ECONOMETRICA, INC.

Revised Findings Report

Final

CACFP Sponsor Tiering Determination Aging Study, 2015–2020

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Executive Summary

ES.1. Background

The U.S. Department of Agriculture Food and Nutrition Service administers the Child and Adult Care Food Program (CACFP) to provide financial support to eligible daycare homes and centers that serve meals to children who are enrolled to receive childcare. Originally established in 1968, CACFP has steadily increased its reach. In Fiscal Year (FY) 2015, a daily attendance of 4.18 million participants benefited from more than 2 billion meals and snacks reimbursed by CACFP. Approximately 3.3 million of the 4.18 million participants were served in childcare centers, whereas approximately 780,000 children were served in daycare homes,[1] which corresponded to 1.4 billion meals and snacks served in centers (70 percent of total) and 526 million meals and snacks served in homes (25 percent of total).[2] Participating daycare homes are reimbursed by CACFP on a per-meal basis at a pre-determined rate, which varies based on the type of meal provided (breakfast, snack, or lunch/supper) and the level of reimbursement the provider qualifies for (Tier I, which receives a higher reimbursement rate, or Tier II). As an example of the magnitude of these rates, Table ES-1 shows the reimbursement rates in effect from July 1, 2014, through June 30, 2015 (Program Year (PY) 2015).[3] Eligibility for the Tier I rate is based on the location of the daycare home in a low-income area or the provider's own household income level. Providers who do not meet the Tier I eligibility criteria are classified as Tier II and receive lower rates of reimbursement. However, meals served to low-income children in Tier II homes are eligible for higher reimbursement.

Table ES-1. CACFP Reimbursement Rates, PY 2015

	Breakfast		Lunch/Supper		Snack	
Year	Tier I	Tier II	Tier I	Tier II	Tier I	Tier II
July 1, 2014–June 30, 2015	$1.31	$0.48	$2.47	$1.49	$0.73	$0.20

Source: Federal Register, https://www.fns.usda.gov/cacfp/federal-register-documents/notices/view-all.

Because reimbursement rates are tiered based on a set of need-based qualifications, and Tier I offers a substantially higher reimbursement rate than Tier II, each year tiering errors occur (stemming both from intentional abuse of the program as well as unintentional misuse) that result in erroneous reimbursement payments. Errors are observed in both directions; that is, entities that qualify for Tier I are reimbursed at the lower Tier II levels (i.e., are underpaid), and entities that only qualify for Tier II are reimbursed at the higher Tier I levels (i.e., are overpaid). The latter

[1] Data estimated from http://frac.org/wp-content/uploads/cacfp-participation-trends-2016.pdf, retrieved on May 24, 2018.

[2] Data obtained from https://fns-prod.azureedge.net/sites/default/files/pd/ccsummar.pdf, retrieved on May 24, 2018.

[3] Previous tiering assessments, which provide data on sampled Family Day Care Home (FDCH) error rates and meals served in error for this tiering study, focused on PY. A PY runs from August of a given calendar year to July of the following calendar year, and as such, is not aligned with FYs. The analysis in this report relies predominantly on FY data. If data described in this report are wholly calculated or provided by PY, then PY is referenced; otherwise, yearly data is denoted as FY.

(erroneous overpayment) is observed much more frequently than the former. However, all error rates have been observed to be steadily declining since FY 2011. In FY 2011, under and over payments yielded an overall tiering error rate of 1.58 percent of FDCHs, resulting in $11.98 million in erroneous reimbursements, while as of FY 2015, the error rate had declined to 0.54 percent, costing $4.18 million.

The goal of the analysis presented in this report is to forecast the Tier I, Tier II, and overall error rates for each year from FY 2016 through FY 2020 and to estimate the cost to CACFP associated with the predicted tiering errors. This analysis was contracted to Econometrica, Inc., which leveraged existing data to develop and execute a modeling strategy to produce accurate forecasts for CACFP.

ES.2. Analytical Framework

Econometrica performed the analysis in two discrete steps. First, the team examined the evolution of Tiering Error Rates over time and explored the correlation between these error rates and sociodemographic, economic, and structural factors. This baseline descriptive analysis revealed the relationship between the error rates and these broad factors and informed the specification of later multivariate regression analysis. In Step 2, Econometrica used a multistage regression to forecast error rates and the resulting erroneous reimbursement amounts in each year from FY 2016 to FY 2020.

These analyses were constructed on the foundation of two types of error:

1. The probability of having ***any*** error, regardless of the number of meals provided.
2. The percentage of meals provided in error, ***if*** the provider had an error. Providers that did not have any errors were excluded from this category.

ES.3. Methodology and Results

ES.3.1. Step 1

The main goal of Step 1 was to gain an understanding of the factors that contribute to Tiering Error Rates to identify the covariates necessary to include in the regression analysis to accurately produce forecast estimates. Econometrica consulted current literature and a subject matter expert (SME) to construct a list of potential control variables, including CACFP descriptive variables, State- and national-level socioeconomic variables, educational achievement variables, and technological indicator variables. Econometrica worked with these data to identify a subset of variables whose correlation with Tiering Error Rates were statistically significant; the subset of statistically significant variables (listed in Table ES-2, along with their correlation coefficient and t-statistic) were included in the econometric analysis in Step 2.

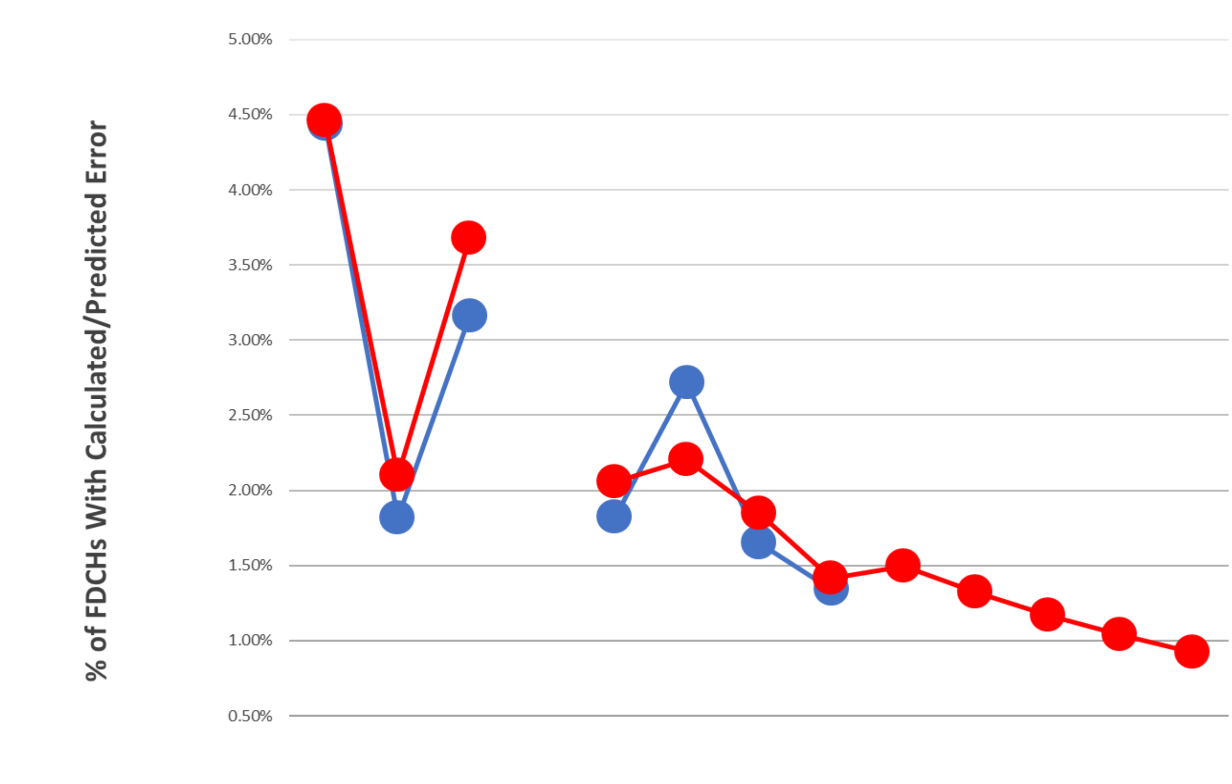
Table ES-2. Statistically Significant Correlation Between State-Year Level Selected Variables and FDCH-Level Tiering Error Incidence Rates, FYs 2008–2015

Variable	Correlation	T-Statistic
Math Scores	0.17%	4.91
% Children in Poverty, <18	-20.59%	(3.96)
% Children in Poverty <5	-16.93%	(3.33)
% Expenditure per Capita	30.59%	2.97
Science Scores	0.10%	2.93
Percent w/o Broadband Access	-4.76%	(2.88)
Graduation Rate, Econ. Disadv.	-11.71%	(2.85)
% Math Proficient	8.79%	2.59
Avg. Sponsor Size	0.00%	2.42
% Advanced Math	21.25%	2.34
% Basic Math	9.55%	2.03

ES.3.2. Step 2

In the second step, Econometrica used a multistage regression process to forecast error rates and the resulting erroneous reimbursement amounts in each year from FY 2016 to FY 2020. In the first stage, the team constructed a logit model to estimate the probability of a tiering error over various lengths of time (1 to 5 years) into the future. The model regressed a binary dependent variable ($y_{it} = 1$ if $FDCH_i$ had a tiering error in year t, $y_{it} = 0$ otherwise) against the year-based sociodemographic, economic, and structural variables listed above, as well as a time trend/fixed effect. The model was estimated for FY 2008 to FY 2015 and then forecasted for FY 2016 to FY 2020. As Figure ES-1 shows, the predicted Tiering Error Rates from this model aligned well with the observed data from FY 2008 to FY 2015.

Figure ES-1. Estimated Misclassification as Percentage of FDCHs, Overall, FYs 2008–2020



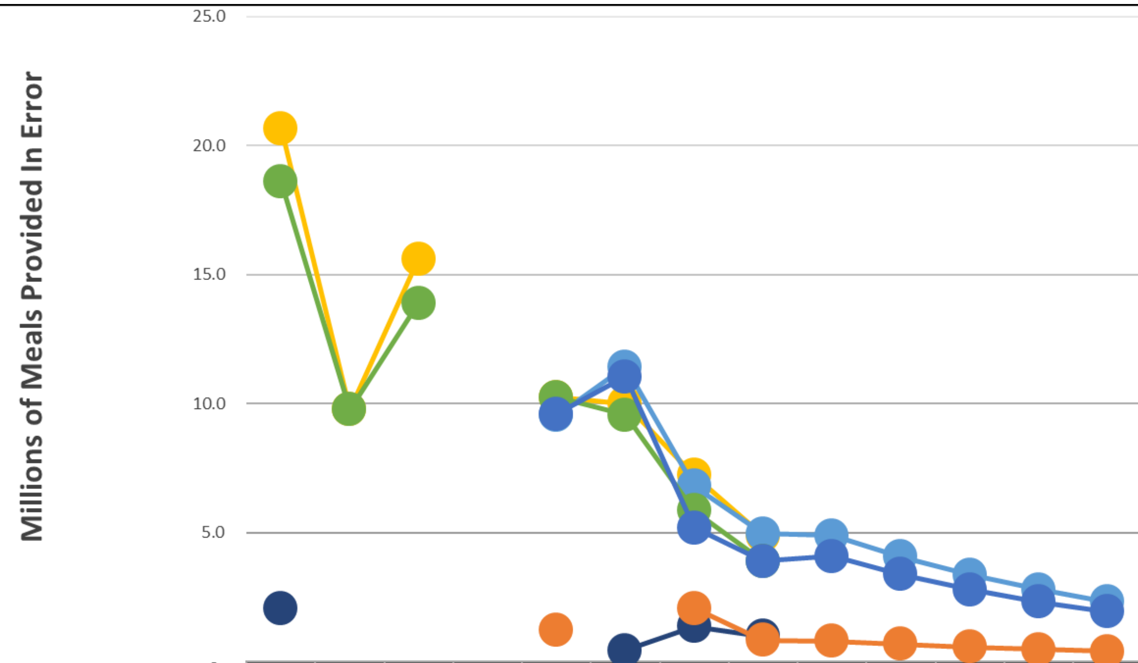
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tiering Error Rate - Observed	4.44%	1.82%	3.16%		1.82%	2.72%	1.65%	1.34%					
Tiering Error Rate - Estimated	4.46%	2.10%	3.68%		2.06%	2.20%	1.85%	1.41%	1.49%	1.32%	1.17%	1.04%	0.92%

Note: Error Rates correspond to the percentage of misclassified FDCHs.

In the second stage of Step 2, Econometrica estimated the number of meals provided in error, given that a provider had an erroneous tier classification. Analysis in this stage consisted of two parts. First, a multivariate regression estimated and predicted the proportion of meals provided in error out of the total number of meals provided by entities with a tiering error.[4] The resulting predicted values for this regression were used to estimate the total number of meals-in-error as the simple product of the percent of meals-in-error, the error rate, and the total number of meals. These estimates followed the trends in the data observed from FY 2008 to FY 2015 and found the model fit the data well. Figure ES-2 shows the Stage 2 estimates.

[4] This step is needed because, while the tiering error applies to the designation of the FDCH, children may also be designated as Tier I or Tier II, which implies that not all meals provided by a FDCH with a tiering error are provided in error. See "Child and Adult Care Food Program (CACFP): Assessment of Sponsors' Tiering Determinations Program, Year 2015, Final Report.", page 23, https://fns-prod.azureedge.net/sites/default/files/ops/CACFPTiering2015.pdf.

Figure ES-2. Estimated Number of Meals Reimbursed in Error – Overall and by Tier, FYs 2008–2020

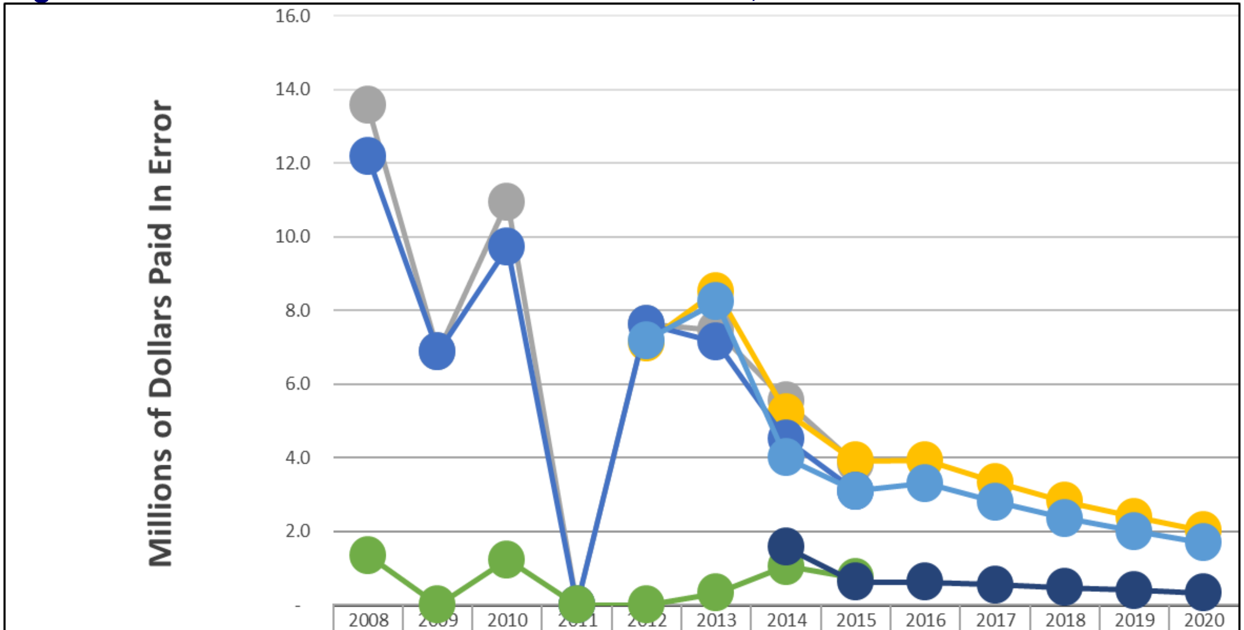


	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Meals in Error (Observed)	20.7	9.8	15.6		10.2	10.0	7.2	4.9					
Meals in Error (Estimated)					9.5	11.4	6.8	5.0	4.9	4.1	3.4	2.8	2.3
Meals in Error. Tier 1 (Observed)	18.6	9.8	13.9		10.2	9.6	5.8	3.9					
Meals in Error, Tier 1 (Estimated)					9.6	11.0	5.2	3.9	4.1	3.4	2.8	2.3	1.9
Meals in Error, Tier 2 (Observed)	2.1					0.4	1.4	1.0					
Meals in Error, Tier 2 (Estimated)					1.2		2.1	0.8	0.8	0.7	0.6	0.5	0.4

Note: Tier II values were estimated using the estimated rate of error and the estimated proportion of meals-in-error overall and for Tier I.

Using the estimated error rates, proportion of meals-in-error, and number of meals-in-error, Econometrica also estimated the costs of the predicted meals-in-error. Econometrica first calculated the unit cost of an error by dividing the total error cost by the total number of meals-in-error and then multiplied the unit cost by the estimated number of meals-in-error. Figure ES-3 shows the estimated costs of misclassification.

Figure ES-3. Estimated Costs of Misclassification, FYs 2008–2020



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Error Costs - Observed	13.6	6.9	10.9	-	7.6	7.5	5.5	3.8					
Error Costs - Estimated					7.1	8.5	5.2	3.9	3.9	3.3	2.8	2.4	2.0
Error Costs - Tier 1 - Observed	12.2	6.9	9.7	-	7.6	7.1	4.5	3.1					
Error Costs - Tier 1 - Estimated					7.2	8.2	4.0	3.1	3.3	2.8	2.4	2.0	1.7
Error Costs - Tier 2 - Observed	1.3	-	1.2	-	-	0.3	1.0	0.7					
Error Costs - Tier 2 - Estimated							1.6	0.6	0.6	0.5	0.5	0.4	0.3

Note: Values for FYs 2008–2015 were estimated directly using the CACFP Assessment data.
Note: Reimbursement costs were estimated using the number of meals-in-error multiplied by the average cost of a meal in error.

ES.4. Conclusions

The forecast produced for this report indicates that the general decreasing trend in tiering errors, meals in error, and costs of misclassification is expected to continue, leading to fewer tiering errors, fewer meals provided in error, and lessening costs of misclassification.

It is important, however, to note the limitations of these findings. First, the small sample size of the data available results in a large variance of the estimates produced by these models, particularly for Tier II errors. There are much fewer Tier II homes than Tier I homes, and the sampling method used to obtain the CACFP Assessment data samples both types of homes proportionally. This method results in very few Tier II homes included in each year sample, and even fewer associated tiering errors (some years have none). As a result, we do not have sufficient CACFP Assessment data for Tier II homes to conduct regression analysis.

The lack of identifiable information at the FDCH level, such as localized geographic regions (e.g., county or census tract), also limited the models. These particular limitations led to the inclusion of characteristics at a higher geographic level, such as State, which may mask FDCH-specific variation.

Lastly, the forecasts reported here depend on the values of the forecasted explanatory variables (e.g., poverty indicators), which are vulnerable to unforeseen changes due to economy-wide shocks. Variations from the predicted values of any of these variables may affect the predicted error rates and cost estimates in an unforeseeable manner.

1. Introduction

The following report details analytical findings from the Econometrica Team's (led by Econometrica, Inc., and including Elder Research, Inc., and Westat; hereinafter referred to as Econometrica) efforts to model and forecast error rates and error amounts occurring under the Child and Adult Care Food Program (CACFP) for each Fiscal Year (FY) from 2015 to 2020. The U.S. Department of Agriculture (USDA) Food and Nutrition Service contracted with Econometrica to leverage existing data for this forward-looking analysis. The data tables and analyses presented in this report reflect the outcomes of Econometrica's two-step modeling approach, summarized as follows. In the first step, the analysis focused on identifying correlation between historical error rates and several candidate control variables for regression models. In the second step of our modeling approach, we:

1. Estimated the probability of an error with a logistic model that controlled for select variables identified in Step 1.
2. Estimated the expected number of meals-in-error provided, conditional on the existence of a tiering error, with a multivariate linear regression model.
3. Leveraged estimates from (1) and (2) to predict the expected dollar amount of tiering errors.

Section 2 details this methodology.

1.1. Background

CACFP reimburses eligible daycare homes and centers that serve meals to children enrolled in their care. Qualifying Family Day Care Homes (FDCHs), a type of CACFP facility, are private residences that provide daycare, meals, and snacks to nonresident children. FDCHs are classified into one of two reimbursement rate tiers by sponsor agencies for meals they provide. Tier I rates are higher than Tier II rates. Consequently, misclassification into Tier I will result in improper overpayment, and misclassification into Tier II will result in improper underpayment. These rates vary by meal or snack type within both tiers. Table 1 and Figure 1 show the reimbursement rates for each tier, by meal type, from Program Year (PY) 2006 to PY 2016.

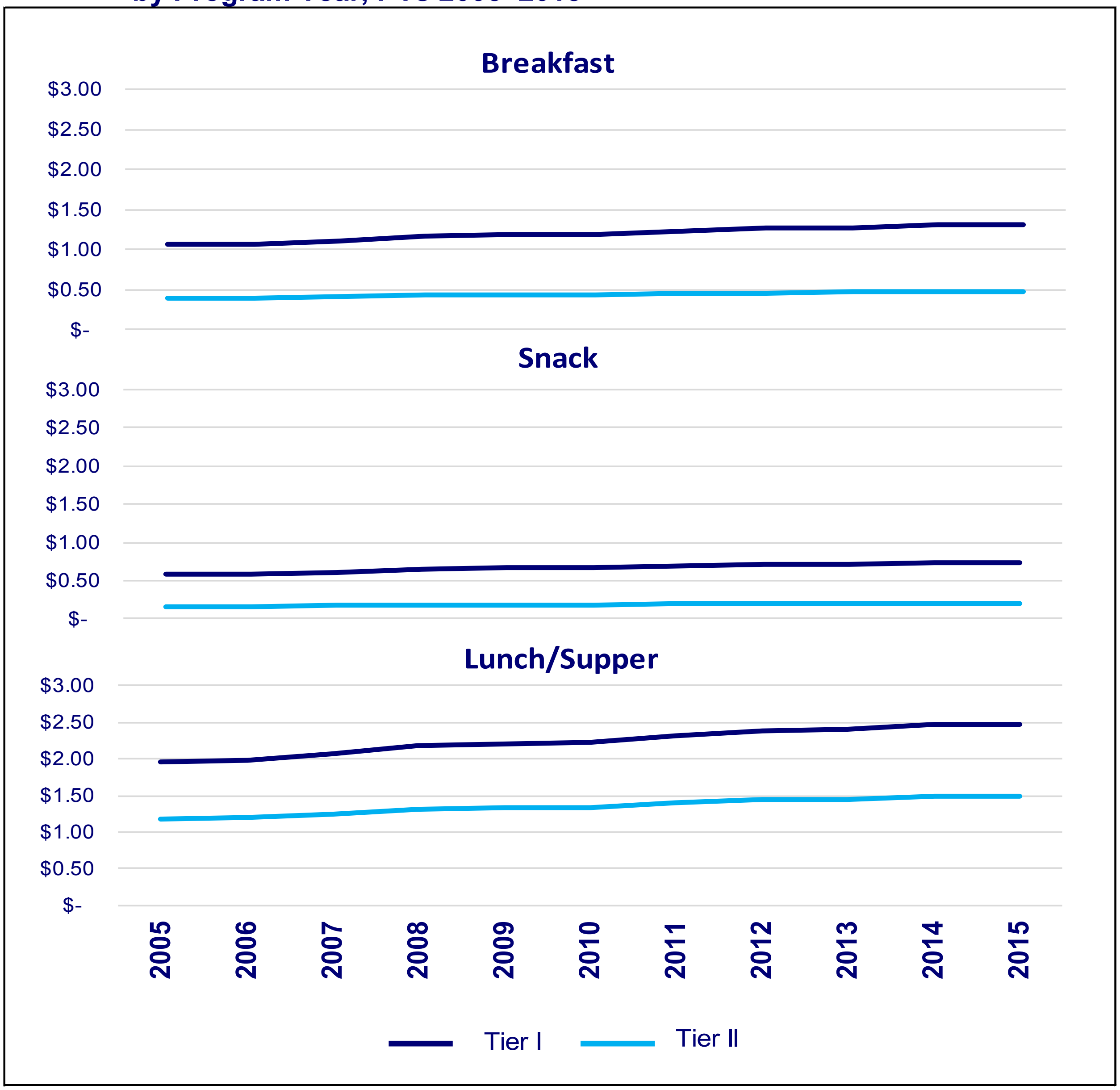
Table 1. CACFP Reimbursement Rates, PYs 2006–2016

	Breakfast		Lunch/Supper		Snack	
Program Year	Tier I	Tier II	Tier I	Tier II	Tier I	Tier II
July 1, 2005–June 30, 2006	$1.06	$0.39	$1.96	$1.18	$0.58	$0.16
July 1, 2006–June 30, 2007	$1.06	$0.39	$1.97	$1.19	$0.58	$0.16
July 1, 2007–June 30, 2008	$1.11	$0.41	$2.06	$1.24	$0.61	$0.17
July 1, 2008–June 30, 2009	$1.17	$0.43	$2.18	$1.31	$0.65	$0.18
July 1, 2009–June 30, 2010	$1.19	$0.44	$2.21	$1.33	$0.66	$0.18
July 1, 2010–June 30, 2011	$1.19	$0.44	$2.22	$1.34	$0.66	$0.18
July 1, 2011–June 30, 2012	$1.24	$0.45	$2.32	$1.40	$0.69	$0.19
July 1, 2012–June 30, 2013	$1.27	$0.46	$2.38	$1.44	$0.71	$0.19
July 1, 2013–June 30, 2014	$1.28	$0.47	$2.40	$1.45	$0.71	$0.19
July 1, 2014–June 30, 2015	$1.31	$0.48	$2.47	$1.49	$0.73	$0.20

Program Year	Breakfast Tier I	Breakfast Tier II	Lunch/Supper Tier I	Lunch/Supper Tier II	Snack Tier I	Snack Tier II
July 1, 2015–June 30, 2016	$1.32	$0.48	$2.48	$1.50	$0.74	$0.20

Source: Federal Register, https://www.fns.usda.gov/cacfp/federal-register-documents/notices/view-all.

Figure 1. CACFP Reimbursement Rates for Meals Served in FDCHs, by Program Year, PYs 2005–2015



Source: Federal Register, https://www.fns.usda.gov/cacfp/federal-register-documents/notices/view-all.

FDCHs can receive a Tier I classification based on:

1. Geographic eligibility, which is based on the daycare home being located in a low-income area. For these purposes, a low-income area is defined as an area where at least 50 percent of children are eligible for free and reduced-price meals, which can be determined via census area eligibility (i.e., three separate criteria based on the percentage of children from low-income households within a census tract, census block group, or neighboring census block groups) or school boundary area eligibility based on the percentage of enrolled children who are from low-income households.
2. Income eligibility (i.e., based on the provider's own low household income).

FDCHs are classified as Tier II if Tier I criteria are not met, except in instances where an FDCH serves children eligible for Tier I rates, as determined by household income thresholds. FDCH tier classification may change over time.

To meet Improper Payments Elimination and Recovery Act of 2010 requirements, the Food and Nutrition Service collected data for 11 annual assessments that estimated the number of misclassified FDCHs and corresponding erroneous payments from FY 2005 through FY 2015. Due to their consistent methodology, these assessments provided a comparison over time of misclassification rates and associated costs. The most recent contractor, Optimal Solutions Group, estimated misclassification and consequent erroneous payments over the program period; these data suggest a downward trend in misclassification rates, particularly in recent years.

While misclassification rates are trending downward, the total payment amounts (driven by the number of meals provided) have steadily increased since the program was established in 1968.[5] For FY 2015, 4.18 million daily participants benefited from more than 2 billion meals or snacks reimbursed by CACFP, a 10 percent increase from 2005 levels.[6] Approximately 3.3 million of the 4.18 million participants were served in childcare centers, whereas approximately 780,000 children were served in daycare homes,[7] which corresponded to 1.4 billion meals and snacks served in centers (70 percent of total) and 526 million meals and snacks served in homes (25 percent of total). Given the trending growth of utilization of this program and the related increases in the program's costs ($3.3 billion in 2015), accurately projecting error rates into the future will be beneficial for program planning purposes and more efficient than conducting annual evaluations, as has been the case prior to Econometrica's work.

1.2. Report Purpose and Organization

The rest of this report describes the CACFP Assessment data, the methodology, and the findings as to the predicted error rates, overall and by tier, as well as the expected costs associated with those predicted tiering errors. Furthermore, to ensure unbiasedness and fitness, the report compares these findings with observed error rates over time. The remainder of this report is presented in the following sections. Section 2 describes and discusses the limitations of the CACFP Assessment

[5] https://fns-prod.azureedge.net/sites/default/files/pd/ccsummar.pdf.
[6] https://fns-prod.azureedge.net/sites/default/files/pd/ccsummar.pdf.
[7] Data estimated from http://frac.org/wp-content/uploads/cacfp-participation-trends-2016.pdf, retrieved on May 24, 2018.

data. Section 3 presents Econometrica's analytical methodology, including a detailed description of our model specifications, error outcomes definitions, variable selection, comparisons against past estimates, and limitations of our modeling approach. Section 4 provides the calculations of the national error estimates and the predicted costs associated with these errors. Lastly, Section 5 contains the conclusions of the modeling work.

2. The CACFP Assessment Data

The estimation of the tiering errors is principally based on CACFP Assessment data collected by previous contractors for the years 2005–2015. These data were random samples collected using a stratified methodology, which is broadly described as follows:[8]

1. Randomly select, with replacement, a sample of 15 States. The probability of selection for each State is directly proportional to the number of the FDCHs in each State. This implies that large States, such as California, are more likely to be selected in a given year than other States and can be selected more than once for a given year, which occurred in years 2013, 2014, and 2015.
2. For each instance of State selected, select a random sample of four FDCH sponsors with replacement.[9] The probability of selection for a given sponsor is directly proportional to their number of sponsored FDCHs. As with States, this method implies that a sponsor can be selected more than once for a given year. Moreover, this also implies that for States selected twice in a given year (such as California in 2013, 2014, and 2015), twice the number of sponsors is selected.
3. Once the FDCH sponsors are selected, select a random sample of FDCHs for each of the sponsors, stratified by tier such that the proportion of homes by tier for each sponsor in the sample matches that in the population. Historically, however, for some sponsors, the fraction of FDCHs in Tier II has been so small that no Tier II homes have been selected.

The analytical data Econometrica received resulted in several analytical limitations, as follows:

1. FY 2005 and FY 2007 data were not available.
2. FY 2006 data were generated with a different methodology, making FY 2006 incompatible with data from other years. In particular, per the documentation provided for that year, it is not always clear whether fields refer to reimbursement amount or number of meals. In addition, monthly counts in the 2006 dataset do not necessarily aggregate to overall counts. According to the CACFP report on 2006 assessment data, it appears that yearly data were imputed for FDCHs with incomplete monthly records.
3. FDCHs were selected randomly across data years, preventing us from establishing a panel of data at the FDCH-year level and from leveraging FDCH-specific characteristics that were in the CACFP Assessment data. This resulted in our use of characteristics from various data sources at higher levels of geography, such as State-level (described in Section 3.3.2).

[8] USDA, Nutrition Assistance Program Report, Food and Nutrition Service, Office of Policy Support (2017), "Child and Adult Care Food Program (CACFP) Assessment of Sponsors Tiering Determinations, 2015 Final Report." https://fns-prod.azureedge.net/sites/default/files/ops/CACFPTiering2015.pdf, accessed on May 25, 2018.
[9] Sponsors are organizations that manage CACFP sites, including FDCHs.

4. State identifiers in FY 2006, FY 2009, and FY 2010 data were masked in a manner that differed from other FY data and did not conform to known State identifier crosswalks. This deviation in State identification prevented our use of State-level explanatory variables in the analysis of these years.
5. Data year FY 2011 is missing several key characteristic variables that precludes the use of the information provided for this year. For instance, the FY 2011 data include the number of meals but not the reimbursement amount or reimbursements made in error.
6. The mismatch of FY tiering assessment data with other data used in the report that are calculated at different timeframes (e.g., FY) may not best reflect CACFP operations.

In summary, our analysis did not include FYs 2005, 2006, 2007, and 2011, and only limitedly used years 2009 and 2010. The analysis fully used years 2012–2015. Overall, the small sample size of FDCHs in a given, usable, FY and the need for using nonlocalized or FDCH-specific data will likely yield large standard errors/confidence intervals for our estimates. Table 2 below and Table A-1 in Appendix A display a summary of the sample characteristics for years 2008–2010, and 2012–2015. Note that the summary characteristics in this table are unweighted. For a table with a weighted summary characteristics of the CACFP Assessment data, see Table 3.

Table 2 and Table A-1 in Appendix A show that, with a few exceptions, only 44 FDCHs were selected for each State drawing. Note that due to their size and therefore greater probability of selection, California and New York are selected multiple times for some years. Furthermore, these two tables show that tiering errors are rare. Thus, due to the limited number of Tier II FDCHs selected, there are 3 years in the sample (2009, 2010, and 2012) for which no Tier II errors are found.

Table 2. CACFP Assessment Data Summary Statistics (Unweighted), FYs 2008–2015.

Program Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2008	AZ	44	1	175,768	119	471	236,363	334
2008	CA	88	2	374,000	32,260	7,054	516,429	4,633
2008	IL	44	2	197,046	40,869	19,332	280,750	11,979
2008	KY	44	2	152,107	16,636	7,775	199,351	5,122
2008	LA	44	4	103,898	671	4,854	145,389	3,214
2008	ME	44	1	188,891	24,733	5,415	246,603	3,555
2008	MN	44	3	83,912	102,776	6,141	165,191	3,961
2008	NE	44	-	113,878	66,750	-	184,985	-
2008	NM	44	1	92,644	-	1,241	127,588	820
2008	NY	44	1	123,544	19,882	3,457	179,197	2,218
2008	OH	44	4	147,726	6,677	3,125	199,702	2,061
2008	OR	44	1	117,162	20,060	5,765	165,599	3,629
2008	TX	44	3	231,884	32,301	19,030	341,446	13,006
2008	UT	44	5	155,397	27,058	18,146	222,929	12,011
2009	Unknown	44	-	98,639	-	-	142,210	-
2009	Unknown	44	1	166,941	33,789	1,102	248,392	755
2009	Unknown	44	5	192,423	19,895	17,885	286,122	12,836
2009	Unknown	44	-	160,371	11,879	-	226,871	-
2009	Unknown	44	1	137,826	41,866	5,547	208,629	3,897

Program Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2009	Unknown	44	1	106,946	40,691	3,792	179,947	2,605
2009	Unknown	44	2	214,518	23,068	8,313	327,776	5,779
2009	Unknown	44	1	216,562	-	4,584	289,007	3,071
2009	Unknown	44	-	141,851	39,024	-	219,115	-
2009	Unknown	88	1	331,868	25,642	4,348	500,077	3,174
2009	Unknown	44	-	101,227	65,228	-	174,568	-
2009	Unknown	44	1	54,342	120,279	2,761	149,465	1,897
2009	Unknown	44	-	152,229	21,454	-	218,480	-
2009	Unknown	44	-	106,097	-	-	153,307	-
2010	Unknown	44	1	100,392	88,775	5,006	187,269	3,491
2010	Unknown	88	-	309,034	62,399	-	477,538	-
2010	Unknown	44	4	199,046	14,717	8,579	278,893	5,986
2010	Unknown	44	-	170,681	12,824	-	253,642	-
2010	Unknown	44	-	122,091	-	-	183,447	-
2010	Unknown	44	3	136,321	33,695	9,908	207,334	6,547
2010	Unknown	44	3	147,190	80,847	14,898	249,237	10,381
2010	Unknown	44	-	94,178	-	-	137,036	-
2010	Unknown	44	5	188,747	30,025	21,348	306,165	15,514
2010	Unknown	44	-	131,517	-	-	194,507	-
2010	Unknown	44	-	216,306	34,028	-	320,440	-
2010	Unknown	44	2	146,650	35,292	7,315	228,754	5,087
2010	Unknown	44	2	191,574	32,427	4,697	281,305	3,286
2010	Unknown	44	1	150,983	6,996	-	227,235	-
2012	AZ	44	-	159,692	-	-	242,477	-
2012	CA	88	3	360,413	21,832	9,661	566,804	7,236
2012	IL	44	3	158,883	10,646	4,210	243,792	3,105
2012	LA	44	-	121,638	-	-	183,045	-
2012	MA	44	-	116,474	45,122	-	202,414	-
2012	MN	44	3	123,961	94,809	16,125	236,041	11,768
2012	NM	44	-	94,839	-	-	147,896	-
2012	NY	44	1	234,629	10,493	6,700	370,455	5,225
2012	OR	44	-	176,763	13,519	-	262,465	-
2012	SD	44	1	148,445	91,486	4,834	269,070	3,472
2012	TN	44	1	184,503	-	4,633	267,018	3,386
2012	TX	44	1	157,569	19,430	6,727	242,448	4,981
2012	UT	44	-	189,523	14,524	-	308,281	-
2012	WI	44	2	99,566	56,616	5,999	187,309	4,796
2013	CA	44	-	177,317	13,450	-	290,954	-
2013	GA	44	-	178,057	4,744	-	261,029	-
2013	IA	44	3	168,170	32,116	6,602	262,270	4,913
2013	KS	44	-	139,395	41,236	-	229,734	-
2013	LA	44	-	129,124	-	-	216,242	-
2013	MD	44	-	148,840	26,674	-	247,414	-
2013	ME	44	-	165,744	22,737	-	245,491	-
2013	MI	44	5	152,520	9,171	5,368	226,195	4,018
2013	MN	44	6	135,072	65,083	22,289	242,289	16,805
2013	NC	44	3	161,127	2,057	9,341	232,347	6,825
2013	NY	88	2	403,968	17,835	14,090	655,550	10,774
2013	PA	44	2	180,954	25,099	5,624	279,516	4,186

Program Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2013	TX	44	-	173,853	12,379	-	289,095	-
2013	VT	44	1	124,719	16,393	2,590	180,585	1,707
2014	AZ	1	-	1,281	-	-	2,178	-
2014	CA	176	1	673,170	109,641	614	1,137,415	479
2014	DC	1	-	3,470	-	-	4,639	-
2014	FL	44	1	181,634	-	8,635	276,121	6,771
2014	IL	43	-	221,956	6,655	-	332,856	-
2014	KS	44	3	149,873	20,872	14,127	233,329	10,711
2014	LA	44	-	136,703	-	-	226,460	-
2014	MD	54	1	218,035	23,195	3,994	355,539	3,312
2014	MN	44	2	109,868	86,526	7,244	220,043	5,425
2014	MO	1	-	-	762	-	530	-
2014	MS	43	-	93,726	-	-	149,392	-
2014	NM	43	-	125,890	-	-	203,596	-
2014	NY	44	-	183,041	8,405	-	308,985	-
2014	OK	44	-	193,887	16,833	-	291,763	-
2014	TX	44	-	189,173	16,473	-	303,508	-
2014	VA	44	3	142,871	55,657	11,461	256,476	8,736
2014	WY	44	3	165,190	51,293	4,305	274,836	3,259
2015	AZ	44	-	153,554	-	-	256,378	-
2015	CA	88	1	359,471	36,032	6,976	599,804	5,781
2015	IA	44	-	156,674	36,660	-	257,418	-
2015	IL	44	1	178,345	21,547	5,259	276,711	4,111
2015	LA	44	-	129,165	693	-	213,180	-
2015	MA	44	-	96,465	23,439	-	159,025	-
2015	MI	44	-	162,610	26,634	-	262,750	-
2015	MN	44	2	128,035	59,201	7,712	232,428	5,953
2015	NC	44	-	142,937	4,711	-	221,340	-
2015	NY	88	5	357,458	22,789	9,325	565,015	7,080
2015	OR	44	1	221,178	8,114	86	347,637	58
2015	TX	44	-	235,191	-	-	378,991	-
2015	WA	44	-	169,576	14,576	-	257,359	-

3. Methodology of Analysis

Econometrica performed a two-step analysis to complete this work:

- Step 1: Identification of the most appropriate control variables for the econometric analysis and prediction.
- Step 2: Multistage econometric analysis and prediction of tiering errors and associated reimbursement costs.

Sections 3.1 and 3.2 detail both steps.

3.1. Step 1: Identification of the Most Appropriate Control Variables

We examined the evolution of tiering error rates over time and considered the correlation between these error rates and sociodemographic, economic, and structural factors to understand the relationship between the error rates and these variables at a macro-level and inform the specification of our multivariate regression analysis conducted in Step 2.

Our variable identification began with a large set of potential control variables, including:

- Annual State and national level CACFP descriptive variables obtained from the National Data Bank (NDB). These data included number of sponsors, number of FDCHs, number of meals provided by tier, and daily attendance. As detailed in Section 2, consistent FDCH State identification was not feasible across all FYs. When State identifiers were usable, as in FY 2008 and FY 2012–2015, we considered State-year level data. We used national-level data when FDCH State was not identifiable (FY 2009–2010).
- Annual State and national level socioeconomic variables, such as median income, gross domestic product (GDP), number of children in poverty younger than 4, and number of children younger than 18, from the U.S. Department of Commerce, Bureau of Economic Analysis and U.S. Census Small Area Income and Poverty Estimates (SAIPE).
- Annual State and national level educational achievement variables, including math and science scores, graduation rates, and college attendance rates from the Institute of Education Sciences (IES).
- Annual State and national level technological advancement indicator variables, such percentage of the population without access to broadband and percentage of tax returns that were filed electronically, from Internal Revenue Service Data Book and Federal Communications Commission (FCC) Broadband Report.

Section 3.3.2 provides the full set of potential explanatory variables considered and their summary statistics.

Once these potential variables were identified, Econometrica verified their completeness and imputed values where necessary. The imputation process was based on a simple regression approach for each variable with missing values at the State and/or national level. The imputation regressions used year to control for a time-trend, year-squared to control for a potential nonlinear time-trend, State binary variables to control for unobservable State characteristics (i.e., State fixed effects), and interactions between the State binary variables and year to control for secular State trends. This specification is exhibited in Equation 1, where *Y* denotes the variable being imputed, Year identifies year, State is the binary variable identifying a particular State *i, i* indexes State, and *t* indexes period of time (year):

Equation 1.

$$Y_t = \alpha_0 + \alpha_1 \text{Year} + \alpha_2 \text{Year}^2 + \beta_i \text{State}_i + \gamma_i \text{State}_i \cdot Year + \varepsilon_t$$

We used this model to predict values for missing State-years. For predictions that were negative, we imputed values with a simple average of the corresponding State values in surrounding State-years. Equation 2 demonstrates this imputation correction.

Equation 2.

$$\text{If } \widehat{Y}_t < 0, \text{then } \widehat{\widehat{Y}}_t = \frac{Y_{t-1} + Y_{t+1}}{2}$$

Across data sources, we imputed the following data points:

- **Broadband access,** which was missing for 2009, 2012, and 2015 at the State level and for 2010 at the national level.[10]
- **Education achievement variables.** Several of these variables required some imputation, which varied for different years and States:
    - College Attendance Rate.
    - High School Graduation Rate.
    - Economic Disadvantaged High School Graduation Rate.
    - Math Scores.
    - Science Scores.
    - Educational Spending per Capita.
    - Educational Spending per Capita – Percentage.

After completing the imputation process, Econometrica predicted the values of the potential explanatory variables for years FY 2016–2020 for use in modeling and predicting error rates and corresponding meals and reimbursements over the FY 2016–2020 period. The prediction of future values for the explanatory variables was also based on a simple econometric regression model, using year as control variable for each State and potential explanatory variable in the data. Equation 3 displays the regression specification, with *i* denoting State.

Equation 3.

$$Y_i = \alpha_0 + \alpha_1 \text{Year} + \alpha_2 \text{Year}^2 + \varepsilon$$

Next, Econometrica created lagged variables at year *t-1* for all the potential explanatory variables. Lastly, we graphed and estimated the correlation over time between historical, observed tiering error rates and each potential variable and their lagged values.[11] This step allowed for the identification and ranking of variables most correlated with tiering errors over time. Potential explanatory variables with statistically significant correlations with the historical error rates were selected as control variables for model inclusion in Step 2.

3.2. Step 2: Multistage Regression Analysis to Model and Predict Error Rates and Expected Error-Associated Costs for FY 2016−2020

We used a multistage regression process to forecast error rates and estimate erroneous reimbursement amounts in each year from FY 2016 to FY 2020.

[10] To impute the values at the national level, we treated the national figures as an additional State.

[11] Section 3.3.2 presents a table with these correlations as well as figures illustrating these correlations for selected variables.

3.2.1. First Stage: Estimation and Prediction of the Tiering Error Rates

We first predicted the probability of a tiering error over various lengths of time (1 to 5 years) of future periods, using a logistic model. Equation 4 provides the general form of this logistic model, where y_{it} is the binary indicator variable ($y_{it} = 1$ if FDCH$_i$ had a tiering error in year t). The probability of an error is calculated as a function of a constant, β_0; a vector of year-based sociodemographic, economic, and structural variables, and aggregate CACFP Assessment State-level characteristics, E_{st} such as the total number of FDCHs in operation in a given State-year, for a particular State s; a time trend, *Year*; and a logistically distributed error term, ϵ_{it}.[12] Section 3.3.2 describes the variables included in Equation 5.

Equation 4.

$$Pr(y_{it} = 1) = f(\beta_0 + \beta_a E_{st} + \alpha_t Year + \epsilon_{it})$$

The model used CACFP Assessment data from all available years. States were unidentifiable for FY 2009 and FY 2010; as a result, instead of State-level variables, we used national-level control variables as a proxy for economic, demographic, and technological conditions for these 2 years. We used State-level control variables for years FY 2008, and FY s 2012–2015. Equation 5 provides the general form of this model.

Equation 5.

$$\begin{aligned} Pr(y_{it} = 1) = f(\beta_0 + \alpha_{t1} Year + \alpha_{t2} Year^2 + \beta_i I_i \\ + \beta_s I_i(\text{State dummy including unknown States}) \\ + \beta_N I_i(\text{Year} - \text{national level control variables}) \\ + \beta_s (1 - I_i)(\text{Year} - \text{State level control variables}) + \epsilon_{it}) \end{aligned}$$

Where:

$$I_i = \begin{cases} 1 & \text{If the State for FDCH } i \text{ is NOT identified} \\ 0 & \text{Otherwise} \end{cases}$$

Note that this analysis approach allows for the inclusion of all the CACFP Assessment data available.

Many of the control variables identified in the Step 1 (Section 3.1) are highly collinear with each other. Thus, we narrowed this set of control variables by iterating over various compositions of these variables to identify and use the variables that provided the most robust and reliable estimation, as determined by the goodness of fit (R-squared) as well as stability of findings, significance of the control variables, and proximity of estimates to observed data prior to FY 2016.[13] To ensure robustness and a basis for comparison, a model using only a time trend as control variable was also estimated and compared to the findings of the full model. To ensure that error

[12] The original specification in the analysis plan also included a vector of FDCH-specific characteristics in each year, C_{fi} as control variables in the regression. Because these variables are FDCH-specific, there is only a sample of FDCHs that changes from year to year, and there is no equivalent sample for PY 2016–2020. As such, it is not possible to predict these values in a meaningful way to use for prediction of future tiering errors. Thus, these variables were eliminated from final model specifications.

[13] Section 4 provides the control variables selected through this iterative process, as well as the regression findings.

rates were representative of FDCHs nationally, we used previously determined CACFP Assessment population weights to weight predicted error rates prior to FY 2016. These sampling weights, however, were not available for the FY 2016–FY 2020 period. For this, we leveraged the number of FDCHs (predicted based on the NDB data) as weights for FYs 2016–2020.

To ensure the accuracy of our model, Econometrica also estimated the prediction model's tiering error rates for FY 2008–2015 and compared these estimates to the observed tiering error rates for FY 2008–2015.

These models predicted the overall (Tier I and Tier II aggregated) and Tier I error rates. Tier II error rate prediction was not feasible due to small sample size (see Section 2). As an alternative to models presented above, we calculated the Tier II error rate based on our estimation for the overall and Tier I error rates, requiring an assumption that the number of overall errors is equal to Tier I plus Tier II errors. The Tier II error rate calculation is shown in Equations 6 and 7.[14]

Equation 6.

$$\begin{aligned}&\text{Overall No. FDCHs With an Error}\\&\qquad = \text{No. of Tier I FDCHs With Error} + \text{No. of Tier II FDCHs With an Error}\end{aligned}$$

Then:

Equation 7.

$$\text{Error Rate (ER) Tier II} = \frac{\text{ER Overall} * \text{No. FDCHs} - \text{ER Tier I} * \text{No. Tier I FDCHs}}{\text{No. Tier II FDCHs}}$$

3.2.2. Second Stage: Estimation of the Expected Number of Meals Provided in Error

The second stage estimates the number of meals provided in error, conditional on an erroneous tier classification. The general form for this model is provided in Equation 8. This specification included data from years FY 2012–2015 only, as the specification using all available years resulted in unreliable outcomes due to the variability in the data. In this specification, the explanatory variables used also included State-level sociodemographic, economic, and structural variables and CACFP State-level characteristics, E, that were identified in Step 1 (Section 3.1) and that vary over time t.

Equation 8.

$$E(\text{Number of Error Meals}) = P(\text{Error}) \times E(\text{Number of Error Meals} | \text{Error} = 1)$$

[14] According to the USDA, Nutrition Assistance Program Report, Food and Nutrition Service, Office of Policy Support (2017), "Child and Adult Care Food Program (CACFP) Assessment of Sponsors Tiering Determinations, 2015 Final Report." https://fns-prod.azureedge.net/sites/default/files/ops/CACFPTiering2015.pdf, accessed on May 25, 2018, this assumption is not accurate. However, this assumption was the only feasible approximation for predicting Tier II tiering error rates given other data limitations.

To estimate the expected number of meals provided in error, we first modeled the proportion of meals provided in error out of the total number of meals provided by an FDCH that had a tiering error.[15] Equation 9 provides the general form estimating the number of meals provided in error as a proportion of total meals provided, by FDCH.

Equation 9.

$$y_{it} = \beta_0 + \alpha_{t1} Year + \alpha_{t2} Year^2 + \beta_s(\text{Year} - \text{State level control variables}) + \epsilon_{it}$$

Where:

Equation 10.

$$y_{it} = \frac{\text{No. Meals Provided in Error by FDCH } i}{\text{Total No. Meals Provided by FDCH } i},$$

As above, a simple model using only year (the time trend) as the explanatory variable was used to test the approach's reliability and robustness. The final selection of the full set of explanatory variables for this analysis was an iterative process so as to minimize the additional noise introduced by excessive collinearity of explanatory variables and maximize the model's reliability. As above, this estimation used the sampling weights provided in the CACFP data for FYs 2012–2015; for the prediction, the numbers of FDCHs were used for FYs 2016−2020.

Similar to the estimation of the tiering error rates, the specification in Equation 9 was used to estimate the proportion of meals error for all types of FDCHs and for Tier I FDCHs. Once the estimated and predicted proportions of meals-in-error were obtained, they were used to estimate the number of meals-in-error using Equation 11.

Equation 11.

$$\begin{aligned}&\text{Number of Error Meals (NEM)}\\&\qquad = \text{Proportion of Error Meals(PEM)} * \text{Tiering Error Rate (TER)} * \text{Total Meals}\end{aligned}$$

As before, the sample size was too small to use a regression for estimating the Tier II proportion of meals-in-error. Thus, the findings for the overall and Tier I proportion of meals-in-error were used to estimate the Tier II proportion of meals-in-error (Equations 11, 12, and 13):

Equation 12.

$$\text{Overall NEM} = \text{Tier I NEM} + \text{Tier II NEM}$$

Then:

[15] This step is needed because, while the tiering error applies to the designation of the FDHC, children may also be designated as Tier I or Tier II, which implies that not all meals provided by a FDCH with a tiering error are provided in error. See "Child and Adult Care Food Program (CACFP): Assessment of Sponsors' Tiering Determinations Program, Year 2015, Final Report.", page 23, https://fns-prod.azureedge.net/sites/default/files/ops/CACFPTiering2015.pdf.

Equation 13.

$$\text{PEM Tier II} = \frac{\text{PEM Overall} * \text{TER Overall} * \text{Total Meals} - \text{PEM Tier I} * \text{TER Tier I} * \text{Total Meals Tier I}}{\text{TER Tier II} * \text{Total Meals Tier II}}$$

3.2.3. Third Stage: Estimation of the Expected Reimbursement Costs of Meals Provided in Error

Given the estimates for the tiering error rates, proportion of meals-in-error, and number of meals-in-error, we estimated the associated reimbursement costs for meals provided in error. For this stage, we used the CACFP Assessment cost of reimbursement error data to estimate and predict the unit cost of a meal reimbursed in error, as indicated in Equation 14.

Equation 14.

$$\text{Unit Cost of an Error (UCE)} = \frac{\text{Total Error Costs}}{\text{Total Meals} - \text{in} - \text{Error}}$$

We used a regression model to forecast the UCE akin to the one used to predict all the explanatory variables (see Equation 3).

We then calculated the reimbursement error costs by multiplying the estimated UCE times the estimated number of meals-in-error, as shown in Equation 15.

Equation 15.

$$\text{Total Reimbursement Error Costs} = \text{UCE} * \text{NEM}$$

3.3. Models Specification and Considerations

This section provides descriptions for the primary dependent variables in our regression analysis and potential explanatory variables for methods described in Section 3.2.

3.3.1. Error Outcome Definition

Primary regression models measure two types of error:

1. **Probability of an FDCH having an error,** regardless of the number of meals provided in error by the FDCH. Thus, this is a binary variable that takes the value of one when an error has occurred and zero otherwise. This outcome variable is estimated overall and for Tier I and Tier II.
2. **Percentage of meals provided in error for the FDCH that had an error.** This measure of error is defined only for FDCHs that had a tiering error and corresponds to the proportion of meals provided in error relative to the total meals provided by the FDCH. This outcome variable is estimated overall and for Tier I and Tier II.

These two variables are the basis for all the estimations in this report, including the number of meals-in-error, as well as reimbursement error costs overall and by tier.

3.3.2. Model Variable Selection

The analyses in this report required the identification and vetting of relevant control variables that could be used to forecast tiering error rates and the proportion of meals provided in error by FDCHs with a tiering error. Because of limited data availability and the nonpanel design of CACFP Assessment data of FDCHs (see Section 2), the need arises to find other potential explanatory variables to use for the prediction of tiering errors. This section details identification of external (to CACFP Assessment data) variables selected for methods discussed in Section 3.2.

Our team's SME suggested including the following State-level and national-level data that may be relevant in the estimation of tiering rates:

1. The number of children of daycare age (e.g., from approximately 6 months to 6 years old) in poverty, which may provide insight into the potential pool of children for FDCH.
2. The average sponsor size, as approximated by the number of FDCHs divided by the number of sponsors in a given State or sponsor size category.
3. The average daily FDCH attendance, as provided in the NDB.

The latter two characteristics may provide insight into sponsors' and FDCHs' capacity and potential efficiency or experience. Furthermore, the following FDCH capacity characteristics may be relevant: (1) the total number of meals (Tier I and Tier II) and (2) the number of meals by type (breakfast/lunch/snack/supper). Predicting these data at the FDCH level, however, is not feasible due to the lack of a time-series data on FDCHs. Consequently, our analysis instead selected the equivalent variables from the NDB at the State-year level.

Other selected potential independent variables for the analyses capture sociodemographic and structural/economic State profiles, aspects that may influence the overall error rate and erroneous payment amount. Technological proficiency, for example, may impact erroneous tiering classifications or the identification of such classifications.

As indicated above, the specific variables included in each analysis were selected through an iterative process in which maximizing the fit of the model to the data available was sought.

Table 3 displays the summary statistics for the CACFP Assessment data, weighted by each FDCH's main weight indicator, as provided in the CACFP Assessment data. Table 4, Table 5, and Table 6 display the mean and predicted values of the selected potential explanatory variables during the period of interest. In these tables, columns shaded in gray indicate predicted values, and rows shaded in pink denote SME-chosen variables; dark pink indicates predicted values for the SME-chosen variables.

Table 3 displays various elements from the CACFP Assessment data. This table shows that the tiering error rate, the total number of meals reimbursed in error, and the costs associated with these errors have decreased over time. The total number of meals provided, on average, has also decreased from FY 2008 to FY 2015 by approximately 70 million. Similar decreases can be observed over the NDB data (Table 4), which further demonstrates decreases in the number of FDCHs (primarily Tier II FDCHs), corresponding to decreases in sponsor sizes. Forecasted NDB values for FYs 2015–2020 match decreasing trends seen in earlier years. Table 5 shows summary statistics for educational attainment and proficiency variables. Most variables in Table 5 appear to have an increasing trend, with the exception of math scores, and percentage education expenditure per capita, which are either decreasing or constant. Table 6 provides summary statistics for a series of socioeconomic and technological indicators. This table shows that even though the GDP and median income are increasing, the number and percentage of children in poverty increased for the period 2008–2012 and decreased for the period 2012–2015. Regarding the technology indicators, no clear trends are observed, due to high data variability over this period.

Table 3. CACFP Assessment Data Characteristics – Weighted, FYs 2008–2015

Variable	2008	2009	2010	2012	2013	2014	2015
Total Meals (MM)	559.65	555.93	566.32	516.78	504.04	464.73	488.62
Total Meals Tier I (MM)	445.54	450.15	456.79	427.85	442.74	394.51	429.72
Total Meals Tier II (MM)	114.11	105.78	109.53	88.94	61.30	70.22	58.90
Total Breakfasts Tier I (MM)	95.33	94.55	98.78	84.68	99.49	84.33	99.15
Total Breakfasts Tier II (MM)	31.28	28.62	30.32	25.13	16.38	20.05	15.13
Total Lunches and Suppers Tier I (MM)	181.42	185.16	186.97	183.39	176.80	163.28	168.87
Total Lunches and Suppers Tier II (MM)	39.75	38.12	38.49	30.49	21.81	24.77	20.33
Total Snacks Tier I (MM)	168.79	170.43	171.05	159.77	166.44	146.90	161.71
Total Snacks Tier II (MM)	43.08	39.04	40.72	33.31	23.11	25.39	23.44
Total Cost Meals ($MM)	655.66	695.31	715.72	701.52	708.71	656.01	707.70
Total Costs Breakfasts ($MM)	119.17	123.11	130.88	116.31	133.89	117.60	137.23
Total Costs Lunches and Suppers ($MM)	425.56	454.24	464.61	468.51	452.30	429.00	447.59
Total Costs Snacks ($MM)	110.93	117.96	120.22	116.70	122.52	109.40	122.88
Certification Errors (Mean, % FDCHs)$^{\Delta}$	4.44%	1.82%	3.16%	1.82%	2.72%	1.65%	1.34%
Total Meals in Error (MM)	20.66	9.77	15.60	10.23	9.99	7.21	4.88
Total Breakfasts in Error (MM)	4.63	1.35	3.22	2.48	2.78	2.08	1.02
Total Lunches and Suppers in Error (MM)	8.32	4.76	6.46	4.27	3.45	2.71	2.09
Total Snacks in Error (MM)	7.71	3.67	5.92	3.48	3.76	2.43	1.76
Total Error Costs (MM)	13.53	6.87	10.94	7.64	7.46	5.53	3.84
Breakfasts Error Costs (MM)	3.25	1.00	2.41	1.96	2.25	1.69	0.85
Lunches and Suppers Error Costs (MM)	6.86	4.14	5.69	3.93	3.25	2.58	2.05
Snacks Error Costs (MM)	3.42	1.73	2.84	1.74	1.95	1.27	0.94

Note: The row highlighted in gray indicates the calculated Tiering Error Rates from the CACFP Assessment data, and has been given a superscript of Δ.

Table 4. Selected NDB Variables, FYs 2008–2020

NDB CACFP Variables	2008◊	2009◊	2010◊	2012◊	2013◊	2014◊	2015◊	2016˙	2017˙	2018˙	2019˙	2020˙
Avg. Daily Attendance All◊	16,648.6◊	16,625.8◊	16,297.9◊	16,098.6◊	15,550.0◊	15,291.8◊	15,248.3◊	15,179.1˙	15,002.2˙	14,825.4˙	14,648.6˙	14,471.8˙
Avg. Daily Attendance Tier I◊	12,397.3◊	12,657.2◊	12,636.5◊	13,335.3◊	13,068.7◊	13,032.1◊	13,157.4◊	12,969.5˙	13,006.2˙	13,042.9˙	13,079.6˙	13,116.3˙
Avg. Daily Attendance Tier II◊	4,251.3◊	3,968.6◊	3,661.4◊	2,763.3◊	2,481.4◊	2,259.7◊	2,090.9◊	2,209.6˙	1,996.1˙	1,782.5˙	1,569.0˙	1,355.5˙
Avg. Sponsor Size◊	192.5◊	192.9◊	193.0◊	191.3◊	194.9◊	191.2◊	187.4◊	186.7˙	185.7˙	184.7˙	183.7˙	182.7˙
Number of Sponsors (M)	825	806	791	748	735	713	696	702Δ	688Δ	674Δ	660Δ	646Δ
Number of FDCHs (M)	141.4	140.5	137.0	127.8	122.4	117.9	113.8	114.6Δ	111.4Δ	108.2Δ	105.0Δ	101.7Δ
Number of Tier I FDCHs (M)	104.8	106.6	106.1	105.5	102.9	100.5	98.4	97.8Δ	96.6Δ	95.5Δ	94.3Δ	93.2Δ
Number of Tier II FDCHs (M)	36.7	33.9	30.9	22.3	19.5	17.4	15.4	16.8Δ	14.8Δ	12.7Δ	10.6Δ	8.5Δ
Total Meals (MM)◊	626.3◊	612.5◊	594.8◊	568.4◊	550.5◊	537.1◊	525.8◊	529.3˙	518.8˙	508.3˙	497.8˙	487.3˙
Total Meals Tier I (MM)◊	478.5◊	478.0◊	471.8◊	478.0◊	470.5◊	465.0◊	461.1◊	458.5˙	455.8˙	453.2˙	450.5˙	447.9˙
Total Meals Tier II (MM)◊	147.8◊	134.4◊	123.0◊	90.4◊	80.0◊	72.1◊	64.7◊	70.8˙	63.0˙	55.1˙	47.3˙	39.4˙
Total Breakfasts (MM)◊	147.9◊	143.8◊	138.6◊	130.8◊	126.0◊	122.0◊	118.7◊	119.9˙	116.9˙	113.9˙	110.8˙	107.8˙
Total Breakfasts Tier I (MM)◊	108.1◊	107.1◊	105.0◊	105.7◊	103.7◊	101.9◊	100.6◊	100.2˙	99.3˙	98.3˙	97.4˙	96.4˙
Total Breakfasts Tier II (MM)◊	39.9◊	36.7◊	33.6◊	25.1◊	22.3◊	20.1◊	18.1◊	19.7˙	17.6˙	15.5˙	13.5˙	11.4˙
Total Lunches (MM)◊	168.4◊	164.8◊	159.7◊	152.5◊	146.8◊	143.1◊	140.1◊	141.4˙	138.5˙	135.6˙	132.7˙	129.7˙
Total Lunches Tier I (MM)◊	123.6◊	123.7◊	122.1◊	124.7◊	122.2◊	120.9◊	120.1◊	119.6˙	119.0˙	118.4˙	117.9˙	117.3˙
Total Lunches Tier II (MM)◊	44.8◊	41.2◊	37.6◊	27.8◊	24.6◊	22.2◊	20.0◊	21.9˙	19.5˙	17.1˙	14.8˙	12.4˙
Total Snacks (MM)◊	236.2◊	230.5◊	223.6◊	212.9◊	205.9◊	200.5◊	195.9◊	197.3˙	193.1˙	188.9˙	184.6˙	180.4˙
Total Snacks Tier I (MM)◊	180.6◊	180.1◊	177.5◊	179.1◊	176.1◊	173.7◊	171.9◊	171.0˙	169.8˙	168.5˙	167.3˙	166.1˙
Total Snacks Tier I (MM)◊	55.6◊	50.5◊	46.1◊	33.8◊	29.8◊	26.8◊	24.0◊	26.3 ˙	23.3˙	20.3˙	17.3˙	14.3˙
Total Suppers (MM)◊	73.7◊	73.3◊	72.9◊	72.2◊	71.7◊	71.6◊	71.1◊	70.7˙	70.3˙	70.0˙	69.7˙	69.4˙
Total Suppers Tier I (MM)◊	66.3◊	67.1◊	67.3◊	68.5◊	68.4◊	68.6◊	68.5◊	67.7˙	67.8˙	67.9˙	68.0˙	68.1˙
Total Suppers Tier II (MM)◊	7.4◊	6.2◊	5.6◊	3.8◊	3.3◊	3.0◊	2.6◊	3.0˙	2.5˙	2.1˙	1.7˙	1.3˙

Data Source: NDB.
Note: Cells shaded in gray indicate predicted values to be used in the forecast of Tiering Error Rates. Cells shaded in lighter pink highlight variables suggested by the SME. The darker pink highlights predicted values to be used in the forecast that are also SME-suggested variables.
Note: Data in gray has been given a superscript of ∆ for years 2016-2020, data in light pink has been given a superscript of ◊ for years 2008-2015, and data in dark pink has been given a superscript of ˙ for years 2016-2020.

Table 5. Average Educational Variables, FYs 2008–2020

Educational Variables	2008	2009	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020
College Attendance	62.0%	58.7%	62.0%	60.7%	63.8%	65.1%	66.5%	66.7%$^{\Delta}$	67.7%$^{\Delta}$	68.7%$^{\Delta}$	69.7%$^{\Delta}$	70.7%$^{\Delta}$
Graduation Rate	75.7%	76.5%	78.3%	79.7%	79.9%	82.0%	83.0%	83.9%$^{\Delta}$	84.9%$^{\Delta}$	85.9%$^{\Delta}$	86.9%$^{\Delta}$	87.9%$^{\Delta}$
Grad. Rate Economic Disadvantage	68.6%	69.4%	70.7%	72.3%	72.8%	73.8%	75.1%	75.9%$^{\Delta}$	76.8%$^{\Delta}$	77.6%$^{\Delta}$	78.5%$^{\Delta}$	79.4%$^{\Delta}$
Math Advanced %	6.0%	5.7%	6.5%	6.9%	7.6%	7.1%	7.0%	7.4%$^{\Delta}$	7.6%$^{\Delta}$	7.8%$^{\Delta}$	7.9%$^{\Delta}$	8.1%$^{\Delta}$
Math Basic %	78.7%	81.8%	80.2%	81.4%	83.1%	82.6%	81.7%	85.2%$^{\Delta}$	86.2%$^{\Delta}$	87.2%$^{\Delta}$	88.1%$^{\Delta}$	89.1%$^{\Delta}$
Math Proficiency %	36.8%	38.9%	38.8%	40.2%	42.4%	41.0%	39.9%	43.5%$^{\Delta}$	44.4%$^{\Delta}$	45.3%$^{\Delta}$	46.3%$^{\Delta}$	47.2%$^{\Delta}$
Math Scores (mean)	251.4	239.5	249.5	245.7	241.9	239.9	240.2	231.4$^{\Delta}$	228.2$^{\Delta}$	224.9$^{\Delta}$	221.7$^{\Delta}$	218.4$^{\Delta}$
Science Scores (mean)	147.5	147.6	148.7	150.2	150.9	151.7	152.4	152.5$^{\Delta}$	153.1$^{\Delta}$	153.7$^{\Delta}$	154.3$^{\Delta}$	154.8$^{\Delta}$
% Expenditure per Capita	22.2%	22.0%	21.9%	21.5%	21.4%	21.4%	21.1%	21.0%$^{\Delta}$	20.8%$^{\Delta}$	20.6%$^{\Delta}$	20.5%$^{\Delta}$	20.3%$^{\Delta}$
Expenditure per Capita (mean, $)	1,652.7	1,687.9	1,725.4	1,807.6	1,850.4	1,890.2	1,956.6	1,976.5$^{\Delta}$	2,017.0$^{\Delta}$	2,057.5$^{\Delta}$	2,098.1$^{\Delta}$	2,138.6$^{\Delta}$

Data Source: IES; U.S. Census – Small Area Income and Poverty Estimates (SAIPE).
Note: Columns shaded in gray indicate predicted values to be used in the forecast of Tiering Error Rates.
Note: Cells shaded in gray for years 2016-2020 have been given a superscript of Δ.

Table 6. Socioeconomic Variables and Technology Indicators, FYs 2008–2020

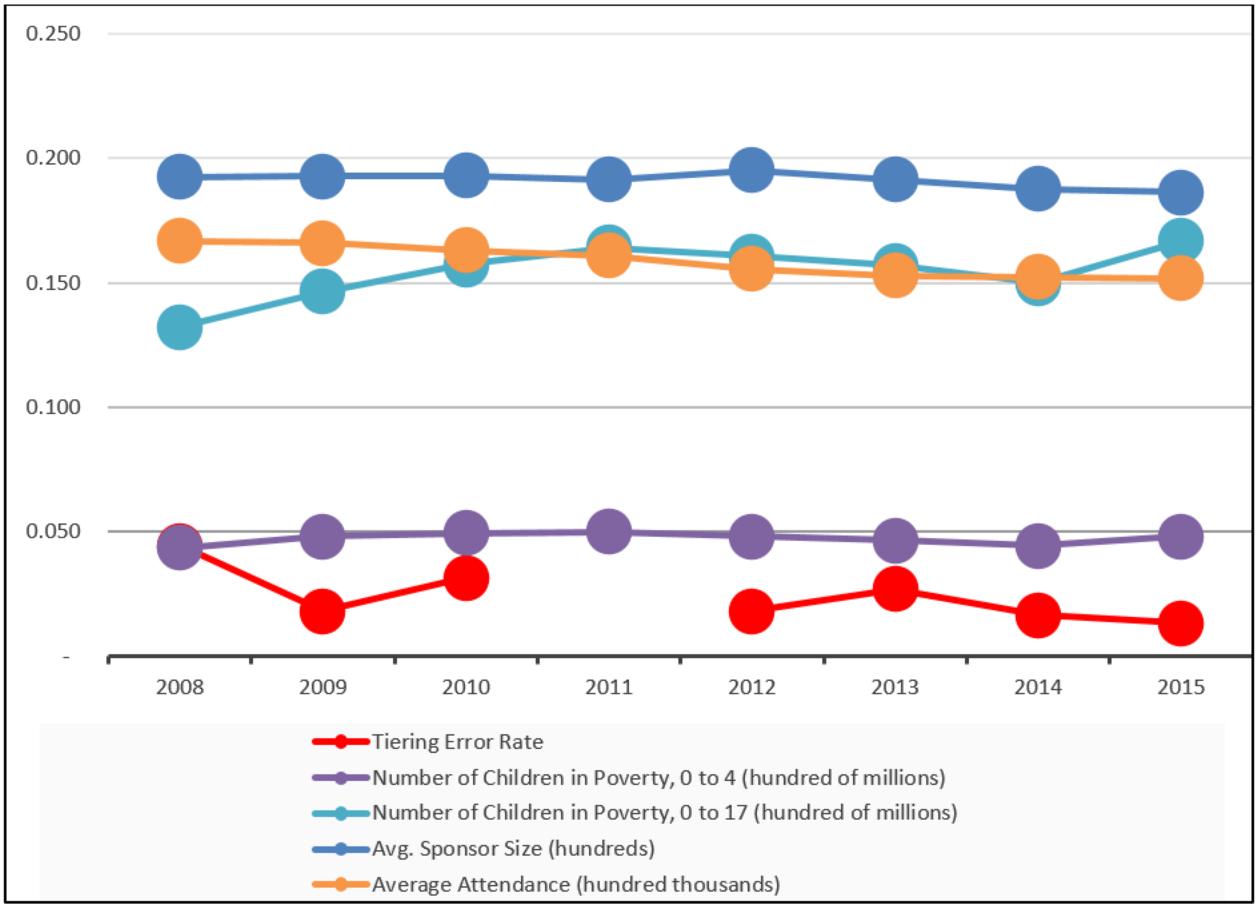
Variable	2008	2009	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020
Socioeconomic Variables												
GDP ($G)	14,627	14,320	14,860	16,041	16,577	17,312	18,007	17,720$^{\Delta}$	18,119$^{\Delta}$	18,519$^{\Delta}$	18,918$^{\Delta}$	19,318$^{\Delta}$
Median Income ($M)	52.1	50.4	50.0	51.9	53.1	54.5	56.4	55.4$^{\Delta}$	56.1$^{\Delta}$	56.7$^{\Delta}$	57.4$^{\Delta}$	58.0$^{\Delta}$
Children in Poverty, Age 0 to 4 (MM)$^{\lozenge}$	4.37$^{\lozenge}$	4.85$^{\lozenge}$	4.96$^{\lozenge}$	5.01$^{\lozenge}$	4.81$^{\lozenge}$	4.66$^{\lozenge}$	4.45$^{\lozenge}$	4.86$^{\cdot}$	4.89$^{\cdot}$	4.92$^{\cdot}$	4.95$^{\cdot}$	4.97$^{\cdot}$
Children in Poverty, Age 0 to 17 (MM)$^{\lozenge}$	13.24$^{\lozenge}$	14.66$^{\lozenge}$	15.75$^{\lozenge}$	16.40$^{\lozenge}$	16.09$^{\lozenge}$	15.69$^{\lozenge}$	15.00$^{\lozenge}$	16.68$^{\cdot}$	16.99$^{\cdot}$	17.30$^{\cdot}$	17.61$^{\cdot}$	17.91$^{\cdot}$
% Children in Poverty, 0 to 4	20.6%	22.3%	24.4%	24.5%	23.5%	22.9%	21.8%	24.1%$^{\Delta}$	24.3%$^{\Delta}$	24.6%$^{\Delta}$	24.8%$^{\Delta}$	25.1%$^{\Delta}$
% Children in Poverty, 0 to 17	17.3%	19.0%	20.6%	21.3%	20.9%	20.4%	19.6%	21.7%$^{\Delta}$	22.0%$^{\Delta}$	22.4%$^{\Delta}$	22.8%$^{\Delta}$	23.2%$^{\Delta}$
Technology Indicators												
% Total Tax Returns, e-filed	60.3%	58.6%	49.5%	57.8%	58.1%	52.8%	56.4%	56.5%$^{\Delta}$	57.1%$^{\Delta}$	57.7%$^{\Delta}$	58.3%$^{\Delta}$	59.0%$^{\Delta}$
% Individual Tax Returns, e-filed	56.4%	54.8%	52.4%	57.7%	56.6%	53.8%	55.6%	57.2%$^{\Delta}$	58.1%$^{\Delta}$	59.1%$^{\Delta}$	60.0%$^{\Delta}$	60.9%$^{\Delta}$
% Population With No Broadband Access	6.0%	8.7%	10.9%	13.3%	22.0%	12.7%	18.6%	19.8%$^{\Delta}$	21.4%$^{\Delta}$	22.9%$^{\Delta}$	24.5%$^{\Delta}$	26.1%$^{\Delta}$

Data Source: U.S. Department of Commerce, Bureau of Economic Analysis; SAIPE; Internal Revenue Service Data Book; FCC Broadband Report.
Note: Cells shaded in gray indicate predicted values to be used in the forecast of Tiering Error Rates and have been given a superscript of Δ. Cells shaded in lighter pink highlight variables suggested by the SME and have been given a superscript of ◊. The darker pink highlights predicted values to be used in the forecast that are also SME-suggested variables and have been given a superscript of ˙.

After summarizing the potential explanatory variables shown above, we compared and estimated the correlation between the overall tiering error rate and potential explanatory variables. We found the correlation between the variables and the tiering errors to be highly similar to tiering error correlations with lagged variables, indicating that no additional information would be gained by incorporating the lagged variables. We excluded lagged variables from analysis given this finding and the inherent loss of data points from using lagged variables.

Figure 2 and Figure 3 display the historical relationship between the tiering error rates and the potential explanatory variables suggested by our SME. Figure 4 displays the relationship between the tiering error rates and the potential explanatory variables identified as those with the highest correlation with error rates.

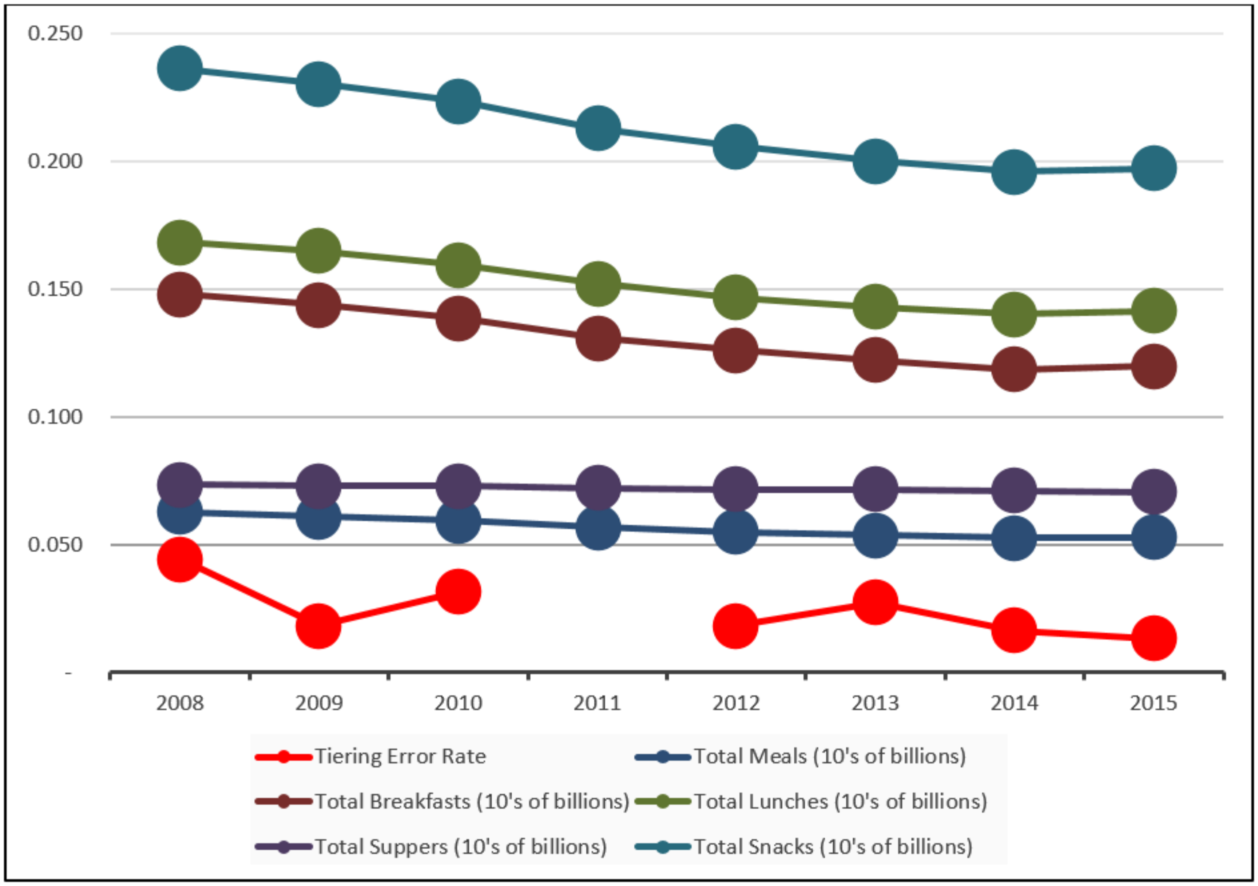
Figure 2. Comparison of Error Rate With SME-Suggested Variables (Socioeconomic and CACFP-NDB), FYs 2008–2015



Source: CACFP Assessment data; SAIPE; NDB CACFP; IES.
Note: The units for the comparison variables were adjusted for purposes of scale and comparability with the Tiering Error Rate.

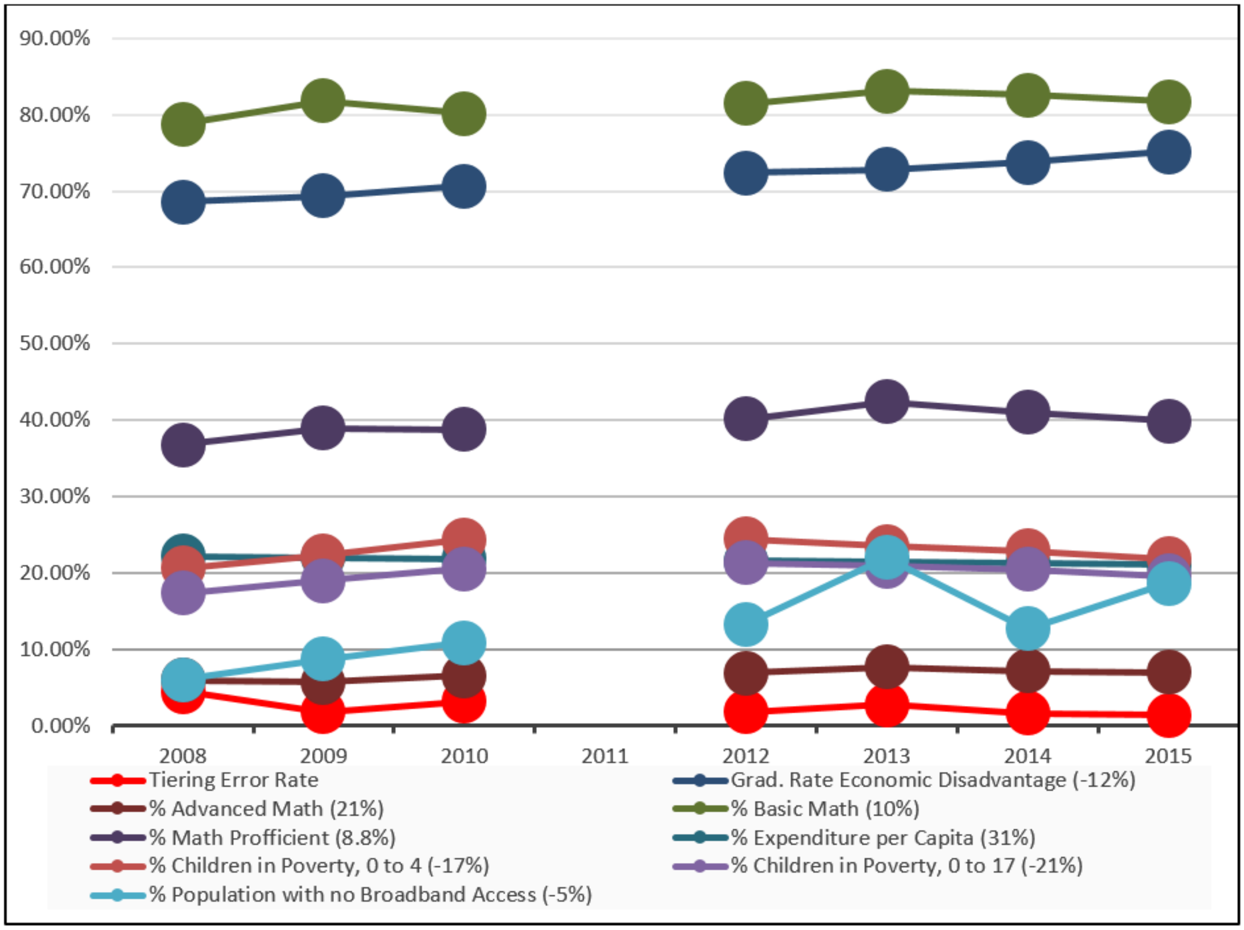
The variables in Figure 2 display little variation over time, making it difficult to visually discern whether there is correlation between these variables and the tiering error rates. The variables in Figure 3, however, appear to be generally decreasing over time, which is consistent with the general trend of the Tiering Error Rates.

Figure 3. Comparison of Error Rate With SME-Suggested Variables (Total Number of Meals, Overall and by Type), FYs 2008–2015



Source: CACFP Assessment data and NDB CACFP State-level data.
Notes: For purposes of scale and comparability, the number of meals is expressed in tens of billions for each type of meal.

Figure 4. Comparison of Error Rate With Variables Most Correlated With Errors, FYs 2008–2015



Source: CACFP Assessment data; SAIPE; IES; FCC Broadband Reports.
Notes: Estimated correlation between Tiering Error Rates and each of the selected variables is shown in parenthesis after each variable name in the legend.

While estimates indicate that there is correlation between the variables in Figure 4 and tiering error rates, the small variation of all these variables over time makes it difficult to visually assess this correlation. Table 7 presents the estimated correlation between all the Tiering Error Rates and the potential explanatory variables, identified in decreasing order by statistical significance as given by the t-statistic. In this table, variables highlighted in light pink indicate those variables selected by our SME that are statistically significantly different from zero; variables in gray are those whose correlation with the Tiering Error Rate is not statistically significantly different from zero; and variables in dark pink are those suggested by our SME that are not statistically significantly different from zero.

Table 7. Estimated Correlation Between Selected Variables and Error Rates, FYs 2008–2015

Variable	Correlation	T-Statistic
Math Scores	0.17%	4.91
% Children in Poverty, <18	-20.59%	(3.96)
% Children in Poverty <5	-16.93%	(3.33)
% Expenditure per Capita	30.59%	2.97
Science Scores	0.10%	2.93
Percent w/o Broadband Access	-4.76%	(2.88)
Graduation Rate, Econ. Disadv.	-11.71%	(2.85)
% Math Proficient	8.79%	2.59
Avg. Sponsor Size[◊]	0.00%[◊]	2.42[◊]
% Advanced Math	21.25%	2.34
% Basic Math	9.55%	2.03
College Attendance[Δ]	-2.70%[Δ]	(1.11)[Δ]
Median Income[Δ]	0.00%[Δ]	0.85[Δ]
Graduation Rate[Δ]	-3.59%[Δ]	(0.82)[Δ]
Expenditure per Capita[Δ]	0.00%[Δ]	0.61[Δ]
% Tax Return E-file[Δ]	-0.54%[Δ]	(0.20)[Δ]
Total Suppers[˙]	0.00%[˙]	(0.09)[˙]
Total Breakfasts[˙]	0.00%[˙]	0.06[˙]
Total Lunches[˙]	0.00%[˙]	0.04[˙]
GDP[Δ]	0.00%[Δ]	(0.03)[Δ]
No. Sponsors[Δ]	0.00%[Δ]	(0.03)[Δ]
Total Snacks[˙]	0.00%[˙]	0.03[˙]
Total Meals[˙]	0.00%[˙]	0.02[˙]
% Individual Tax Returns, E-filed[Δ]	0.00%[Δ]	(0.02)[Δ]
Avg. Daily Attendance[˙]	0.00%[˙]	0.02[˙]
No. Children in Poverty, <4[˙]	0.00%[˙]	(0.02)[˙]
Number of FDCHs[Δ]	0.00%[Δ]	0.01[Δ]
No. Children in Poverty, <18[˙]	0.00%[˙]	0.00[˙]

Note: This table is sorted by level of statistical significance. The correlation of variables shaded in gray is not statistically significantly different from zero. Variables highlighted in pink were suggested by our SME. The variables in darker pink denote both being suggested by the SME and their correlation with tiering error rates not being statistically significantly different from zero.

Note: Cells in gray have been given a superscript of Δ, cells in light pink have been given a superscript of ◊, and cells in darker pink have been given a superscript of ˙.

Given the results from this correlation analysis, we selected variables for the multistage regression and prediction analysis that are statistically significantly correlated with the Tiering Error Rates. Furthermore, regardless of their correlation with the tiering errors, we also used the variables selected by our SME.

3.3.3. Limitations

There were several limitations that potentially constrained and limited the estimations and predictions in this report. While most of them relate to the CACFP Assessment data and are mentioned in Section 2, it was deemed important to present them and summarize them again in this subsection:

1. The small sample size of the CACFP Assessment data results in a large variance of outcome estimates. This applies in particular to the estimate of Tier II errors, whose incidence is low. In addition, there are two missing data years (FY 2005 and FY 2007). The data provided for 2006 was produced with a different methodology, which makes this year's data incompatible with data from other years. Three data years—FY 2006, FY 2009, and FY 2010—have State identifiers that do not conform to known State identifiers, and therefore it is not possible to use State-level explanatory variables in the analysis for these years of data. Lastly, data year FY 2011 is missing several key characteristic variables that precludes the use of the information provided for this year.
2. The CACFP Assessment data across years only contained data geographic identification at the State level rather than the finer levels of identification (e.g., census block), which limited the variation to exploit in the modeling and analysis stages.
3. The CACFP Assessment data did not contain sponsor or FDCH characteristics other than State (where identifiable) and their assessment data. This lack of detail greatly limits the level of accuracy feasible to obtain in the estimation and prediction of error rates, as it precludes us from obtaining different estimates for each FDCH as a function of their unique characteristics. Instead, we were only able to estimate the same tiering error value for all FDCHs in a given State for a given year.
4. Because the CACFP sample of States and FDCHs has changed every year, it is not possible to use it to forecast important characteristics (such as number of meals, as indicated by the SME) that can further explain the variation in error rates. Instead, the equivalent NDB State-level data variables were used; they display less variation than the FDCH-specific variables would have provided.
5. To the extent that our forecasts depend on the values of the forecasted explanatory variables (e.g., indicators of poverty), major economy-wide shocks affecting the expected values for these variables would also affect the predicted error rates and reimbursement costs in an unforeseeable manner.

4. National Error Estimates

The methodology described in Section 3 was used to estimate and predict tiering error rates, the number of meals provided in error, and the total costs associated with these errors. This section presents resulting estimates.

4.1. Estimated and Predicted Tiering Error Rates

Table 8 presents the estimated coefficients from the logistic regression findings obtained using Equation 5 to estimate the overall probability of a tiering error. This table shows that, State-level variables are much more likely to explain the variability in Tiering Error Rates than national-level variables. Furthermore, a high level of collinearity across the explanatory variables is expected, which would explain apparent inconsistencies in the coefficients obtained (for example, positive and statistically significant for the number of breakfasts, while negative and statistically significant for the number of lunches).

Table 8. Tiering Error – Overall Logistic Regression Findings, FYs 2008–2015

Tiering Error, Overall		Coef.	T-Statistic	P-Value
Year◊		(0.18)◊	(1.92)◊	0.06◊
Unknown State Dummies	State 1	(4.71)	(0.74)	0.46
	State 2	(5.18)	(0.79)	0.43
	State 3	(2.47)	(0.39)	0.70
	State 4	-		
	State 5	(4.67)	(0.72)	0.47
	State 6	(3.45)	(0.54)	0.59
	State 7	(3.07)	(0.48)	0.63
	State 9	(4.76)	(0.73)	0.47
	State 10	(3.25)	(0.52)	0.61
	State 11	(6.16)	(0.96)	0.34
	State 12	-		
	State 13	(3.73)	(0.59)	0.56
	State 14	(4.13)	(0.65)	0.51
	State 15	(4.71)	(0.74)	0.46
Unknown State Binary Variable Interacted With National Level Variables	Math Advanced %◊	96.25◊	1.92◊	0.06◊
	% Children in Poverty, 0 to 17	-		
	% Children in Poverty, 0 to 4	-		
	Total Meals	-		
	Total Breakfasts	-		
	Total Lunches	-		
	Graduation Rate, Economic Disadvantage	-		
	Math Proficiency %	-		
	% Population With No Broadband Access	-		
	Average Sponsor Size	-		
Known State Binary Variable Interacted With State Level Variables	Math Advanced %˙	(36.45)˙	(2.93)˙	0.00˙
	% Children in Poverty, 0 to 17◊	8.25◊	1.91◊	0.06◊
	% Children in Poverty, 0 to 4˙	(8.88)˙	(2.24)˙	0.03˙
	Total Meals	1.87	1.41	0.16
	Total BreakfastsΔ	2.16Δ	2.07Δ	0.04Δ
	Total Lunches˙	(4.05)˙	(2.16)˙	0.03˙
	Graduation Rate, Economic Disadvantage*	(4.24)*	(1.81)*	0.07*
	Math Proficiency %Δ	15.59Δ	3.02Δ	0.00Δ
	% Population With No Broadband Access	(1.59)	(0.85)	0.40
	Average Sponsor Size◊	0.00◊	1.67◊	0.10◊
Constant◊		356.55◊	1.87◊	0.06◊
R-Squared				7.00%

Note: The color shading in this table indicates statistical significance: (1) Dark blue, positive and statistically significant at the 5% or 1% level; (2) light blue, positive and statistically significant at the 10% level; (3) dark red, negative and statistically significant at the 5% or 1% level; and (4) light red, negative and statistically significant at the 10% level. Cells shaded in dark blue have been given a superscript of Δ, cells in lighter blue has been given a superscript of ◊, cells in dark red has been given a superscript of ˙, and cells in light red have been given a superscript of *.

Table 9 and Figure 5 display the predicted and estimated overall Tiering Error Rates, along with the observed Tiering Error Rates. In turn, Table 12 and Figure 6 display these same variables, but for Tier I and Tier II.

As observed in Table 9 and Figure 5, the Tiering Error Rates, both observed and estimated/predicted, are expected to continue their decreasing trend. This finding is also observed for Tier I, as shown on Table 9 and Figure 6; however, this general trend is not found for Tier II. An explanation for this finding may rely on both the decreasing number of total Tier II meals (Table 4) and the low number of Tier II errors in the sample, which makes any estimation/prediction difficult.

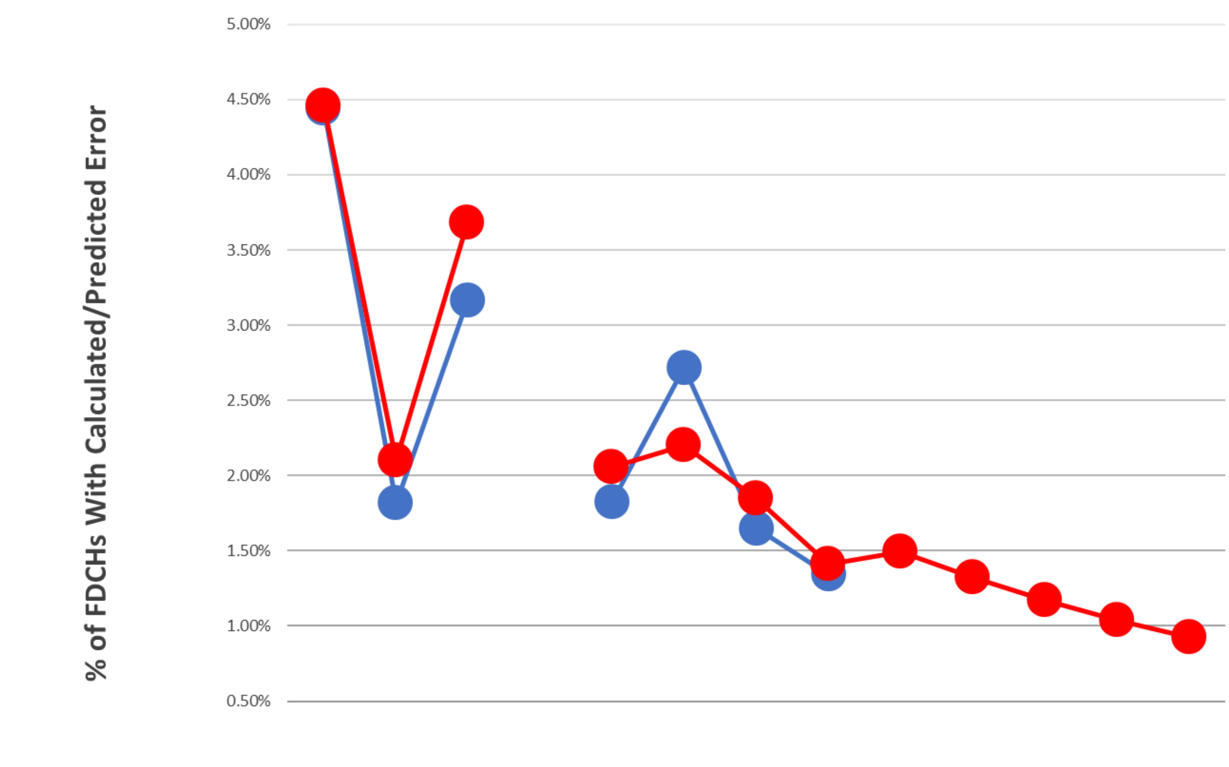
Another observation stemming from these two tables and figures is that the estimated/predicted values match the observed values and their variability over time closely.

Table 9. Observed, Estimated, and Predicted Overall Tiering Error Rates, FYs 2008–2020

Program Year	Error Rate	Error Rate (Est.)	SE Error Rate (Est.)
2008	4.4%	4.5%	0.77%
2009	1.8%	2.1%	0.78%
2010	3.2%	3.7%	1.12%
2012	1.8%	2.1%	0.30%
2013	2.7%	2.2%	0.40%
2014	1.7%	1.8%	0.35%
2015	1.3%	1.4%	0.30%
2016[Δ]		1.5%[Δ]	0.46%[Δ]
2017[Δ]		1.3%[Δ]	0.49%[Δ]
2018[Δ]		1.2%[Δ]	0.51%[Δ]
2019[Δ]		1.0%[Δ]	0.54%[Δ]
2020[Δ]		0.9%[Δ]	0.58%[Δ]

Note: Error Rates correspond to the percentage of misclassified FDCHs.
Note: Rows shaded in gray denote predicted values for FYs 2016–2020, and have been given a superscript of Δ.
Note: Standard Errors were estimated using a "bootstrap" methodology.

Figure 5. Estimated Misclassification as Percentage of FDCHs – Overall, FYs 2008–2020



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tiering Error Rate - Observed	4.44%	1.82%	3.16%		1.82%	2.72%	1.65%	1.34%					
Tiering Error Rate - Estimated	4.46%	2.10%	3.68%		2.06%	2.20%	1.85%	1.41%	1.49%	1.32%	1.17%	1.04%	0.92%

Note: Error Rates correspond to the percentage of misclassified FDCHs.

Table 10 presents the estimated coefficients from the logistic regression findings obtained using Equation 5 to estimate the Tier I probability of a tiering error. Similar to the results displayed in Table 8, we observed that the regression omitted most of the national-level variables from the analysis, and that the State-level variables' coefficients display similar apparent inconsistencies. As before, these apparent inconsistencies are explained by the high multicollinearity existent across the State-level explanatory variables.

Table 10. Tiering Error – Tier I Logistic Regression Findings, FYs 2008–2015

Tiering Error, Overall		Coef.	T-Statistic	P-Value
Year^Δ		(0.30)^Δ	(3.30)^Δ	0.00^Δ
Unknown State Dummies	State 1	(6.03)	(0.80)	0.43
	State 2	(6.75)	(0.86)	0.39
	State 3	(4.18)	(0.55)	0.58
	State 4	-		
	State 5	(6.38)	(0.82)	0.41
	State 6	(4.85)	(0.64)	0.52
	State 7	(4.54)	(0.60)	0.55
	State 9	(6.61)	(0.85)	0.39
	State 10	(4.79)	(0.63)	0.53
	State 11	(7.96)	(1.04)	0.30
	State 12	-		
	State 13	(5.09)	(0.67)	0.51
	State 14	(5.68)	(0.75)	0.45
	State 15	(6.56)	(0.86)	0.39
Unknown States Binary Variable Interacted With National Level Variables	Math Advanced %^Δ	112.24^Δ	2.16^Δ	0.03^Δ
	% Children in Poverty, 0 to 17	-		
	% Children in Poverty, 0 to 4	-		
	Graduation Rate, Economic Disadvantage	-		
	Math Proficiency %	-		
	% Population With No Broadband Access	-		
	Average Sponsor Size	-		
	Total Meals Tier I	-		
	Total Breakfasts Tier I	-		
	Total Lunches Tier I	-		
Known States Binary Variable Interacted With State Level Variables	Math Advanced %˙	(32.56)˙	(2.47)˙	0.01˙
	% Children in Poverty, 0 to 17^Δ	9.75^Δ	2.14^Δ	0.03^Δ
	% Children in Poverty, 0 to 4˙	(10.05)˙	(2.43)˙	0.02˙
	Graduation Rate, Economic Disadvantage	(4.27)	(1.60)	0.11
	Math Proficiency %^Δ	15.69^Δ	2.89^Δ	0.00^Δ
	% Population With No Broadband Access	(0.48)	(0.25)	0.80
	Average Sponsor Size^Δ	0.00^Δ	3.09^Δ	0.00^Δ
	Total Meals Tier I	0.98	0.41	0.68
	Total Breakfasts Tier I^◊	2.19^◊	1.64^◊	0.10^◊
	Total Lunches Tier I	(3.02)	(1.50)	0.14
Constant^Δ		599.89^Δ	3.23^Δ	0.00^Δ
R-Squared				10.8%

Note: The color shading in this table indicates statistical significance: (1) Dark blue, positive and statistically significant at the 5% or 1% level; (2) light blue, positive and statistically significant at the 10% level; (3) dark red, negative and statistically significant at the 5% or 1% level; and (4) light red, negative and statistically significant at the 10% level. Note: Cells shaded in dark blue have been given a superscript of Δ, cells in light blue have been given a superscript of ◊, and cells in dark red have been given a superscript of ˙.

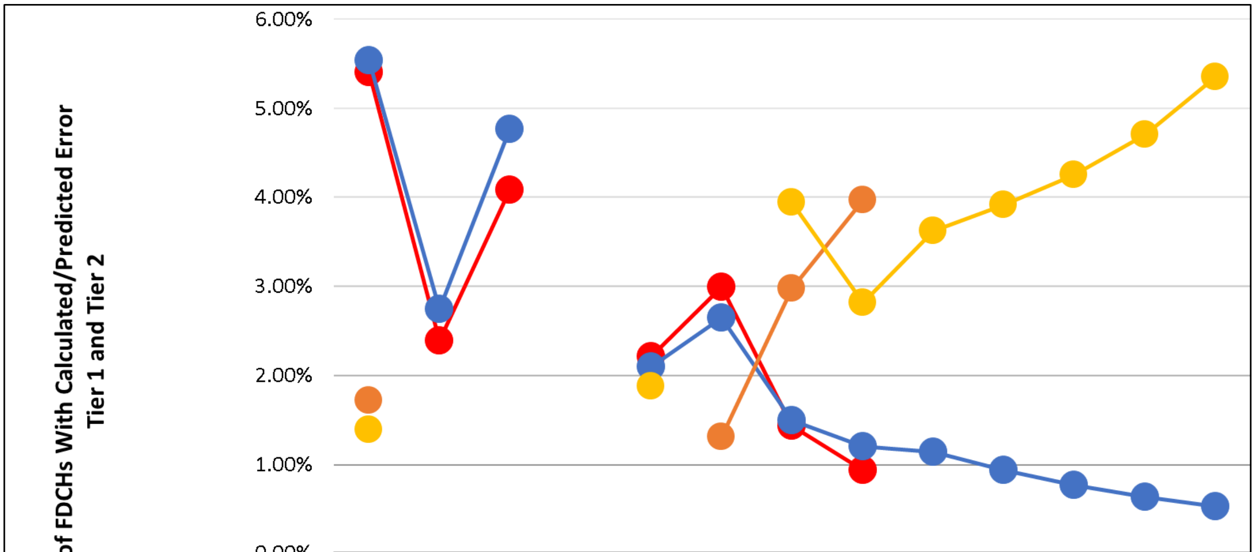
Note that we did not use a regression model to estimate the probability of Tier II errors. This is because the small sample size for Tier II homes and the low incidence of error did not provide enough data to conduct this analysis. As noted in Section 3.2, we used Equation 7 to estimate the Tier II error rate, and the small sample of Tier II FDCHs may result in large variation and low reliability estimates.

Table 11. Observed, Estimated, and Predicted Overall Tier I and Tier II Error Rates, FYs 2008-2020

Year	Error Rate Tier I	Error Rate (Est.) Tier I	SE Error Rate (Est.) Tier I	Error Rate Tier II	Error Rate (Est.) Tier II	SE Error Rate (Est.) Tier II
2008	5.40%	5.53%	0.96%	1.71%	1.38%	1.24%
2009	2.39%	2.74%	1.08%			
2010	4.08%	4.76%	1.51%			
2012	2.20%	2.09%	0.32%			
2013	2.98%	2.64%	0.49%	1.30%		0.95%
2014	1.42%	1.49%	0.30%	2.97%	3.93%	1.46%
2015	0.93%	1.19%	0.28%	3.96%	2.81%	1.20%
2016Δ		1.13%Δ	0.53%Δ		3.61%Δ	2.30%Δ
2017Δ		0.93%Δ	0.49%Δ		3.91%Δ	2.68%Δ
2018Δ		0.76%Δ	0.45%Δ		4.25%Δ	3.14%Δ
2019Δ		0.63%Δ	0.42%Δ		4.70%Δ	4.12%Δ
2020Δ		0.52%Δ	0.41%Δ		5.35%Δ	5.49%Δ

Note: Error Rates correspond to the percentage of misclassified FDCHs.
Note: Rows shaded in gray denote predicted values for FYs 2016–2020, and have been given a superscript of Δ.
Note: Standard Errors were estimated using a “bootstrap” methodology.

Figure 6. Estimated Misclassification as Percentage of FDCHs – Tier I and Tier II, FYs 2008–2020



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Error Rate Tier I - Observed	5.40%	2.39%	4.08%		2.20%	2.98%	1.42%	0.93%					
Error Rate Tier I - Estimated	5.53%	2.74%	4.76%		2.09%	2.64%	1.49%	1.19%	1.13%	0.93%	0.76%	0.63%	0.52%
Error Rate Tier II - Observed	1.71%					1.30%	2.97%	3.96%					
Error Rate Tier II - Estimated	1.38%				1.87%		3.93%	2.81%	3.61%	3.91%	4.25%	4.70%	5.35%

Note: Error rates correspond to the percentage of misclassified FDCHs for each Tier I and Tier II.
Note: Tier II error rates were estimated based on overall and Tier I Error Rates results.

4.2. Estimated and Predicted Number of Meals Reimbursed in Error

We calculated the number of meals reimbursed in error by first estimating the proportion of meals provided in error out of the total meals provided by FDCHs with an error. We used a linear regression approach to model and estimate this proportion (see Equation 9 and Equation 10). Table 12 displays the findings from this regression analysis, overall and for Tier I.

Once this proportion was obtained, we used it to calculate the expected and predicted number of meals provided in error (see Equation 11). As indicated in Section 3.2.2, due to data constraints, only FYs 2012–2015 were used in the estimation

Similar to the two previous regression findings tables, Table 12 displays a large level of collinearity across the explanatory variables used. This can be seen because only one variable (College Attendance) appears to be statistically significantly different from zero, but there is also a large goodness of fit (R-squared) for each of the two regressions in this table. A large R-squared suggests that the independent variables altogether explain a large proportion of the variability in the proportion of meals in error, even though almost none of them appears to have a significant coefficient.

Table 12. Proportion of Meals in Error, Regression Analysis Results – Overall and Tier I, FYs 2012-2015

Average % Meals in Error	Overall			Tier I		
	Coef.	T-Statistic	P-Value	Coef.	T-Statistic	P-Value
Year	0.01	0.31	0.76	0.01	0.52	0.61
% Children in Poverty, 0 to 4	(1.31)	(1.19)	0.24	(1.53)	(1.64)	0.11
Total Meals	(0.04)	(0.41)	0.69	(0.01)	(0.08)	0.94
Total Lunches	0.00	1.09	0.28	0.00	0.65	0.52
College Attendance	(1.60)˙	(2.97)˙	0.01˙	(0.68)	(0.81)	0.42
Graduation Rate, Economic Disadvantage	(0.07)	(0.09)	0.93	0.24	0.31	0.76
Math Scores	0.00	0.35	0.73	(0.00)	(0.57)	0.57
Average Sponsor Size	(0.00)	(1.25)	0.22	(0.00)*	(1.79)*	0.08*
Average Daily Attendance	(0.00)	(1.00)	0.32	(0.00)	(0.64)	0.53
% No Broadband Access	(0.35)	(1.46)	0.15	(0.24)	(1.26)	0.21
Constant	(23.69)	(0.28)	0.78	(20.77)	(0.45)	0.65
R-squared			21.5%			36.7%

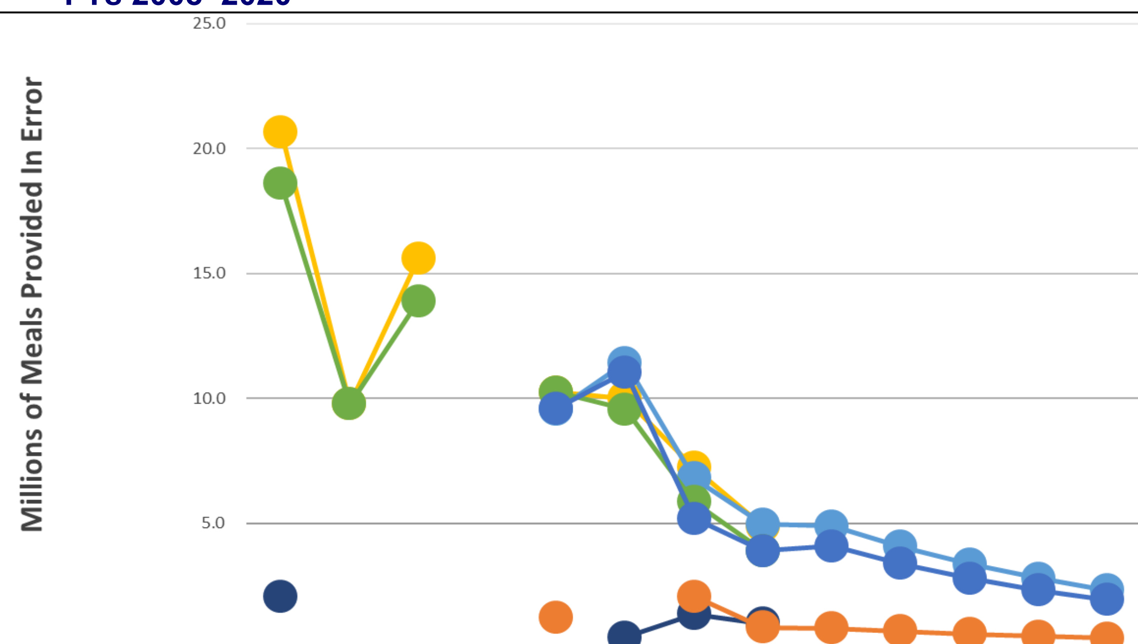
Note:The color shading in this table indicates statistical significance: (1) Dark blue, positive and statistically significant at the 5% or 1% level; (2) light blue, positive and statistically significant at the 10% level; (3) dark red, negative and statistically significant at the 5% or 1% level; and (4) light red, negative and statistically significant at the 10% level.
Note: Cells shaded in dark blue have been given a superscript of ∆, cells shaded in light blue have been given a superscript of ◊, cells shaded in dark red have been given a superscript of ˙, and cells shaded in light red have been given a superscript of *.

Table 13 and Table 14 below display the observed, estimated, and predicted proportion of meals in error and the number of meals in error respectively. The proportion of meals in error overall and for Tier I is estimated using the findings in Table 12, and the number of meals in error are estimated using those predicted proportions and Equation 11. As before, the findings and predictions obtained from the regression analysis were used to estimate the Tier II number of meals and proportion of meals in error. In turn, Figure 7 graphically summarizes these results and provides the observed and the estimated/predicted number of meals reimbursed in error, overall and by tier presented.

Table 13 shows a decreasing trend in the overall proportion of meals in error, whereas no trend is observed for Tier I and a decreasing trend is shown for Tier II. In turn, Table 14 displays a decreasing trend in the number of meals reimbursed in error overall and by tier. This finding is explained mostly by the decreasing number of meals provided overall and by each tier during the analysis period.

Table 14 shows that similar to the trend observed for predicted tiering errors for FYs 2016–2020, the expected number of meals reimbursed in error is also decreasing. This trend is observed mostly for the overall number and the Tier I meals reimbursed in error, whereas the trend for the Tier II meals reimbursed in error appears to be constant or slightly decreasing. However, because of the small sample size for Tier II error rates in the CACFP Assessment data, this observation is subject to large variation and uncertainty. Furthermore, note that for this estimation, only data from FYs 2012–2015 were used. This results from data inconsistencies and large variations found in the early data years, as well as lack of enough information (no State identification). These issues would have resulted in inconsistencies and heightened unreliability in our data estimation and prediction processes.

Figure 7. Estimated Number of Meals Reimbursed in Error – Overall and by Tier, FYs 2008–2020



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Meals in Error (Observed)	20.7	9.8	15.6		10.2	10.0	7.2	4.9					
Meals in Error (Estimated)					9.5	11.4	6.8	5.0	4.9	4.1	3.4	2.8	2.3
Meals in Error. Tier 1 (Observed)	18.6	9.8	13.9		10.2	9.6	5.8	3.9					
Meals in Error, Tier 1 (Estimated)					9.6	11.0	5.2	3.9	4.1	3.4	2.8	2.3	1.9
Meals in Error, Tier 2 (Observed)	2.1					0.4	1.4	1.0					
Meals in Error, Tier 2 (Estimated)					1.2		2.1	0.8	0.8	0.7	0.6	0.5	0.4

Note: Units for the number of meals is millions of meals.
Note: Tier II values were estimated using the estimated rate of error and the estimated proportion of meals-in-error overall and for Tier I.

Table 13. Observed, Estimated, and Predicted Overall Tier I and Tier II Proportion of Meals in Error, FYs 2008-2020

Year	Overall			Tier I			Tier II		
	PEM	PEM– Est.	Std. Error. PEM	PEM	PEM – Est.	Std. Error. PEM	PEM	PEM – Est	Std. Error. PEM (*)
2008	66.4%			68.5%			31.0%		
2009	81.4%			85.7%					
2010	82.6%			80.6%					
2012	80.9%	75.5%	3.74%	80.9%	75.8%	3.47%			
2013	59.8%	66.8%	3.70%	60.5%	67.8%	4.08%	42.4%		
2014	81.4%	75.8%	5.87%	86.7%	78.9%	4.29%	69.5%	72.9%	
2015	74.1%	73.9%	7.54%	84.8%	84.7%	4.48%	61.9%	45.3%	
2016$^{\Delta}$		61.7%$^{\Delta}$	12.73%$^{\Delta}$		79.0%$^{\Delta}$	10.73%$^{\Delta}$		30.9%$^{\Delta}$	
2017$^{\Delta}$		59.1%$^{\Delta}$	16.24%$^{\Delta}$		80.0%$^{\Delta}$	13.20%$^{\Delta}$		27.5%$^{\Delta}$	
2018$^{\Delta}$		56.6%$^{\Delta}$	19.35%$^{\Delta}$		81.0%$^{\Delta}$	14.97%$^{\Delta}$		24.4%$^{\Delta}$	
2019$^{\Delta}$		54.0%$^{\Delta}$	22.77%$^{\Delta}$		82.0%$^{\Delta}$	16.68%$^{\Delta}$		21.3%$^{\Delta}$	
2020$^{\Delta}$		51.4%$^{\Delta}$	26.20%$^{\Delta}$		83.1%$^{\Delta}$	18.78%$^{\Delta}$		18.3%$^{\Delta}$	

Note: Rows shaded in gray denote predicted values for FYs 2016–2020, and have been given a superscript of Δ.

Note: PEM denotes the Proportion of Error Meals.

Note: Standard Errors were estimated using a “bootstrap” methodology. (*) It was not possible to estimate standard errors for Tier II PEM.

Table 14. Observed, Estimated, and Predicted Overall Tier I and Tier II Number of Meals in Error (Thousands), FYs 2008-2020

	Overall			Tier I			Tier II		
Year	NEM	NEM – Est.	Std. Error. NEM	NEM	NEM – Est.	Std. Error. NEM	NEM	NEM – Est	Std. Error. NEM
2008	20,660			18,587			2,073		
2009	9,771			9,771					
2010	15,597			13,899					
2012	10,233	9,539	3,045	10,233	9,602	3,044			
2013	9,990	11,410	2,700	9,560	11,040	2,676	430		
2014	7,213	6,804	2,233	5,846	5,190	1,951	1,368	2,068	1,174
2015	4,879	4,965	2,077	3,897	3,893	1,935	982	823	920
2016$^{\Delta}$		4,882$^{\Delta}$	1,220$^{\Delta}$		4,090$^{\Delta}$	1,254$^{\Delta}$		791$^{\Delta}$	822$^{\Delta}$
2017$^{\Delta}$		4,056$^{\Delta}$	1,240$^{\Delta}$		3,379$^{\Delta}$	1,180$^{\Delta}$		677$^{\Delta}$	827$^{\Delta}$
2018$^{\Delta}$		3,366$^{\Delta}$	1,238$^{\Delta}$		2,796$^{\Delta}$	1,100$^{\Delta}$		570$^{\Delta}$	855$^{\Delta}$
2019$^{\Delta}$		2,791$^{\Delta}$	1,296$^{\Delta}$		2,317$^{\Delta}$	1,042$^{\Delta}$		473$^{\Delta}$	906$^{\Delta}$
2020$^{\Delta}$		2,312$^{\Delta}$	1,316$^{\Delta}$		1,926$^{\Delta}$	1,001$^{\Delta}$		386$^{\Delta}$	946$^{\Delta}$

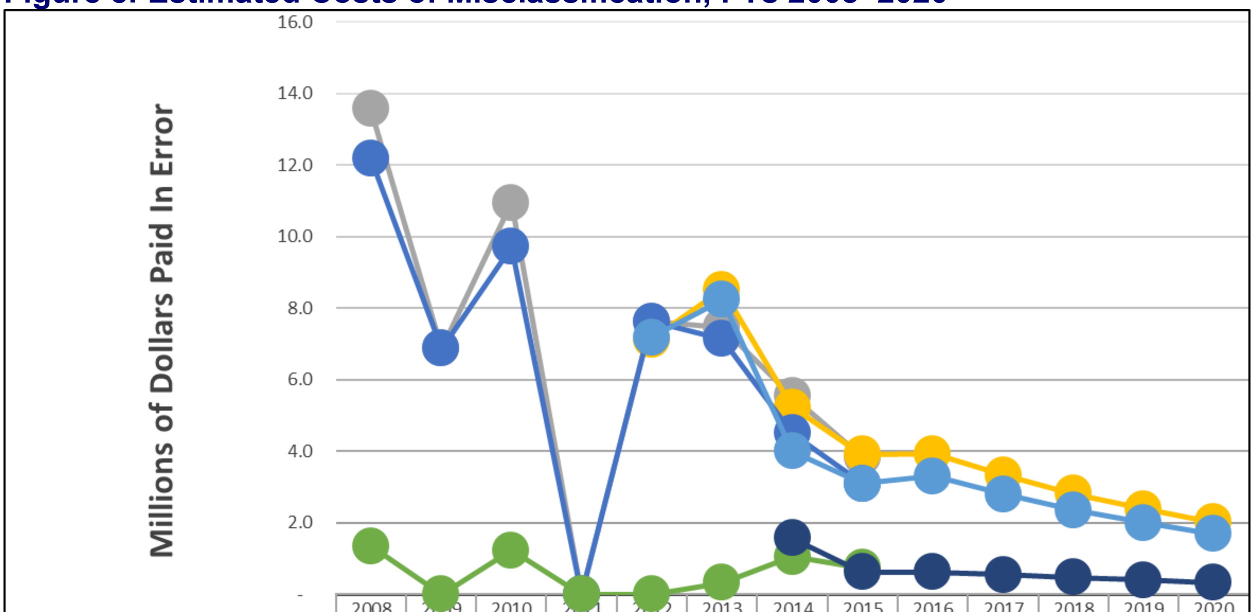
Note: Rows shaded in gray denote predicted values for FYs 2016–2020, and have been given a superscript of Δ.
Note: NEM denotes the Number of Error Meals.
Note: Standard Errors were estimated using a “bootstrap” methodology.

4.3. Estimated Costs of Tier Misclassification

We estimated the costs of tier misclassification by first using the CACFP data to calculate the weighted unit costs of tiering errors. We then multiplied the estimated unit costs by the estimated number of meals provided in error to obtain the overall costs of meals misclassification.

Figure 8 presents the observed (FYs 2008–2015) and predicted (FYs 2016–2020) misclassification costs. These costs, as the number of meals-in-error and the Tiering Error Rates, also display a decreasing trend overall and for each Tier I and Tier II, consistent with the findings in the previous sections that show a decreasing trend for overall and Tier I estimated costs of tier misclassification. Because the estimated costs of misclassification were calculated using Equation 15; that is, multiplying the estimated number of meals provided in error (Equation 11) by the unit cost of a reimbursement error. Only data for FYs 2012–2015 were used in the analysis due to the data inconsistencies mentioned above. Similar to Figure 7, in Figure 8 the estimated costs of misclassification for Tier II are expected to follow a somewhat horizontal trend or slightly decreasing trend, but this finding is subject to a high degree of uncertainty due to the small sample of Tier II errors available for estimation in the CACFP Assessment data.

Figure 8. Estimated Costs of Misclassification, FYs 2008–2020



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Error Costs - Observed	13.6	6.9	10.9	-	7.6	7.5	5.5	3.8					
Error Costs - Estimated					7.1	8.5	5.2	3.9	3.9	3.3	2.8	2.4	2.0
Error Costs - Tier 1 - Observed	12.2	6.9	9.7	-	7.6	7.1	4.5	3.1					
Error Costs - Tier 1 - Estimated					7.2	8.2	4.0	3.1	3.3	2.8	2.4	2.0	1.7
Error Costs - Tier 2 - Observed	1.3	-	1.2	-	-	0.3	1.0	0.7					
Error Costs - Tier 2 - Estimated							1.6	0.6	0.6	0.5	0.5	0.4	0.3

Note: Values for FYs 2008–2015 were estimated directly using the CACFP Assessment data.
Note: Reimbursement costs were estimated using the number of meals-in-error multiplied by the average cost of a meal in error.

Table15 displays the findings in Figure 8 in further detail. In particular, this table shows the decreasing trend in the aggregate costs of reimbursement for meals in error that matches the decreasing trends overall and by tier found for the number of meals reimbursed in error (see Figure 7 and Table 14).

Table 15. Observed, Estimated, and Predicted Overall Tier I and Tier II Costs of Reimbursement of Meals in Error (Millions $), FYs 2008-2020

	Overall			Tier I			Tier II		
Year	COST	COST – Est.	Std. Error. COST	COST	COST – Est.	Std. Error. COST	COST	COST – Est.	Std. Error. COST
2008	13.56	-		12.19	-		1.35	-	
2009	6.87	-		6.87	-		-	-	
2010	10.94	-		9.71	-		1.23	-	
2012	7.62	7.13	2.28	7.62	7.17	2.28	-	-	
2013	7.46	8.52	2.03	7.13	8.24	2.01	0.32	-	
2014	5.53	5.22	1.72	4.49	3.99	1.50	1.04	1.57	0.87
2015	3.84	3.90	1.66	3.10	3.09	1.56	0.74	0.62	0.69
2016$^{\Delta}$	-	3.92$^{\Delta}$	0.98$^{\Delta}$	-	3.30$^{\Delta}$	1.01$^{\Delta}$	-	0.62$^{\Delta}$	0.64$^{\Delta}$
2017$^{\Delta}$	-	3.33$^{\Delta}$	1.02$^{\Delta}$	-	2.79$^{\Delta}$	0.97$^{\Delta}$	-	0.54$^{\Delta}$	0.65$^{\Delta}$
2018$^{\Delta}$	-	2.82$^{\Delta}$	1.04$^{\Delta}$	-	2.36$^{\Delta}$	0.93$^{\Delta}$	-	0.46$^{\Delta}$	0.68$^{\Delta}$
2019$^{\Delta}$	-	2.38$^{\Delta}$	1.11$^{\Delta}$	-	1.99$^{\Delta}$	0.90$^{\Delta}$	-	0.39$^{\Delta}$	0.74$^{\Delta}$
2020$^{\Delta}$	-	2.01$^{\Delta}$	1.15$^{\Delta}$	-	1.69$^{\Delta}$	0.88$^{\Delta}$	-	0.33$^{\Delta}$	0.78$^{\Delta}$

Note: Rows shaded in gray denote predicted values for FYs 2016–2020, and have been given a superscript of Δ.
Note: Standard Errors were estimated using a "bootstrap" methodology.

4.4. Variable/Factor Sensitivity

The analyses in this report incorporated robustness and sensitivity analysis to ensure the reliability of their findings. All regression analyses began by using only year (a time-trend) as the explanatory variable for the predictions and estimations; those findings were compared later with the final multivariate analysis findings to ensure consistency and robustness. Furthermore, the final analysis variables were identified by an iterative process that ensured the maximum model fit and minimized the collinearity of the explanatory variables identified.

5. Conclusion

This report presented the estimated and predicted Tiering Error Rates, number of meals paid in error, and the associated costs of these misclassifications for FYs 2016–2020 using CACFP Assessment data and other external datasets.

For these purposes, a two-step and multistage approach was used. The findings in this report indicate that the general decreasing trend in tiering errors, meals-in-error, and costs of misclassification is expected to continue, leading to fewer tiering errors, fewer meals provided in error, and smaller costs of misclassification. A limitation of these findings is the large standard errors in our estimation, which result from a limited sample size in the CACFP Assessment data. This limitation was, however, minimized by pooling the data from all data-years available and the use of explanatory variables in the analyses.

It must be kept in mind that the regression models used in this report do not imply causality between the measures of tiering error and the explanatory variables selected, but only correlation. Because the mechanisms that link these explanatory variables and the measures of error analyzed have not been assessed, it is not possible to ensure that the relationship found will be maintained over time. In fact, these predictions are contingent on economic factors that determine their values and trend; should any economic shock affect these factors, then the future realization of these errors may differ from the predicted values.

Appendix A. Summary CACFP Assessment Data by Tier

Table A-1. CACFP Assessment Data Summary Statistics by Tier (Unweighted) , FYs 2008-2015

		Tier I							Tier II						
Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2008	AZ	43	1	172,956	-	471	232,490	334	1	-	2,812	119	-	3,873	-
2008	CA	72	2	346,587	111	7,054	458,103	4,633	16	-	27,413	32,149	-	58,326	-
2008	IL	32	1	185,818	1,855	14,840	243,554	9,075	12	1	11,228	39,014	4,492	37,196	2,904
2008	KY	39	2	151,613	451	7,775	189,015	5,122	5	-	494	16,185	-	10,336	-
2008	LA	43	4	103,898	-	4,854	144,893	3,214	1	-	-	671	-	496	-
2008	ME	34	1	186,618	2,891	5,415	232,451	3,555	10	-	2,273	21,842	-	14,153	-
2008	MN	19	3	81,458	5,786	6,141	103,058	3,961	25	-	2,454	96,990	-	62,133	-
2008	NE	27	-	109,513	1,245	-	140,403	-	17	-	4,365	65,505	-	44,582	-
2008	NM	43	1	90,647	-	1,241	124,521	820	1	-	1,997	-	-	3,067	-
2008	NY	36	1	119,844	1,286	3,457	163,824	2,218	8	-	3,700	18,596	-	15,372	-
2008	OH	39	3	136,289	926	1,089	181,079	710	5	1	11,437	5,751	2,036	18,624	1,351
2008	OR	37	1	111,841	-	5,765	147,442	3,629	7	-	5,321	20,060	-	18,157	-
2008	TX	38	3	218,895	332	19,030	306,431	13,006	6	-	12,989	31,969	-	35,015	-
2008	UT	34	5	147,266	1,704	18,146	195,384	12,011	10	-	8,131	25,354	-	27,545	-
2009	Unknown	44	-	98,639	-	-	142,210	-							
2009	Unknown	33	1	166,431	3,626	1,102	227,843	755	11	-	510	30,163	-	20,549	-
2009	Unknown	38	5	192,423	2,258	17,885	272,371	12,836	6	-	-	17,637	-	13,751	-
2009	Unknown	40	-	159,888	180	-	219,215	-	4	-	483	11,699	-	7,655	-
2009	Unknown	30	1	109,840	72	5,547	145,403	3,897	14	-	27,986	41,794	-	63,227	-
2009	Unknown	28	1	106,946	845	3,792	151,838	2,605	16	-	-	39,846	-	28,109	-
2009	Unknown	38	2	208,648	942	8,313	304,126	5,779	6	-	5,870	22,126	-	23,650	-
2009	Unknown	43	1	211,722	-	4,584	282,925	3,071	1	-	4,840	-	-	6,082	-
2009	Unknown	30	-	132,742	112	-	181,587	-	14	-	9,109	38,912	-	37,528	-
2009	Unknown	77	1	323,576	2,176	4,348	469,577	3,174	11	-	8,292	23,466	-	30,500	-
2009	Unknown	29	-	90,573	7,423	-	122,674	-	15	-	10,654	57,805	-	51,894	-
2009	Unknown	13	1	49,526	3,200	2,761	69,416	1,897	31	-	4,816	117,079	-	80,049	-
2009	Unknown	36	-	146,131	211	-	196,447	-	8	-	6,098	21,243	-	22,033	-
2009	Unknown	44	-	106,097	-	-	153,307	-							
2010	Unknown	20	1	99,367	1,939	5,006	131,513	3,491	24	-	1,025	86,836	-	55,756	-
2010	Unknown	70	-	297,458	6,258	-	421,669	-	18	-	11,576	56,141	-	55,869	-

		Tier I							Tier II						
Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2010	Unknown	39	4	197,170	-	8,579	267,056	5,986	5	-	1,876	14,717	-	11,837	-
2010	Unknown	38	-	170,578	123	-	245,506	-	6	-	103	12,701	-	8,137	-
2010	Unknown	44	-	122,091	-	-	183,447	-							
2010	Unknown	32	3	134,058	-	9,908	182,469	6,547	12	-	2,263	33,695	-	24,866	-
2010	Unknown	27	3	128,337	741	14,898	172,304	10,381	17	-	18,853	80,106	-	76,933	-
2010	Unknown	42	-	91,680	-	-	133,201	-	2	-	2,498	-	-	3,835	-
2010	Unknown	38	5	188,747	5,342	17,375	289,341	12,645	6*	-*	-*	24,683*	3,973*	16,824*	2,869*
2010	Unknown	44	-	131,517	-	-	194,507	-							
2010	Unknown	36	-	207,396	3,251	-	287,169	-	8	-	8,910	30,777	-	33,271	-
2010	Unknown	33	2	136,681	687	7,315	190,930	5,087	11	-	9,969	34,605	-	37,824	-
2010	Unknown	33	2	175,808	517	4,697	238,893	3,286	11	-	15,766	31,910	-	42,411	-
2010	Unknown	42*	1*	145,423*	686*	-*	214,616*	-*	2	-	5,560	6,310	-	12,619	-
2012	AZ	44	-	159,692	-	-	242,477	-							
2012	CA	81	3	352,048	-	9,661	539,558	7,236	7	-	8,365	21,832	-	27,246	-
2012	IL	39	3	158,883	-	4,210	236,427	3,105	5	-	-	10,646	-	7,365	-
2012	LA	44	-	121,638	-	-	183,045	-							
2012	MA	31	-	115,229	5,128	-	176,064	-	13	-	1,245	39,994	-	26,350	-
2012	MN	22	3	119,535	1,039	16,125	165,169	11,768	22	-	4,426	93,770	-	70,871	-
2012	NM	44	-	94,839	-	-	147,896	-							
2012	NY	41	1	223,289	4,342	6,700	351,443	5,225	3	-	11,340	6,151	-	19,012	-
2012	OR	41	-	176,763	-	-	253,439	-	3	-	-	13,519	-	9,026	-
2012	SD	28	1	140,789	23,501	4,834	212,551	3,472	16	-	7,656	67,985	-	56,519	-
2012	TN	44	1	184,503	-	4,633	267,018	3,386							
2012	TX	39	1	156,777	4,551	6,727	230,973	4,981	5	-	792	14,879	-	11,475	-
2012	UT	41	-	184,104	187	-	288,667	-	3	-	5,419	14,337	-	19,614	-
2012	WI	30	2	98,362	6,129	5,999	150,406	4,796	14	-	1,204	50,487	-	36,903	-
2013	CA	38	-	176,861	-	-	277,661	-	6	-	456	13,450	-	13,293	-
2013	GA	41	-	178,057	-	-	257,728	-	3	-	-	4,744	-	3,301	-
2013	IA	34	2	158,802	948	4,722	227,533	3,498	10	1	9,368	31,168	1,880	34,737	1,415
2013	KS	33	-	138,135	1,268	-	201,316	-	11	-	1,260	39,968	-	28,418	-
2013	LA	44	-	129,124	-	-	216,242	-							
2013	MD	37	-	148,500	1,439	-	227,090	-	7	-	340	25,235	-	20,324	-
2013	ME	38	-	164,995	86	-	230,818	-	6	-	749	22,651	-	14,673	-
2013	MI	40	5	152,520	1,923	5,368	221,178	4,018	4	-	-	7,248	-	5,017	-

		Tier I							Tier II						
Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2013	MN	27	6	134,659	9,551	22,289	202,409	16,805	17	-	413	55,532	-	39,879	-
2013	NC	43	3	158,478	2,057	9,341	228,497	6,825	1	-	2,649	-	-	3,850	-
2013	NY	84	2	401,946	66	14,090	639,582	10,774	4	-	2,022	17,769	-	15,968	-
2013	PA	39	2	180,954	-	5,624	263,734	4,186	5	-	-	25,099	-	15,782	-
2013	TX	40	-	173,853	-	-	278,014	-	4	-	-	12,379	-	11,081	-
2013	VT	35	1	122,219	261	2,590	169,522	1,707	9	-	2,500	16,132	-	11,063	-
2014	AZ	1	-	1,281	-	-	2,178	-							
2014	CA	143	1	664,550	15,550	614	1,045,042	479	33	-	8,620	94,091	-	92,373	-
2014	DC	1	-	3,470	-	-	4,639	-							
2014	FL	44	1	181,634	-	8,635	276,121	6,771							
2014	IL	41	-	221,956	-	-	328,646	-	2	-	-	6,655	-	4,210	-
2014	KS	36	3	145,914	-	14,127	212,871	10,711	8	-	3,959	20,872	-	20,458	-
2014	LA	44	-	136,703	-	-	226,460	-							
2014	MD	46	1	214,063	-	3,994	332,783	3,312	8	-	3,972	23,195	-	22,757	-
2014	MN	24	2	94,260	6,969	7,244	144,396	5,425	20	-	15,608	79,557	-	75,647	-
2014	MO								1	-	-	762	-	530	-
2014	MS	42	-	92,215	-	-	147,172	-	1	-	1,511	-	-	2,219	-
2014	NM	43	-	125,890	-	-	203,596	-							
2014	NY	43	-	183,041	7,190	-	308,135	-	1	-	-	1,215	-	849	-
2014	OK	40	-	193,887	-	-	280,001	-	4	-	-	16,833	-	11,763	-
2014	TX	40	-	189,173	2,593	-	292,859	-	4	-	-	13,880	-	10,650	-
2014	VA	32	1	135,344	1,654	2,786	207,979	2,124	12	2	7,527	54,003	8,675	48,497	6,612
2014	WY	30	2	150,807	151	4,232	216,004	3,214	14	1	14,383	51,142	73	58,832	45
2015	AZ	44	-	153,554	-	-	256,378	-							
2015	CA	77	1	350,821	120	6,976	555,458	5,781	11	-	8,650	35,912	-	44,345	-
2015	IA	36	-	153,131	1,849	-	228,758	-	8	-	3,543	34,811	-	28,661	-
2015	IL	39	1	178,345	3,552	5,259	264,366	4,111	5	-	-	17,995	-	12,345	-
2015	LA	44	-	129,165	693	-	213,180	-							
2015	MA	33	-	91,179	313	-	134,493	-	11	-	5,286	23,126	-	24,533	-
2015	MI	36	-	159,936	-	-	240,542	-	8	-	2,674	26,634	-	22,208	-
2015	MN	26	2	122,137	2,551	7,712	182,048	5,953	18	-	5,898	56,650	-	50,379	-
2015	NC	42	-	141,887	-	-	216,486	-	2	-	1,050	4,711	-	4,855	-
2015	NY	82	2	349,487	5,779	3,441	542,866	2,642	6	3	7,971	17,010	5,884	22,149	4,439
2015	OR	41	-	218,201	-	-	337,738	-	3	1	2,977	8,114	86	9,900	58

		Tier I							Tier II						
Year	State	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)	# FDCHs	# FDCHs w/ Error	# Meals Tier I	# Meals Tier II	# Meals in Error	Cost ($)	Error Cost ($)
2015	TX	44	-	235,191	-	-	378,991	-							
2015	WA	41	-	169,069	475	-	246,924	-	3	-	507	14,101	-	10,435	-

Source: CACFP Assessment Data for years FYs 2008–2010, FYs 2012–2015.

Note: The two rows highlighted for FY 2010 denote data consistency problems for two situations: (1) A tiering error has been found, but no meals provided in error are indicated; (2) no tiering error is indicated; however, meals in error and error costs are shown in the data.

Note: Cells shaded in light red have been given a superscript of *.