**Technical Appendix: Creation and Interpretation of the State SNAP Policy Index**

This technical appendix describes the process we implemented for creating a state SNAP policy index, which is used as the instrumental variable in all analyses. As noted in the main body of the paper, we selected nine policies for inclusion in this index from the USDA State SNAP Policy Database(1), which records monthly variation in state policies. We based our choice of policies on previous research, which has also used state SNAP policies in instrumental variables (IV) analyses of the effects of SNAP participation(2). We included the following policies:

* Two continuous measures of inflation-adjusted spending on SNAP outreach and spending on SNAP outreach squared (both in 2015 constant dollars). Greater outreach spending should increase SNAP participation.
* The proportion of SNAP households that were required to recertify eligibility within a six-month period. More frequent recertification requirements should create a barrier and reduce SNAP participation.
* A dichotomous indicator for whether the state had adopted broad based categorical eligibility (BBCE). BBCE allows states to use TANF maintenance of effort funds to expand income eligibility levels and to waive asset tests. The adoption of BBCE is associated with increases in SNAP participation.
* A dichotomous indicator for whether states allowed SNAP applicants to exempt at least one vehicle from consideration for the asset eligibility test. Exempting vehicles from assets tests should increase participation.
* A dichotomous indicator for whether states required fingerprints or other biometric data to prove identity. Biometric requirements create burden for new and recertifying SNAP benefit recipients and should lower participation.
* A dichotomous indicator for whether a state adopted simplified reporting to allow recipients to maintain eligibility. Simplified reporting speeds recertification and should increase participation.
* Two separate dichotomous indicators for whether the state chose to expand eligibility for SNAP to all non-citizen adults and non-citizen older adults. Expanded eligibility for these two groups should increase participation.

Appendix Table 1 lists all of the state policy instruments, their coding, the predicted impact on SNAP participation, and citations for earlier studies that have also used them to predict SNAP participation.

Respondents to the 2008-2013 NHIS reported on household-level SNAP participation in the previous calendar year, and so we set out to create our state SNAP policy index based on policies from the years prior to each wave of NHIS data collection (i.e., 2007-2012). However, at the time of analysis, data on state SNAP policies were only available until September 2012 for two of the nine policies (whether states allowed applicants to exempt a vehicle from assets tests and whether they had implemented simplified reporting systems). Thus, to generate a measure, which indexed the overall state SNAP policy climate in the years when participation was being reported, we took a number of different steps:

First, we used the USDA ERS state snap policy database (which records monthly variation in SNAP policies1) to create annual measures of state SNAP policies. For outreach spending, which was our sole continuous policy measure, we created an annual average of spending and spending squared. For all other policies, which were coded as 0-1 dichotomies, we created annual measures equal to the proportion of months a policy was in effect during a given year. The use of proportions allowed for consistency between all other policy measures and the two policies for which data were only available until September 2012.

Second, after creating annual measures, we assigned values from the previous calendar year (to match with the timing of SNAP participation) to each NHIS respondent.

Third, we standardized all policy variables to have a mean of zero and a standard deviation of one.

Last, with Stata 15, we used the command (*alpha* [policy variables], *gen(index)*) to create a numeric average of all the policies. In the process of creating our index, the *alpha* command automatically reverse-coded a number of the variables. Thus, the final result was an average index of state policies, with higher levels indicating states with **less** permissive/generous state policies. As noted in the main body of the paper, this index had good internal reliability (alpha = 0.70). Descriptive information on the SNAP policy index is presented in Table 2 of the manuscript.

 Consistent with our IV approach, we do not focus on the exact nature of the relationship between our SNAP policy index or individual SNAP policies and SNAP participation. The policies that comprise our index may vary within states over time and across states at a specific point in time. Notably, states may also vary in their specific implementation of each policy (e.g., use automatic or manual termination of SNAP benefits after a certain period), which we cannot examine using the NHIS data. Important to the analysis here, though, is that IV analysis requires a strong relationship between an instrument (our policy index) and SNAP participation, which we discuss below. That is, our primary goal in using IV analysis is to address the threat of endogeneity, which is a consistent challenge in all observational studies but is especially pernicious in the study of participation in public programs like SNAP. The primary challenge in implementing IV is the need to identify a sound instrument, which meets the requirements necessary to generate causal estimates. In brief, IV analysis relies on identifying a variable that produces exogenous variability in a treatment of interest, which can then be used to estimate the effect of that treatment on outcomes. Applied to the context of this paper, we take advantage of the fact that state SNAP policies produce arguably-exogenous variability in SNAP participation, and then use only this this portion of the total variability in SNAP participation in the population of eligible households to estimate the effects of SNAP on health and health care utilization. When assumptions hold (as we believe they do, see below), IV using state SNAP policies as instruments can produce causal estimates of SNAP participation. However, the application of this method comes at a cost, as our results only apply to those households who modified their participation in SNAP in relationship to variability in state policies. Thus, unlike other methods which generate an overall average treatment effect, IV generates a more specific local average treatment effect (LATE), as we note in the paper.

In sum, we clarify that our attention to state policies is not substantive insomuch as we do not undertake a formal analysis of individual policies, and we do not demonstrate their individual relationship to SNAP participation in the sample. As reported in the Appendix Table below, these state policies have been widely used to predict SNAP participation in previous work, and we direct the interested reader to these other analyses. Rather, and because we are mindful about the endogeneity of SNAP participation, our attention is primarily focused on whether state SNAP policies satisfy the requirements of sound instruments, as detailed in the pertinent literature on instrumental variables techniques.(3,4) Here, we argue that it does. The first requirement of sound instruments is that they are strongly associated with an endogenous treatment variable, the only assumption that is formally testable. As shown below in the main body of the paper, the index is strongly associated with SNAP receipt. Second, the so-called exclusion restriction requires that an instrument only affects outcomes via variability in the endogenous treatment. Given its specificity to SNAP policy administration, we argue that our policy index is unlikely to affect child and health and health care utilization outcomes other than via its effects on SNAP participation; to ensure that this assumption holds, all of our models control for both state-, family-, and individual-level controls. The third assumption of IV analyses is that an exogenous instrument is as good as randomly assigned. Because our instrument is comprised of state policies which are designed and implemented independent of the benefits of an individual household’s participation in SNAP, we likewise argue that this assumption holds. Finally, there is the monotonicity assumption, which must hold in order for IV analyses to generate causal estimates. Sometimes referred to as the “no-defiers” assumption, the monotonicity assumption requires that our state SNAP policy index (our exogenous instrument) affects months of SNAP participation (the endogenous treatment) in a monotonic direction. That is, as values of the SNAP policy index increase, we would expect changes to months of SNAP participation only in one direction, and not both increases and decreases in months of participation.

Indeed, our case for using an index of state SNAP policies in an IV analysis is underscored by a recent USDA report that created a different but conceptually similar additive index of state SNAP policies(2). Using data from the Survey of Income and Program Participation, the report found that the index was significantly associated with monthly SNAP participation. Moreover, the global F-test for the model using the index was higher than the comparable statistic for a model that included separate measures of the policies, indicating that an index of policies was preferable for use in an IV analysis.

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| **Appendix Table 1: State SNAP Policy Instruments** |
| **Variable** | **Coding** | **Predicted impact on** **SNAP participation** | **Use in Previous Research** |
| Outreach spending to increase participation | Continuous ($1000) | Increase SNAP participation | Meyerhoefer & Pylypchuk (2008)(5) Ratcliffe, McKernan & Zhang (2011)(6) |
| State requires recertification every 6 months or less | 0-1 | Decrease SNAP participation | Yen et al. (2008)(7) |
| State uses broad-based categorical eligibility | 0-1 | Increase SNAP participation | Gregory et al. (2013)(8) |
| State exempts one vehicle from SNAP asset tests | 0-1 | Increase SNAP participation | Gregory et al. (2013)(8)Gregory & Deb (2015)(9)  |
| State requires fingerprint or other biometric information to enroll in SNAP  | 0-1 | Decrease SNAP participation | Gregory & Deb (2015)(9)Meyerhoefer & Pylypchuk (2008)(5) Ratcliffe, McKernan & Zhang (2011)(6) |
| State has implemented simplified systems for reporting changes in earnings | 0-1 | Increase SNAP participation | Gregory & Deb (2015)(9) |
| State makes all/some legal immigrants eligible | 0-1 | Increase SNAP participation | Ratcliffe, McKernan & Zhang (2011)(6)  |

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