The Economic Geography of WIC

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Background and Rationale for the Paper

The aim of the paper is to provide a better understanding of the economic geography of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Specifically, the work is designed to (1) provide a clearer understanding of geographic barriers that impact program participation, and (2) assess the extent to which the program improves food choices in the communities where it reaches. WIC is the nation's third largest food assistance program (Oliveira and Frazao 2015) but focuses narrowly on pregnant, postpartum, or breastfeeding women; infants; and children up to five year of age. The program provides food assistance, nutrition education, and referrals to health and other services (USDA FNS 2015). WIC is commonly cited as one of the most successful early-life policy interventions (Currie and Rossin-Slater 2015; US Government Accountability Office (GAO) 2013). A robust academic literature has linked WIC participation to improved birth outcomes (Devaney 2010; Currie and Rossin-Slater 2015; Hoynes and Schanzenbach 2015). There is also evidence that the WIC program is beneficial in terms of child health (Carlson and Senauer 2003), reduces food insecurity (Herman et al. 2004; Bitler, Gundersen and Marquis 2005) and improves healthfulness of food purchases and food consumption (Arcia, Crouch and Kulka 1990; Yen 2010; Ishdorj and Capps 2013).

This earlier work demonstrates clear benefits to the WIC program, but many eligible individuals do not participate (Tiehen and Jacknowitz 2008; Jacknowitz and Tiehen 2009; Bitler, Currie and Scholz 2010). Geographic hurdles to accessing WIC services may be one factor that affects participation. Visits to WIC clinics are often a requirement of the program and such visits are encouraged by state and local WIC agencies as they provide an opportunity to provide nutrition education to clients. However, the time and monetary costs of travel to WIC clinics may discourage participation among individuals with limited resources. Evidence that clinic access constitutes a meaningful geographic barrier is provided in recent work by Rossin-Slater (2013) who uses clinic access as an instrumental variable for WIC participation in her analysis of birth weights. A second geographic constraint is the proximity of WIC-approved retailers. WIC program food packages consist only of healthy foods tailored to the nutritional needs of target individuals and are available through WIC-approved vendors or distribution centers. Access to WIC-approved food stores may be problematic for eligible households, especially those that lack neighborhood access to supermarkets and other retailers that carry healthy foods and are likely to participate as WIC vendors. Given that travel to WIC clinics of food stores is made more difficult when infants or small children are in tow, these geographic barriers may disproportionately affect the program's ability to reach infants and children.

While geography my limit participation among target households, it may also work to extend the reach of the program in unanticipated ways. Specifically, the presence of WIC participating retailers within a community may alleviate access barriers to healthy foods of WIC and non-WIC participants alike. This is because retailers that participate in the WIC program, are required to stock certain healthy food items so they are available to WIC customers. The proximity to WIC retailers may be especially important to lower income populations in geographic areas with limited access to stores with nutritious food options (Baker et al. 2006; Horowitz et al. 2004). Eligible WIC stores, for example, are required to provide healthy food options to meet the requirements of the WIC food packages. Therefore having a WIC store nearby benefits not only the WIC participants but also others among the low-income population because of an increased selection of healthy foods (Andreyeva 2012).

We propose to use the FoodAPS data to assess both geographic barriers to program access and the potential benefits of spillover effects of the program to increase availability of healthy foods in retail establishments. These issues are central to the role of food access in early child nutrition, both in terms of access to food via the WIC packages but also in terms of whether WIC indirectly improves the healthfulness of purchases by improving the food environment. Access to the FoodAPS data are important for several reasons. Although earlier work has estimated factors that affect WIC participation (Tiehen and Jacknowitz 2008; Jacknowitz and Tiehen 2009; Swann 2010; Rossin-Slater 2013), the FoodAPS data are unique in that they facilitate models that include multiple access barriers and this can show the relative importance of these barriers to WIC-eligible individuals, something that is not clear from the existing literature. Second, the FoodAPS data provide information on eligible non-participants and other ineligible low-income households. Because food purchases can be observable, spillover effects of the WIC program can be estimated in terms of food choices instead of only in terms of the food environment. Whether environmental improvements ultimately translate into healthier choices among non-participants is unknown and there are concerns that improvements in access to healthful foods may not offset established preferences for less healthy foods (Guthrie et. al. 2007; Handbury, Rahkovsky and Schnell 2015). Third, the FoodAPS data allow features of the built environment to be measured at a much finer spatial scale than has been possible in earlier studies. This level of precision is necessary to capture the realities of access constraints facing clients and potential clients of the WIC program. Finally, the FoodAPS data are nationally representative. This is especially important in assessing the WIC program because there can be important differences in delivery across the state agencies that implement the program.

Data & Methods

We propose a nested/hierarchical logit model to study geographic barriers to WIC participation. The nested logit model is a member of the larger family of generalized extreme value models in which variations of the extreme value assumption are used to model variation (so called random effects) at each level (see Wilson and Lorenz 2015). The advantage of a multilevel logit model is that it allows us to recognize spatial patterns based on WIC clinic locations at the community level, examine individual characteristics, and identify random effect at the state level due to policy differences. Information at the individual or household (level 1), community or local WIC agency (level 2), and state WIC agency (level 3) are entered into the model. We denote individual *i's* participation in WIC in State *j*, and community *k* (p_{ijk}) as a binary variable. Assume that p_{ijk} is a function of individual characteristics (X_{ijk}^{q}) indexed by the superscript *q*, distance to a nearby WIC store (d_{ijk}), and distance or access to a WIC clinic (c_{jk}). We model the logit of participation as:

$$\log\left[\frac{p_{ijk}}{1-p_{ijk}}\right] = \beta_0 + \sum_q \beta_q X_{ijk}^q + \beta_d d_{ijk} + \beta_c c_{jk} + v_k + u_{jk} + \varepsilon_{ijk},$$

where β_0 is the overall mean, the β_q coefficients measure the effects of individual characteristics, β_d is the effect of distance to the nearest WIC store, and β_c is the effect of access or distance to the WIC clinic. Level 3, level 2, and level 1 residuals are represented by v_k, u_{jk}, and ε_{ijk}, respectively. We assume that ε_{ijk} follows a binomial distribution, and that random variables v_k and u_{jk} follow $v_k \sim (0, \sigma_v^2)$ and $u_{ik} \sim (0, \sigma_u^2)$.

This model will be estimated from a sample comprised of WIC eligible households. Based on data reported in table 1 of Ver Ploeg et al. (2015), the FoodAPS data contains 461 WIC-participating households and another 685 nonparticipating but WIC-eligible households. Information on individual and household characteristics and distance to nearby WIC-eligible establishments is contained in the FoodAPS datasets. However, access to WIC clinics is not available. Our research team will identify the nearest WIC clinic based on the census block group of each of these 1,146 households. WIC clinic locations are available through state WIC agencies. Most, if not all, locations can be identified through online search tools designed to link participants to WIC services. The specification above controls for policy differences across state agencies. As the study progresses, the above specification may be modified to include specific policy measures and or other covariates as appropriate. We will also test robustness of the effect of different measures of WIC store access, such as the number of WIC stores within a radius of a recipient's census block group.

To assess program spillover of WIC-induced improvements in the food environment on the healthfulness of grocery purchases among low-income non-participating households, we propose a general spatial econometrics model. These models emerged from the realization that cross-sectional observations of any data generating process are likely to be related to each other if they are separated only by geographic distance. As a consequence, the dependent variable depends not only on the hypothesized set of regressors, but also on a weighted average of the dependent variables from all other observations at other points in space, where the weight depends on some distance metric. More specifically, we use a general spatial model (Anselin 2002; Lesage 1999). An advantage of a spatial model is that it allows us to account for spillovers across units in space in addition to allowing us to directly model the program spillovers to non-participants that are of primary interest.

We plan to use a sample of low-income non-participating households to estimate the spatial model using (1) household-level aggregates of food purchases and/or (2) raw food purchase events. In the first case, the household is the unit of analysis. In the second case, the purchase event would be the unit of analysis and the estimation would involve a spatial panel with household fixed or random effects. In either case, the outcome variable would be the healthfulness of the household's purchases as characterized by an appropriate indicator of nutrition quality. One example is the nutrient score proposed by Handbury, Rahkovsky and Schnell (2015). In the household analysis, the independent variable of interest would be the proportion of purchases from WIC-approved vendors. When purchase events are the unit of analysis, the independent variable of interest would be whether the purchase event took place at a WIC approved store. In estimating these models, we plan to include appropriate individual and household-level controls and anticipate the need to homogenize samples by store type and/or by households with certain characteristics. Finally, the spatial weights will be based on the census block group of the household residence.

Pitfalls and Extensions

In assembling information on WIC clinics, we are aware of the fact that the number and locations of clinics may have changed with time and that current clinic locations may not be synchronous with locations as they existed during the time period reflected in the FoodAPS data. Given that there are roughly 90 state agencies that implement WIC, it may not be possible to assemble clinic locations that are perfectly synchronous with the FoodAPS data. We will assess this issue as we gather information on clinic locations.

The spatial econometric model described above assumes that each observation is from a distinct geography. The smallest geography to which we can assign households is the census block group. There are 217,740 census block groups in the United States. For this reason, we expect that census block groups with multiple household assignments will be rare. Nevertheless, this may occur and our empirical approach may need to change to reflect this issue. Similarly, nested/hierarchical logit model described above may need to change depending on density of households within defined communities or primary service areas of local WIC agencies.

Finally, we are aware that the plans described above may need to change to accommodate unanticipated features of the dataset or to address empirical problems that arise. One potential concern is that stores that accept WIC may be endogenous and this would impact our ability to look at the effect of WIC stores on the healthfulness of non-WIC participants. Because this sample will be comprised only of low-income but non-WIC households, we will explore whether the proximity to a WIC clinic is a reasonable instrument for WIC stores. The argument here is that clinic proximity will be positively related to WIC stores but clinics would not be directly affecting the low-income non-WIC households in this sample.

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