits, and program administrative costs. We find that the adoption of EBT reduces the average monthly redemption of food benefits and does not affect program participation, administrative costs, or food security. Under theoretically and empirically motivated assumptions, we show that the intensive margin effects from EBT are welfare increasing, highlighting the importance of intensive margin participation in the evaluation of in-kind transfer programs.

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1 Introduction

For most public programs in the United States, eligibility is necessary but not sufficient for participation. Conditional on eligibility, potential applicants must actively apply for participation; however, application costs may introduce a wedge between eligibility and participation, resulting in partial take-up of public benefits. The normative implications of such screening are unclear and depend on which potential applicants are screened out. Although the economic literature has focused on this extensive margin of participation, unobserved participation costs may operate equally upon the intensive margin of program participation. In particular, information frictions, hassle, and stigma are thought to impede the take-up of benefits, and these costs may also reduce benefit usage among program participants, with ambiguous social welfare implications.

The manner in which these costs operate on the extensive and intensive margins of program participation is of prime importance to U.S. food assistance programs, which seek to supplement the nutrition of the participating population, and frictions preventing full participation along either the extensive or intensive margins impede these efforts. Among these programs, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which serves approximately half of all infants in the United States and around 6.3 million participants monthly, has less than 60% of eligible individuals take-up program benefits.[1] Participants in WIC also fail to fully utilize program benefits, with only 12.6% of participants fully redeeming their issued food benefits and 37% of participating households failing to redeem any benefits in at least one benefit cycle (Phillips et al., 2014; Bitler et al., 2024).

In this paper, we address how frictions along the intensive margin of program participation affect the value of public benefit programs. Many public programs are designed to shift behaviors and outcomes other than household income, and failure to account for the usage of benefits will lead researchers to misstate the true impact of participation costs under both the neoclassical model of Nichols and Zeckhauser (1982) and behavioral targeting model of Bertrand et al. (2004); Deshpande and Li (2018).

We provide empirical evidence from the adoption of electronic benefit transfer (EBT) in WIC – mandated by the USDA in order to address "potential stigma associated with using food benefits" and to ease the shopping experience.[2] How does the introduction of EBT affect the extensive and intensive margins of program participation? Does EBT improve participant and societal welfare? Using administrative data on extensive and intensive program participation, we estimate the effect of EBT introduction on program take-up and usage of benefits. The staggered adoption of electronic benefits at the state-level, identifies the causal relationship between EBT and these outcomes

[1] WIC Program Overview(Please see: https://www.ers.usda.gov/topics/food-nutrition-assistance/wic-program/)
[2] WIC EBT Final Rule press release (Please see: https://www.fns.usda.gov/pressrelease/2016/005316)

of interest.

We find that EBT policies have no effect on total participation or participation among the eligible. Our results, which rule out any increase in participation greater than 2.5 percentage points among the eligible, are at odds both with prior estimates of the effect of WIC EBT on participation and the USDA's anticipation of the effect from electronic benefits (Meckel, 2020; Vasan et al., 2021; Amrbozek, 2022). In contrast, we show that electronic benefits have a sizeable effect along the intensive margin of program participation, reducing average monthly benefit usage by approximately 8% of the pre-EBT mean.

The switch to electronic benefits plausibly reduces transaction costs through changes in social perception and hassle, and the USDA anticipated that such cost reduction would increase take-up and benefit usage, contrasting with our empirical results.[3] While prior research has found large effects on extensive margin participation from hassle, stigma, and information costs (Deshpande and Li, 2018; Finkelstein and Notowidigdo, 2019; Rossin-Slater, 2013), our results provide evidence that use-specific hassle costs, of minimal significance in explaining take-up decisions, may significantly affect usage of benefits.

In order to better understand the mechanism and implications of the observed intensive margin effects, we also examine food security among WIC participating households. We find no effect from the adoption of EBT on food security score or the share of food insecure WIC participating households, suggesting that the changes in benefit redemption are intentional. This result may be rationalized by EBT's relaxation of constraints on the timing of benefit redemption, reducing the option value of food benefits but having minimal effect on underlying food consumption patterns. Before the transition to EBT, any benefits not utilized during a check redemption would be forfeited for the rest of the issuance period, creating uncertainty about the desirability of items and imparting an option value to each food benefit. EBT enables at-will redemption of benefits, eliminating this source of uncertainty and associated option value, decreasing the value and redemption of food benefits.

Our approach to quantifying the normative implications of EBT uses the Marginal Value of Public Funds (MVPF), in the vein of Hendren and Sprung-Keyser (2020), and our estimates capture the dollar denominated welfare cost to participants for each dollar of government savings generated by EBT. Using our previous event-study approach, we find that EBT implementation has a small positive but statistically insignificant effect on WIC administrative costs, measured by nutrition service and administrative (NSA) costs. As EBT did not noticeably affect take-up, focusing solely on the extensive margin of participation may incorrectly estimate the change in societal welfare from EBT as negative – small increases in government administrative costs for no observable change in participant welfare. In contrast, our estimates from the intensive margin provide evidence

[3] WIC EBT Final Rule press release (Please see: https://www.fns.usda.gov/pressrelease/2016/005316)

that the transition to EBT is welfare increasing across a range of plausible assumptions, as the policy change generates government cost savings through a reduction in the redemption of benefits with no corresponding effect on the welfare of individual participants.

Our application addresses the normative implications of frictions in benefit usage, which has been ignored in the existing economic literature in favor of extensive margin effects (Friedrichsen et al., 2018; Rossin-Slater, 2013; Finkelstein and Notowidigdo, 2019). We quantify the welfare consequences of changes in intensive margin participation and demonstrate that a failure to incorporate these effects may lead researchers to misstate the welfare consequences of hassle, stigma, and information costs.

The paper is organized as follows: Section 2 provides the institutional setting, background on the transition to EBT, and an overview of the data; Section 3 outlines the empirical strategy for estimating participation effects and the component parts of the MVPF; Section 4 presents results on participation and provides estimates of the MVPF; Section 5 concludes the paper.

2 Institutional Setting & Data

2.1 Institutional Setting

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) aims to enhance the health and nutrition of low-income pregnant, postpartum women, infants, and children up to age five. In 2021, WIC served an average of 6.3 million participants per month, including approximately half of all infants in the U.S.[4] Program benefits include supplemental food, nutrition education, and referrals to other public assistance programs and healthcare providers. Eligibility is limited to individuals who meet income or adjunctive income eligibility, categorical eligibility, nutritional risk, and residency requirements.[5] While income eligibility requires that participating households have an income below 185% of the Federal Poverty Level, individuals above this threshold may adjunctively qualify through participation in Medicaid, the Supplemental Nutrition Assistance Program (SNAP), or Temporary Assistance for Needy Families (TANF), which may have different income eligibility guidelines.

Cross-participation in other public programs is common among WIC participants, and in 2020, approximately 3.5% of participants were income eligible for WIC through cross-participation (Kline et al., 2022). Although dietary inadequacy often suffices to establish nutritional risk, allowing broad accessibility, fewer than 60% of all eligible households participate, and participation among the eligible declines with child age (Bitler et al., 2003; Betson et al., 2003; Kline et al.,

[4] WIC Program Overview(Please see: https://www.ers.usda.gov/topics/food-nutrition-assistance/wic-program/)
[5] About WIC(Please see: https://www.fns.usda.gov/wic/about-wic)

2022).[6]

Standard monthly benefits include food quantity vouchers for specific food items and cash vouchers for fresh produce. The latter were introduced during the 2009 Food Package revision, which aimed to incorporate healthier options like fruits, vegetables, and whole grains while adjusting quantities of dairy, juice, eggs, and formula to better match nutritional needs and infant age (Chaparro et al., 2020). [7] Quantity vouchers are restricted to specific brands, package sizes, etc. that may vary by state. State-level variations in food-packages exist, but all participants are entitled to the full food package unless modifications are justified for medical or nutritional reasons. Such customization primarily occurs within infant food packages, where formula quantities are adjusted for partially breastfed infants.[8]

2.2 EBT

The WIC EBT Final Rule mandated the transition to electronic benefits for all state agencies by October 1st, 2020 as part of the EBT provisions from the 2010 Healthy, Hunger-Free Kids Act. WIC state-agencies managed the transition independently, with most adopting EBT before the mandated transition, resulting in staggered implementation across states.[9] The state-level timing of EBT adoption is available via the USDA's WIC EBT status report, which tracks the timing of the pilot program, full program rollout, and state-wide implementation.[10] Within each state, the implementation of EBT for participants was similarly staggered across WIC local-agency areas, with the implementation timeline varying by state. The introduction of EBT among participants and participating retailers was not simultaneous in all states, and WIC participants may utilize their benefits at any participating in-state retailer, regardless of local-agency. For analyses making use of within-state implementation timing, mobility across county and local-agency boundaries creates permeable treatment units, introducing a potential violation of the stable unit treatment value assumption (SUTVA). In contrast, participants cannot use WIC benefits across state lines, eliminating treatment contamination at the state-agency level.

The transition to EBT replaced the old system of paper checks with a plastic, debit-like card. Prior to the transition, food benefits were issued through paper checks, which recorded the avail-

[6] WIC Nutrtional Risk Criteria(Please see: https://www.fns.usda.gov/wic/nutrition-risk-criteria)

[7] As part of the revision, WIC state agencies were required to implement revisions to WIC food packages in an effort to align with the 2005 dietary Guidelines for Americans and infant feeding practice guidelines of the American Academy of Pediatrics. These adjustments were designed to ensure cost neutrality, with a focus on revising maximum and minimum requirements for certain supplemental foods and substitution rules (Please see: https://www.govinfo.gov/content/pkg/FR-2006-08-07/pdf/06-6627.pdf)

[8] WIC Food Package Guidance (Please see: WIC Food Package Policy & Guidance, March 2018)

[9] Extensions to implementation were subsequently provided to a number of states due to issues arising from the Covid-19 pandemic

[10] WIC EBT Activities (Please see: https://www.fns.usda.gov/wic/wic-ebt-activities)

able items and quantities. Under the old system, transactions required: (1) segregation WIC items at checkout; (2) presentation of the benefit check to the cash-register attendant; (3) physical confirmation, by the attendant, that each item was covered; (4) written recording of each item's price. The paper check, on which the price of each redeemed item is recorded, would then be submitted by the retailer to the state WIC agency for compensation. Benefits not redeemed on a submitted check are lost for the remainder of the benefit cycle. As these checks represent the entire monthly food package, participants are unable to stagger the redemption of benefits, regardless of the desired timing of food benefit consumption.

Under the EBT system, transactions no longer require (1) segregation of WIC items (2) physical confirmation of item eligibility and (3) written recording of item price, as these actions are done electronically by the cash-register. Phillips et al. (2014) notes that the ease of use of the benefit card increases the frequency with which participants report redeeming benefits; however, it may also introduce an information friction on intensive margin participation. The paper checks act as an informal benefit shopping list, which is not replicated under EBT. As remaining benefits may be redeemed at any point during the benefit cycle under EBT, the loss of this informal shopping list may increase the difficulty in recalling remaining benefits. Across state-agencies, there are multiple methods to check the remaining benefits: customer receipts, state managed phone lines, requesting a remaining balance check from store clerks, assistance from retailer customer service, and smartphone applications.[11]

EBT may also affect retailer participation in WIC by imposing additional fixed and variable costs for EBT software and increasing the difficulty with which retailers may price discriminate (Amrbozek, 2022; Meckel, 2020). This transition to electronic benefits may consequently induce exit among existing retailers and reduce retailer entry, potentially limiting participant access to WIC vendors. Empirical evidence from Meckel (2020) demonstrates that EBT introduction in Texas, completed in April 2009, reduced independent retailer participation by 10.7% while having no statistically significant effect on chain retailer participation.[12]

[11] As of April 2025, we have received confirmation from 42 state-agencies of the availability of smartphone benefit-tracking applications.

[12] Of note, the estimates from Meckel (2020) face two potential limitations: (1) the reliance on county-level data, which may violate the SUTVA assumption as participants can shop across county lines; (2) confounding effects from the October 2009 Food Package Revision, which occurred shortly after Texas completed its EBT implementation. The revision introduced new stocking requirements for fresh produce that disproportionately affected independent retailers compared with chain retailers.

2.3 Data

WIC Administrative Data

For our primary analysis, we use WIC administrative data provided by the U.S. Department of Agriculture's (USDA) Food Nutrition Service (FNS) (U.S. Department of Agriculture, Food and Nutrition Service, 2020), which provides information on participation, food expenditure, and administrative costs. For all analyses, we use state-year averages to avoid identification difficulties from seasonal fluctuations, administrative spending patterns, and variations in within-state implementation timelines.[13] Data availability varies by measure: total participation, eligibility estimates, and coverage rates span 2005-2020; participant composition by category (women, infants, and children) covers 2008-2020; and participation by infant feeding practice is available from 2010-2020. Food expenditure data (2005-2020) and NSA costs (2008-2020) are normalized to 1999 dollars for analysis. Table 1 summarizes state-program characteristics before and after EBT implementation.

Our extensive margin analysis examines EBT implementation effects on coverage rates (participation among eligible populations) and log(total participation). For intensive margin effects, we use average food expenditure per participant as a proxy for benefit redemption, which is not directly observed. Food expenditure captures only direct food benefit provision, including food packages, warehousing, and breast pump purchases. NSA costs measure non-food program expenses covering administrative functions, technology infrastructure, and EBT implementation. The National WIC association reports that approximately 35% of NSA grant funds support program administration, with technology-related costs accounting for about 13% of total state agency expenditures (Gleason et al., 2017; National WIC Association, 2018).

Table 1 shows minimal change post-EBT implementation in the coverage rate, participant composition, and infant feeding practices. In contrast, we observe substantial changes in spending: average food costs decreased by approximately 20% while average NSA costs increased by about 13% following EBT implementation.

CPS & ACS

We construct state-year controls and food security outcomes using the Current Population Survey (CPS) and the American Community Survey (ACS) (Flood et al., 2024; Ruggles et al., 2025). From these surveys, we derive state-year controls including: poverty rate, racial and ethnic composition, median household income, employment rates, educational attainment, and household structure. As shown in Table 1, these characteristics remain largely balanced between the pre- and post-EBT implementation periods.

[13] This state-year aggregation also avoids noise in monthly administrative expenditures, which occasionally report negative values.

Complementing our administrative data, we use the CPS Food Security Supplement to examine changes in program effectiveness. In particular, we analyze two food security measures among WIC-participating households: (1) the share of households reporting low or very low food security, and (2) the average household food security score. Despite the observed decrease in food expenditure, Table 1 shows little change in these food security outcomes following the transition to electronic benefits.

EBT

Data on the timing of EBT implementation by state is obtained from the USDA Food and Nutrition Service's WIC EBT Activities Status Report.[14] This resource documents the state-specific pilot date, state-wide rollout date, and state-wide completion date for WIC EBT implementation. Importantly, this data does not capture the trajectory of within-state implementation – the share of WIC participants in a given state using EBT at any point between rollout initiation and completion. For our analyses, we define treatment as beginning in the year of EBT state-wide rollout for all treated states, ensuring that our treatment indicator does not overlap with pre-treatment periods. Although the pilot date provides an alternative treatment timing measure, pilot programs may vary substantially in size and coverage across states, making treatment effect estimates based on pilot timing difficult to interpret.

3 Econometric Strategy

Event Study

Using the temporal variation in state-wide implementation of WIC EBT, we estimate the following event-study specification to analyze impacts on participation (extensive and intensive margins), administrative costs, food security among WIC participating households, and composition of participants:

$$Y_{s,t} = \sum_{k=T_0}^{-2} \psi_k E_{s,k} + \sum_{k=0}^{T_1} \psi_k E_{s,k} + \varphi_t + \gamma_s + \varepsilon_{s,t} \tag{1}$$

where s,t index the state and year respectively, φ_t are year fixed effects, and γ_s are state fixed effects. $Y_{s,t}$ is the outcome of interest: the coverage rate and log(total participation) for extensive margin participation; average food expenditure for intensive margin participation; average NSA costs for administrative costs; average score and share food insecure for food security; average share of participants for the composition of participants. Treatment is designated by $E_{s,k}$, a dummy

[14](Please see: https://www.fns.usda.gov/wic/wic-ebt-activities)

variable that equals one if state s is k periods away from treatment.[15] T_0 and T_1 represent the maximum number of periods before and after the policy implementation respectively, set to six years pre- and post- treatment for all analyses. For all estimates, we define the treatment as beginning with the period of state-wide EBT implementation.

The error term $\varepsilon_{s,t}$ is assumed to be mean zero, conditional on the covariates, and standard errors are clustered at the state-level across all specifications. The underlying identification assumption is parallel trends between the treated and untreated groups under counterfactual outcomes, i.e., in the absence of treatment these groups would evolve in parallel over time. Under these assumptions, ψ_k identifies the local average treatment effect (LATE) of treatment implementation on the outcome $Y_{s,t}$ k periods after treatment.

The data used in our analyses span the years 2005-2020, with sample size variation occurring due to availability of the outcome data.[16] For our estimation, we use the difference-in-difference estimator from Sun and Abraham (2021) to correct for the inappropriate weighting of group, time treatment effects from staggered policy implementation, an issue well documented in the economics literature (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021).[17]

As a secondary specification, we estimate the following pooled difference-in-difference for the same outcomes of interest:

$$Y_{s,t} = \psi D_{s,t} + \varphi_t + \gamma_s + \beta X_{s,t} + \varepsilon_{s,t} \tag{2}$$

where $D_{s,t}$ is a binary treatment indicator, $Y_{s,t}$ is the outcome of interest, φ_t are year fixed effects, γ_s are state fixed effects, and $X_{s,t}$ is a vector of time-varying controls, including socioeconomic characteristics. As in the event-study, the core identification assumption is parallel trends between treatment and controls, and the error term $\varepsilon_{s,t}$ is assumed to be mean zero. Under these assumptions, ψ identifies the LATE of the treatment on $Y_{s,t}$.

MVPF

To address the normative implications of electronic benefit transfer, we estimate the marginal value of public funds (MVPF):

$$\text{MVPF} = \frac{\text{WTP}}{\text{ME} + \text{FE}} \tag{3}$$

[15] The coefficients are normalized with respect to the period immediately prior to treatment. This $k = -1$ period is excluded from the regression to avoid perfect multicollinearity.

[16] Please see Section 2.3 for additional details.

[17] Failure to correct for staggered treatment timing may result in the application of negative weights to particular group-time effects.

Calculated as the ratio of the willingness-to-pay (WTP) of beneficiaries to the net cost to the government – the sum of the mechanical effect (ME) and the fiscal externality (FE) – the MVPF provides a welfare valuation of marginal changes in policy inclusive of any induced behavioral changes. In our context, the estimated MVPF represents the welfare cost to WIC participants from each dollar of government savings generated by the policy change. For each component, we use coefficient estimates from the pooled difference-in-difference specifications (equation 2): the willingness-to-pay (WTP) and fiscal externality (FE) are estimated by average food expenditure; the mechanical effect (ME) is estimated by average NSA expenditure; food security informs our estimation of WTP. For all MVPF estimates, we impose that net government costs cannot be increased by EBT ($FE + ME < 0$). If government costs are increased by EBT, a negative WTP implies that the policy change has an infinite welfare cost: increasing government costs and decreasing participant welfare. With this baseline assumption, we examine the MVPF under various additional assumptions.

4 Results

In this section, we present our event-study (Equation 1), pooled difference-in-difference (Equation 2), and MVPF estimates (Equation 3)for the effect electronic benefit transfer.

4.1 Extensive Margin Participation

We first plot the estimated change in the take-up of WIC benefits relative to one-year prior to the implementation of WIC EBT (Figures 1c and 1d). There is no evidence of pre-trends for either the coverage rate or log(Total Participation), and following EBT implementation, there is a small, positive, and statistically insignificant effect on participation. Although our results cannot exclude small changes in extensive margin participation, they rule out large changes and suggest that the transition to electronic benefits had a minimal effect on the program participation rate.

Supporting these results, the pooled participation estimates (equation 2) show no evidence of any effect on extensive margin participation and rule out changes in the coverage rate greater than 2.3 percentage points (Table 2). The inclusion of controls for the composition of participants and state-level controls does not affect the statistical significance of the treatment coefficient estimates. Our results suggest that the larger participation effects found in some prior analyses of WIC EBT are likely spurious or related to sample characteristics. By using the coverage rate, our estimates account for changes in eligibility that may drive changes in gross participation, and we use the state-agency as the unit of treatment, avoiding the SUTVA violations from local agency and county level analysis. With both these changes, we find no evidence to suggest that WIC participation is

affected, positively or negatively, by the transition to electronic benefits.

EBT cards are thought to affect take-up by reducing hassle and stigma costs; however, our results show that electronic benefits do not meaningfully reduce these costs or that these costs play a minor role in determining program participation. Prior research indicates that the latter is unlikely (Currie, 2006; Armour, 2018; Bhargava and Manoli, 2015; Finkelstein and Notowidigdo, 2019), and if these costs matter for participation, the observed participation effects can be understood by the temporal difference between program take-up and cost reduction. The reduction in cost occurs only after the participation decision has been made and does not affect the upfront participation costs, e.g., required visits to WIC clinics. As such, future discounting or a failure to recognize benefit redemption costs by eligible non-participants offers one explanation for the observed participation results.

In addition, the extent to which EBT reduces total cost is unclear. WIC participants are typically required to come in-person to a WIC clinic 2-4 times per year for benefit loading, certification activities, and health measurements. These hassle costs of participation are not affected by the transition to electronic benefits, and if benefit use related stigma and hassle costs are relatively small compared to these other costs, then no observable change in participation is natural. In such circumstances, even a large decline in small benefit usage costs would account for only a minor reduction in the total cost of participation, resulting in minimal change in participation.

4.2 Intensive Margin Participation

Examining the intensive margin of program participation, we plot the estimated change in average monthly per participant food expenditure relative to one-year prior to EBT (Figure 1a). There is no evidence of pre-trends in average food expenditure, and following treatment, there is a sharp and sustained decline in food expenditure of approximately \$5 – 16% of the pre-EBT mean. All post-treatment coefficient estimates are negative, and the estimates for 2-4 years post treatment are statistically significant, with the effect maximized in year three. The pooled food expenditure estimates (equation 2) show a statistically significant decline of approximately \$1.6 – 5% of the pre-EBT mean – following the transition to electronic benefits (Table 2), and the statistical significance of these estimates is not affected by the inclusion of controls for the composition of participants and state-level characteristics.

The surprising decline in average food expenditure has a few possible explanations: (1) food expenditure is a poor measurement of food costs and includes non-food administrative program spending; (2) EBT imposes an additional, unexpected transaction cost on participants; (3) participants intentionally reduce the redemption of food benefits; (4) the composition of participants and food packages changes as a result of EBT, decreasing cost; (5) retailer prices charged to WIC par-

ticipants decrease. Through an examination of these alternative explanations, we will demonstrate that this surprising decline likely reflects an intentional behavioral response among participants who, with EBT's enhanced flexibility, choose to redeem only those benefits they truly value.

Mismeasurement

Addressing the first explanation, WIC funding is split between food grants and NSA grants, with the latter covering "management functions (e.g., establishing program policies and procedures, operating food delivery systems, monitoring program operations) and nutrition services functions (e.g., conducting nutrition assessments, providing nutrition education, making referrals)" (Gleason et al., 2017). Program food costs, our proxy for the redemption of benefits, are funds spent on the direct provision of food benefits and breast-pumps to participants, not inclusive of administrative costs. Changes in administrative or benefit delivery costs from the transition to electronic benefits will be captured by NSA expenditure, which explicitly includes funds spent to "[d]evelop, implement, and maintain information systems and technology used to provide services" (Gleason et al., 2017), making food expenditure an appropriate proxy for the redemption of food benefits and mismeasurement unlikely.

Unexpected Transaction Costs

Addressing the possibility of unexpected transaction costs, electronic benefits eliminated the use of paper checks, which listed participant food benefits and acted as an informal shopping list. The removal of this easily accessible list of benefits may increase the difficulty of recalling and redeeming all food benefits; however, there are a number of support services that make this explanation unlikely. Across state agencies, participants have a number of options for checking remaining benefits, including: customer receipts, state managed phone lines, requesting a remaining balance check from store clerks, assistance from retailer customer service, and smartphone applications. If EBT imposed such a benefit information shock, we would anticipate some form of learning behavior, with a sharp immediate drop in expenditure and gradual attenuation of the treatment effect. In contrast, we observe a gradual and steady decline in the usage of benefits, which suggests that participants do not experience an information shock from EBT introduction.

Behavioral Response

Addressing the behavioral response explanation, electronic benefits relax the temporal constraints on food benefit usage in WIC, decreasing the option value of food benefits. Prior to EBT, participants faced a unique constraint on the timing of redemption, as the paper check system necessitated the simultaneous redemption of all benefits. Any benefits not redeemed on a check would be lost

for the remainder of the issuance period, introducing uncertainty about item desirability and generating option value for each food benefit. Due to the associated option value, participants may rationally choose to redeem all available benefits, regardless of immediate need and consumption value. The policy change eliminates this temporal constraint and the option value of each food benefit, thereby reducing the redemption of benefits. Supporting this notion, Bitler et al. (2024) finds lower redemption rates for items more likely to be redeemed at the end of the benefit cycle, i.e., those benefits redeemed due to their impending expiration.

Examining household food security, the policy change has no statistically significant effect on the share of food insecure or the average food security score of WIC participating households (Figure 1f). This suggests that the previous system induced redemption of benefits with a low consumption value – i.e., those redeemed solely due to the associated option value. By offering greater flexibility in benefit redemption, EBT allows participants to tailor their benefit redemption to personal preference, aligning redemption with actual consumption. Our food security estimates show that the drop in benefit usage is likely due to household preferences and the low value placed on specific food items.

Participant Composition

Addressing participant composition, WIC food package assignment and associated food cost may vary by participant category and nutritional need. As such, a change in the composition of the participant pool offers an alternative explanation for the observed decline in food expenditure. In particular, breastfeeding practice determines food package assignment for participating women and infants, and breastfeeding mothers receive a more generous food package and increased duration of eligibility. Plotting the estimated change in the share of participants, we find no evidence that the composition of participants is affected by the transition to electronic benefits (Figure 2). Although we cannot rule out small changes, our coefficient estimates are approximately zero and statistically insignificant for mothers, infants, and children.

Price Discrimination and Retailer Participation

Addressing the fifth explanation, participant shopping patterns and retailer pricing offer an alternative explanation for the observed effect on food expenditure. Meckel (2020) finds that EBT implementation affects the composition of WIC retailers, reducing the number of independent retailers that participated in the program, and provides evidence that these small retailers are more likely price discriminate, overcharging WIC for food items. If EBT drives these firms to exit the program and increases the difficulty of price discrimination, food expenditure may decrease without a corresponding decline in redemption. Of note, the identification in Meckel (2020) uses

the staggered implementation of EBT at the Texas county-level between 2005-2009, an approach which introduces potential SUTVA violations from the use of local area implementation and overlap with the 2009 Food package revision.[18] The latter introduced stocking requirements for fresh fruits and vegetables, which disproportionately affect independent retailers and offers a secondary explanation for the observed 10.7% decline in independent retailer participation. In addition to these methodological concerns, independent stores comprise less than 25% of total WIC spending (Tiehen and Frazão, 2016). Given the estimated 15% decline in food expenditure, this would require spending at independent retailers to fall by approximately 60% following the policy change – a magnitude far larger than documented retailer exit rates and implausible as the sole explanation.

Of these possible explanations, our results indicate that the observed decline in average food expenditure reflects an intentional, behavioral response among WIC participants. Following the transition to electronic benefits, participants choose not to redeem parts of the assigned food package, reducing average monthly per participant food expenditure.

4.3 Welfare

We next address the normative implications of electronic benefit transfer, estimating the marginal value of public funds (equation 3) using our coefficient estimates from the pooled difference-in-difference specifications (equation 2). Our estimates (Table 3) capture the dollar-denominated welfare cost to WIC participants from each dollar of government savings generated by the policy change. Given our statistically insignificant findings along the extensive margin (Figure 1c, Table 2), we focus on the welfare implications of intensive margin effects and administrative costs. Although we do not incorporate the reduction in hassle and stigma at checkout from EBT into our welfare analysis, these changes must have some non-negative value to participants, and correspondingly, our estimates will overstate the welfare cost imposed on participants from EBT. Throughout our analysis, we maintain the assumption that the policy change decreases net government costs ($\text{FE} + \text{ME} < 0$). If EBT were to increase government costs, the policy is welfare reducing unless participants place zero value ($\text{WTP} = 0$) on unredeemed benefits. By examining welfare under various additional assumptions, we demonstrate that the transition to electronic benefits likely increases overall welfare through its intensive margin effects.

Benefits Valued at Face Value

Our baseline assumption imposes that participants value WIC benefits at their dollar value ($\text{FE} = \text{WTP}$), meaning that any unredeemed food benefits represent a non-zero welfare cost to partici-

[18] Please see Section 2.2 for a more detailed discussion of the SUTVA violations from using the local-area as the treatment unit.

pants. Under this conservative assumption, our coefficient estimates identify the range of feasible MVPF values as $[0.55, \infty]$. This range indicates that EBT could potentially impose welfare costs on participants exceeding \$1 for each dollar of government savings – when the net effect on government costs is relatively small – or may instead be welfare-improving when administrative savings are generated(ME < 0). Even under this conservative approach to the valuation of WTP, our estimates suggest EBT may enhance societal welfare.

Benefits Valued Below Face Value

Relaxing our first assumption enables us to decouple government costs from participant welfare effects. If participants strategically forgo the redemption of benefits on which they place the least value, their willingness-to-pay for these unredeemed benefits likely falls below the market price ($|\text{WTP}| \leq |\text{FE}|$) and may approach zero. Empirically, we find that the prevalence of food insecurity and average food security scores among WIC participants (Figures 1e and 1f) remain stable following the transition to electronic benefits. This suggests that participant welfare is minimally affected by unredeemed benefits, and that EBT generates government savings for negligible welfare cost to participants.

No Administrative Cost Changes

As a final scenario, we consider the case where administrative costs are unaffected by the transition to electronic benefits (ME $= 0$). This assumption is supported by our empirical findings, which show no statistically significant change in Nutrition Services and Administration (NSA) costs after EBT implementation (Figure 1b). With no change in administrative expenses, EBT necessarily generates at least \$1 of government savings for each dollar of welfare cost to participants. In the worst case (MVPF $= 1$), the policy functions as a dollar-for-dollar welfare transfer from participants to taxpayers.

Contrary to USDA expectations, our analysis indicates that EBT does not measurably increase participant welfare; however, it improves societal welfare through reductions in government expenditures. The welfare improvements are driven by individual choice: participants strategically forgo benefits on which they place the lowest value, minimizing individual welfare loss. By comparison, an alternative policy of equivalent cost savings by uniform cuts or elimination of certain food benefits would necessarily impose greater individual welfare cost, as some participants inevitably value the lost food benefits. Thus, even elimination of food benefits with the lowest average willingness-to-pay is not welfare maximizing in comparison with the individual screening enabled by EBT. Despite concerns about negative effects on retailer and extensive margin participation, our findings show that EBT implementation is a welfare-enhancing policy change.

5 Conclusion

In this manuscript, we have examined the transition to Electronic Benefit Transfer (EBT) within the Special Supplemental Nutrition Program for Women, Infants, and Children program, evaluating its effect on program participation, benefit utilization, and food security outcomes. Contrary to USDA expectations, we find that EBT implementation did not significantly increase program participation rates among eligible households. Instead, the primary effect of the policy change has been from adjustments to benefit redemption patterns. Our normative analysis shows clearly that societal welfare is increased by the fall in net government costs from these changes in participant behavior. The selective screening of food benefits by participants generates cost savings while minimizing welfare loss, increasing welfare. Our findings show the importance of both extensive and intensive margin responses when evaluating public assistance programs.

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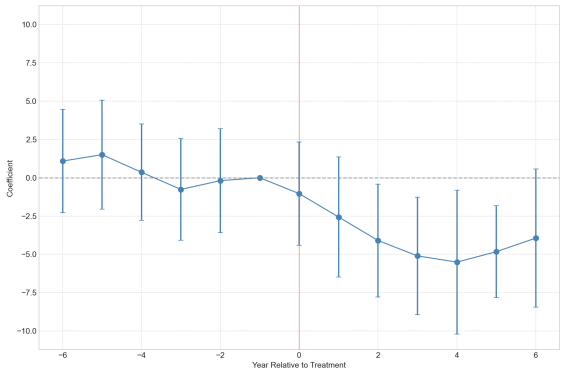
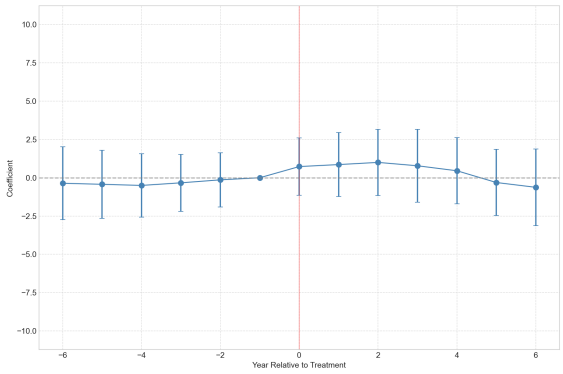
6 Figures

Figure 1: Event Study: Spending, Participation, and Food Security Effects from EBT

Panel A: Administrative Spending

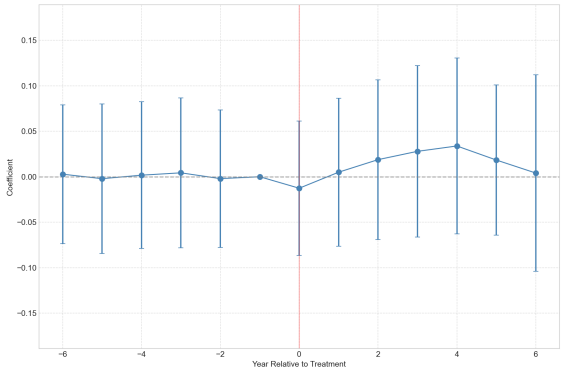


(a) Food Spending

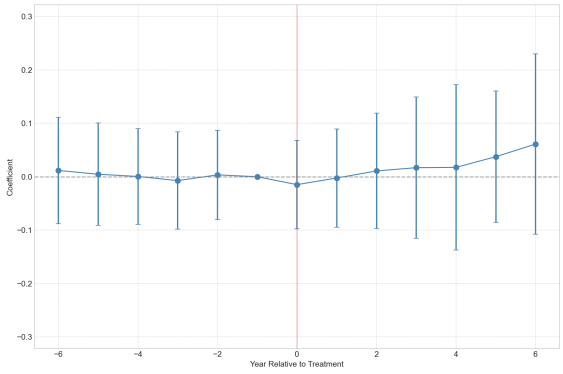


(b) NSA Costs

Panel B: Extensive Margin Participation

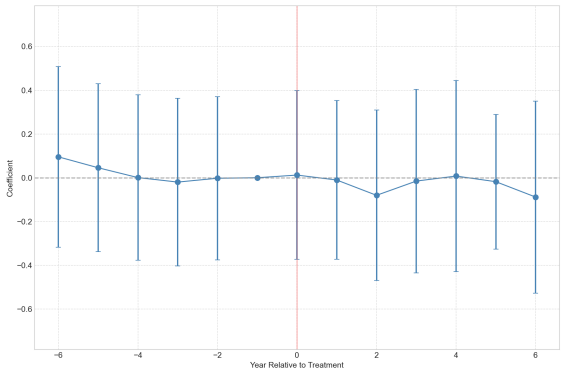


(c) Coverage Rate

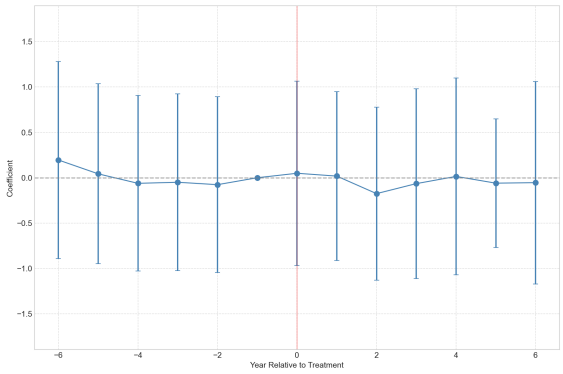


(d) Log(Total Participation)

Panel C: Food Security



(e) Share Food Insecure

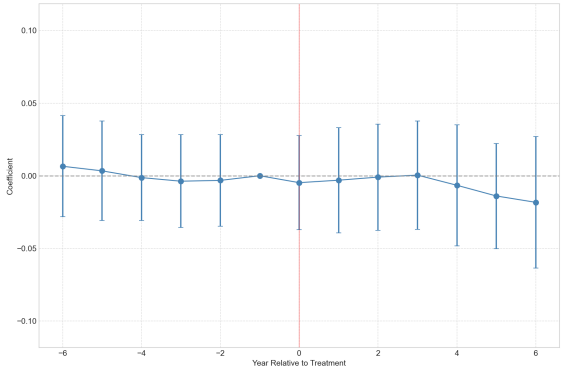


(f) Food Security Score

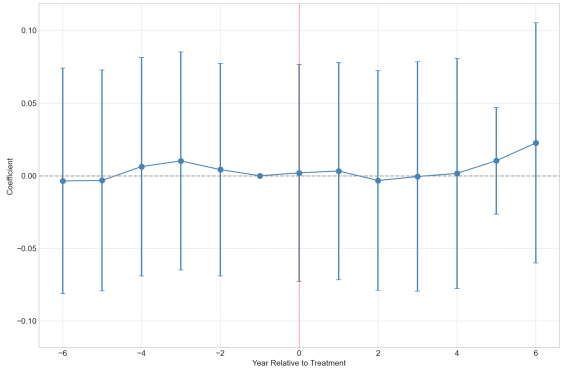
This figure presents the event-study estimates of ψ_k (Equation 1) for the change in program spending, program participation, and participant food security from WIC EBT using the estimator from Sun and Abraham (2021). Panel A presents estimates for the effect on mean food expenditure (capturing benefit redemption) and Mean Nutrition Services and Administration (NSA) Costs (capturing mechanical effects).For both figures in Panel A, the outcome is average monthly spending per participant, and a coefficient estimate of -1 represents a one dollar decline in average monthly expenditure. Panel B present estimates for the effect of EBT on extensive margin program participation, measured by the coverage rate (participation rate among the eligible) and log(total participation). Panel C presents estimates for the effect of EBT on food security among WIC participants, measured by the following: (1) the share of food insecure participants; (2) average food security score. For the latter, positive coefficient indicate increased food insecurity. All estimates include state and year fixed effects, and standard errors are clustered at the state level.

Figure 2: Event Study: Composition of Participants

Panel A: Pregnant Women & Children

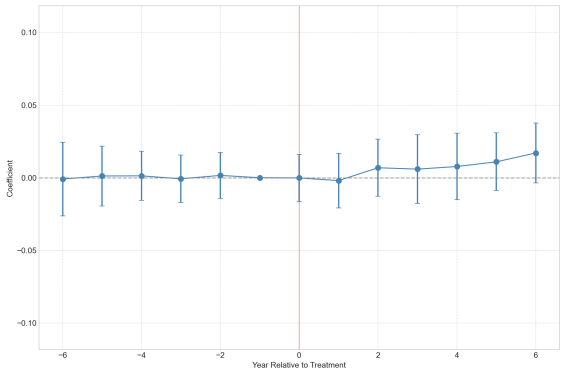


(a) Children

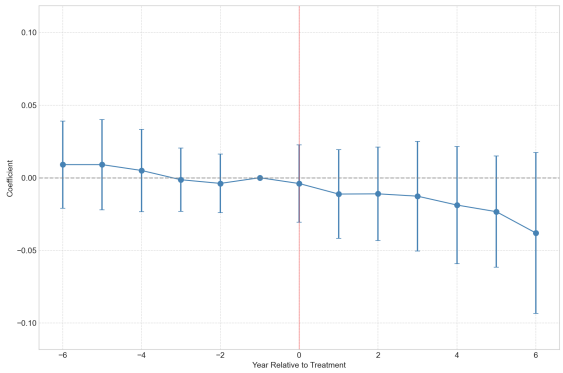


(b) Pregnant Women

Panel B: Fully Breastfeeding

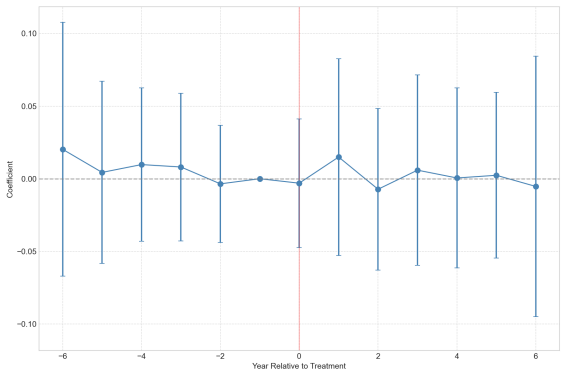


(c) Infants

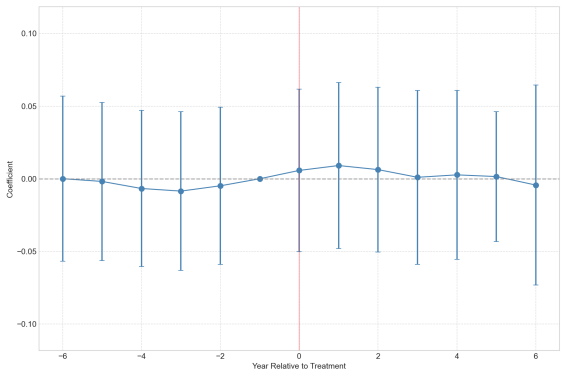


(d) Women

Panel C: Fully Formula-feeding



(e) Infants



(f) Women

This figure presents the event-study estimates of ψ_k (Equation 1) showing the effects of EBT implementation on the composition of participants using the estimator from Sun and Abraham (2021). Panel A displays changes in participation shares for pregnant women and children. Panel B displays changes in participation shares for fully breastfeeding women and infants. Panel C displays changes in participation shares for fully formula-feeding women and infants. For all figures, the independent variable is the share of participants, and a coefficient estimate of -.1 represents a 10 percentage point decline in the share of participants. All specifications include state and year fixed effects, and standard errors are clustered at the state level.

7 Tables

Table 1: State Characteristics Pre-, Post-EBT Adoption

	Post-EBT			Pre-EBT			
	Mean	Obs	SD	Mean	Obs	SD	Difference
Program Spending and Participation							
Coverage Rate	0.55	174	0.06	0.57	591	0.08	−0.02
Average Monthly Food Costs	25.54	221	4.03	32.09	595	4.48	−6.55
Average Monthly NSA Costs	16.89	217	3.71	14.95	446	3.05	1.94
Percentage Women	0.23	217	0.02	0.24	446	0.01	0.00
Percentage Infants	0.25	217	0.03	0.25	446	0.02	0.00
Percentage Children	0.52	217	0.04	0.52	446	0.04	0.00
Composition of Women and Infants							
Pregant Women	0.40	217	0.05	0.42	446	0.05	−0.03
Fully Formula Feeding Women	0.30	217	0.06	0.32	446	0.07	−0.01
Partially Breastfeeding Women	0.15	210	0.08	0.13	351	0.06	0.02
Fully Breasting Women	0.15	217	0.06	0.16	446	0.08	−0.01
Fully Breastfeeding Infants	0.14	210	0.06	0.13	351	0.07	0.01
Partially Breastfeeding Infants	0.16	210	0.09	0.14	351	0.08	0.01
Fully Formula Feeding Infants	0.70	210	0.09	0.73	351	0.11	−0.02
Food Security							
Share Households Food Insecure	0.13	222	0.03	0.14	645	0.03	−0.01
Share WIC-Households Food Insecure	0.41	221	0.19	0.42	645	0.15	−0.01
WIC Food Security Score	2.17	221	0.38	2.21	645	0.33	−0.04
Demographics							
Poverty Rate	0.12	222	0.04	0.13	645	0.03	0.00
Black	0.09	222	0.07	0.12	645	0.12	−0.03
Hispanic	0.15	222	0.13	0.09	645	0.08	0.05
Median Household Income	40703.59	222	6666.64	39447.15	645	6384.29	1256.44
Female Unemployment Rate	0.05	222	0.02	0.06	645	0.02	0.00
Less than High School Degree	0.31	222	0.04	0.33	645	0.04	−0.02
College or Higher	0.22	222	0.05	0.20	645	0.05	0.01
Household Structure							
Married	0.40	222	0.02	0.40	645	0.04	0.00
Households with Children < 5	0.09	222	0.01	0.10	645	0.02	−0.01
Households Employed with Children	0.91	222	0.04	0.90	645	0.04	0.01
Employed Women with Children	0.64	222	0.07	0.63	645	0.06	0.01

This table presents the mean characteristics of state WIC programs and states from USDA Administrative Records and the Current Population Survey Annual Social and Economic Supplement (CPS-ASEC), aggregated to state-year, before and after EBT implementation, between January 2004 and December 2020. The Coverage Rate is the participation rate among the eligible, with the later estimated by the FNS. Average Monthly Food and NSA Costs capture the two distinct buckets of program spending. The percentage of women, infants, and children present the categorical composition of the program. The composition of women and infants presents the proportion of infants and adult-women participants by food package. Food Security presents the share of food-insecure households and the average food security score for WIC participating households – a higher score corresponds to increased insecurity. Demographics presents general state demographic characteristics. Household structure presents general state household characteristics.

Table 2: Pooled Difference-in-Differences Estimates

Panel A: Program Spending

	Average Food Spending ($)			Average NSA Costs ($)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment						
EBT	−1.576	−1.301	−1.299	0.234	0.169	0.151
	(0.460)***	(0.369)***	(0.360)***	(0.328)	(0.323)	(0.283)
Controls						
State FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Participant Controls		✓	✓		✓	✓
All Controls			✓			✓
Observations	816	663	663	663	663	663

Panel B: Extensive Margin Participation

	Coverage Rate			Total Participation (log)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment						
EBT	0.005	0.000	−0.004	0.026	0.018	0.015
	(0.009)	(0.008)	(0.007)	(0.016)	(0.012)	(0.011)
Controls						
State FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Participant Controls		✓	✓		✓	✓
All Controls			✓			✓
Observations	765	612	612	816	663	663

Panel C: Food Security

	Food Insecurity			Food Security Score		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment						
EBT	−0.031	−0.031	−0.023	−0.050	−0.051	−0.041
	(0.024)	(0.028)	(0.026)	(0.047)	(0.056)	(0.051)
Controls						
State FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Participant Controls		✓	✓		✓	✓
All Controls			✓			✓
Observations	866	662	662	866	662	662

This figure presents the event-study estimates of ψ (Equation 2) showing the pooled-effect of EBT implementation on program spending, program participation, and participant food security using the estimator from Sun and Abraham (2021). Panel A presents estimates for the effect on mean food expenditure (capturing benefit redemption) and mean Nutrition Services and Administration (NSA) Costs (capturing mechanical effects). For both tables in Panel A, the outcome is average monthly spending per participant, and a coefficient estimate of -1 represents a one dollar decline in average monthly expenditure. Panel B present estimates for the effect of EBT on extensive margin program participation, measured by the coverage rate (participation rate among the eligible) and log(total participation). Panel C presents estimates for the effect of EBT on food security among WIC participants, measured by the following: (1) the share of food insecure participants; (2) average food security score. All estimates include state and year fixed effects, and standard errors are clustered at the state level.

Table 3: Welfare: MVPF Estimates

Panel A: Benefits Valued at Face Value

	(1)	(2)	(3)
Components			
Willingness to Pay ($)	[-2.478, -0.674]	[-2.024, -0.578]	[-2.005, -0.593]
Mechanical Cost ($)	[-0.409, 0.877]	[-0.464, 0.802]	[-0.404, 0.706]
Fiscal Externality ($)	[-2.478, -0.674]	[-2.024, -0.578]	[-2.005, -0.593]
State FE	✓	✓	✓
Year FE	✓	✓	✓
Participant Composition		✓	✓
All Controls			✓
MVPF	$[0.62, \infty]$	$[0.55, \infty]$	$[0.59, \infty]$

Panel B: Benefits Valued Below Face Value

	(1)	(2)	(3)
Components			
Willingness to Pay ($)	[-2.478, 0]	[-2.024, 0]	[-2.005, 0]
Mechanical Cost ($)	[-0.409, 0.877]	[-0.464, 0.802]	[-0.404, 0.706]
Fiscal Externality ($)	[-2.478, -0.674]	[-2.024, -0.578]	[-2.005, -0.593]
State FE	✓	✓	✓
Year FE	✓	✓	✓
Participant Composition		✓	✓
All Controls			✓
MVPF	[0, ∞]	[0, ∞]	[0, ∞]

Panel C: No Administrative Cost Changes

	(1)	(2)	(3)
Components			
Willingness to Pay ($)	[-2.478, 0]	[-2.024, 0]	[-2.005, 0]
Mechanical Cost ($)	0	0	0
Fiscal Externality ($)	[-2.478, -0.674]	[-2.024, -0.578]	[-2.005, -0.593]
State FE	✓	✓	✓
Year FE	✓	✓	✓
Participant Composition		✓	✓
All Controls			✓
MVPF	[0.00, 1.00]	[0.00, 1.00]	[0.00, 1.00]

This table presents estimates of the Marginal Value of Public Funds (MVPF) under three analytical scenarios. Estimates for component parts are derived from the 95% confidence intervals of Table 2. Panel A shows our baseline estimates where participant willingness-to-pay equals fiscal externality (WTP = FE). Panel B relaxes this constraint by allowing willingness-to-pay to potentially equal zero ($|\text{WTP}| \leq |\text{FE}|$), decoupling government costs from participant welfare effects. Panel C examines the special case where mechanical effects equal zero (ME = 0), isolating the welfare implications of intensive margin effect.