Farmers' markets location determinants: An empirical analysis in New England

Joshua Berning
Assistant Professor of Agricultural Economics
Department of Agricultural and Resource Economics
The University of Connecticut
1376 Storrs Road, Storrs, CT
Email: Joshua.Berning@UConn.edu

Alessandro Bonanno
Assistant Professor of Business Economics
Business Economics Group, School of Social Sciences
Wageningen University
Hollandseweg 1, Room 6.043 P.O. box 8130
6706 KN Wageningen, The Netherlands
and
Adjunct Assistant Professor of Agricultural Economics
Department of Agricultural Economics Sociology and Education
The Pennsylvania State University,
Armsby Building, University Park, PA 16802
Email: alessandro.bonanno@wur.nl
abonanno@psu.edu

and

Hamideh Etemaadnia
Post-doctoral Researcher
Department of Agricultural Economics Sociology and Education
The Pennsylvania State University,
7-F Armsby Building, University Park, PA 16802
Email: hze1@psu.edu
Work Phone: 814-863-2996
Fax: 814-865-3746

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Abstract

The continued growth and success of farmers markets (FMs) across the US leads one to question whether this outlet can help reduce limited food access via farmers directly meeting consumer needs. To date, however, few analyses have assessed the economic forces determining their existence. Applying a simple Industrial Organization framework, we provide a zip-code level empirical evaluation of socio-economic, structural, and competitive features that impact the likelihood of an FM in a given area. Results suggest that market size, education level, presence of children in a household and SNAP participation are demand characteristics that lend to the establishment of FMs; more than income per se. We also find that increased farming activities and reduced farm size increase the likelihood of observing a FM. While FMs are more likely to collocate in areas where there is a larger presence of grocery stores, the existence of more established traditional distribution channels (i.e. fruits and vegetables wholesaling) decreases the probability of observing FMs. As not every community can support an FM, the results of this research will help regional planners and policy makers better understand what factors may be most restrictive for FMs and what investments may help foster their development.

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In the US, a farmers' market (FM) is "a common area where several farmers gather on a recurring basis to sell a variety of fresh fruits, vegetables, and other farm products directly to consumers." (Martinez et al. 2010, page 5). The USDA reports that the number of FMs has increased by 3 times in the fifteen years period 1994-2009, from 1,755 units to 5,274 (Martinez *et al*. 2010), selling a range of products spanning from fresh fruits and vegetables, to flowers, and from baked goods to dairy products.

As the reviews by Brown (2002) and Brown and Miller (2008) summarize, FMs are associated with higher income of participant farms[1] (especially small ones), building of human capital, positive community-wide impacts (from both a social and economic perspective), and improved access to local fresh produce to consumers. Cook (2011) reports, however, the estimated value of fresh produce sales direct-to-consumer in 2010 (including FMs) at $1.4-1.8 billion, or less than 2 percent of the final value of the fresh produce supply chain, which suggests existing opportunities for growth for this channel. Given the benefits of FMs accruing to both consumers and farmers, as well as tapping into low-income consumers' Supplemental Nutrition Assistance Program payments (Businessweek 2012) one might expect their expansion across the US to continue.

While most academic research on FMs has attempted to characterize its shoppers (e.g. Zepeda, 2009; Wolf, Spittler and Ahern 2005) little is known on the market forces that may drive FMs to form. Such lack of interest is surprising especially given the emphasis on the role of this

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[1] It should however be noted that whether or not farmers' participation in direct channel results in better economic performances (i.e. higher profits) for farmers is an unresolved empirical question, as discussed in Bonanno et al. (2013).

channel to provide better access to fresh produce, and that this may lead to positive societal outcomes such as a better nourished population and reduction in childhood obesity (e.g Frieden, Dietz and Collins, 2010).

Based on the industrial organization literature on firms' location, it is known that both demand and supply-side factors impact the probability that firms (including food stores, see Bonanno, 2012, for a discussion) establish in a given location. As empirical analysis of access to large food retailers in the US (Bonanno, Chenarides and Goetz, 2012) suggests not every geographic location can support the same level of access because of lack of demand, paucity of infrastructure and high input prices. Using a similar logic one could reasonably assume that a similar framework applies to the formation of FMs. As FMs face high costs and limited demand, not every community can support one. Knowing what factors facilitate their creation has considerable policy relevance for local policymakers and planners aiming to understand what factors are most restrictive for FMs and what investments may help foster their development.

The purpose of this research is to empirically examine the role played by demand and supply factors to impact the formation of FMs in a given area. To this end, we built a database of zip-code level data encompassing the six New England States. This includes information on farmers' markets numbers, characteristics and location from LocalHarvest, Inc. (www.localharvest.org), augmented with socio-economic variables from different publicly available sources. Using an empirical entry model similar to Bresnahan and Reiss (1991), our estimates point to market size and the presence of more educated consumers, as well as households with children as likely factors to attract FMs, while income per se, seems to be less relevant. On the supply-side, farming activities and the presence of small farms facilitates FM creation, as well as the presence of a grocery stores as they probably appeal to the same

consumer base. The presence of more established traditional distribution channels (i.e. fruits and vegetables wholesaling) decreases the probability of observing FMs, suggesting that presence of efficiencies through traditional supply chains may increase the opportunity cost of direct selling.

In general, such information is relevant for communities and planners that are interested in trying to establish an FM. Specific market conditions beyond household income may play a more important role in the success of FMs.

A Theoretical and Empirical Framework of FMs Creation

FMs are created when "several farmers gather on a recurring basis to sell a variety of fresh fruits, vegetables, and other farm products directly to consumers" (Martinez, 2010). As such, the existence of an FM can be thought of as representing an equilibrium outcome of an entry game where *farms* decide in the first stage whether or not to participate (i.e. "enter" a market) and then, in the second stage, they compete with the other entrants. However, FMs can exist only if the number of entrants is large enough. That requires two conditions:

1. The number of incumbent farmers that can (potentially) enter must be large enough. Let M be the number of potential entrant (farms) in a given area and N the number of FMs. $M_{(x)}$ is the minimum number of farmers needed to observe x number of FMs. A necessary condition needed to observe $N = x$ is $M \geq M_{(x)}$, or:

    Pr $[N = x \mid M < M_{(x)}] = 0$ and Pr $[N = x \mid M \geq M_{(x)}] \geq 0$

2. If condition 1 is satisfied one expects at least *some* farmers find it profitable to participate. Nothing prevents all farmers best response strategy in a given area to be "*do not participate.*" Even if *some* potential entrants are available, the *actual* number of entrants (i.e. whose best

response strategy is that of playing "*participate*"), defined as M^*, must be large enough to guarantee a positive equilibrium number of farmers markets or:

$$\Pr[N>0| M^* \geq M_{(1)}] = 1; \ \Pr[N=1 | M^* \geq M_{(1)}] > 0 \ \text{ and } \ \Pr[N > 1 | M_{(1)} \leq M^* < M_{(2)}] = 0$$

$$\Pr[N>1| M^* \geq M_{(2)}] = 1; \ \Pr[N=2 | M^* \geq M_{(2)}] > 0 \ \text{ and } \ \Pr[N > 2 | M_{(2)} \leq M^* < M_{(3)}] = 0$$

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Conditions 1 and 2 lead to a few peculiar results to consider. First, in spite of most entry games assuming that an entrant's profit is impacted negatively by the equilibrium number of firms (e.g. Bresnahan and Reiss, 1991; Berry, 1992), in our case the function representing the relationship between the number of FM participants and entrants' profits is likely to be discontinuous or kinked. In other words entrant profits will be 0 for $M^* < M_{(1)}$; and positive but declining in M^* for $M_{(1)} \leq M^* < M_{(2)}$. The curvature of farmers profits (in M^*) is then likely to change again for $M_{(2)} \leq M^* < M_{(3)}$ and so on. How such changes in curvature will occur is hard predict.

Second, fixed costs are likely to play a role in determining the number of equilibrium entrants (or its limiting number) in markets where products are vertically differentiated (Shaked and Sutton 1987; Sutton 1991; Ellickson 2006; 2007), or in concentrated markets where later entrants can have higher variable or fixed costs (Bresnahan and Reiss, 1991). In the framework discussed above, fixed costs (organization / participation) may actually decline for additional entrants if $M_{(x)} \leq M^* < M_{(x+1)}$, as some of the costs may be shared. As the $M^* \rightarrow M_{(x+1)}$ saturation may occur, and costs may become higher for additional entrants. If $M^* \geq M_{(x+1)}$ the relationship between costs and profitability of additional entrants will again change.

Finally, if a farmer decides to enter a market where more FMs exist, she will be indifferent on which one to join – that is, in the second stage, competing with other incumbents

will be perceived to be the same *regardless* of which FM they belong to. That is, there is no cost in switching from one FM to another as long as they are in the same area.

Given these considerations, formulating a theoretical model, and its empirical counterpart, which permits to take into account both farm participation and FM creation appears challenging and goes beyond the purpose of this analysis. However, it is clear that the classical drivers of firm locational choices (e.g. market size, demand, cost factors) will impact both the size and characteristics of each FM as well as the likelihood that different farms participate. Thus, in the discussion that follows, we will consider a simpler problem: the existence of FMs *conditional* on condition 1 and 2 being satisfied. Further, we will ignore individual farm decisions. Following the notation in Bresnahan and Reiss (1991), the (aggregate) total profit of the participants in a FM are:

(1) $\pi_N = S(Y, \lambda) V_N(Z, W, \alpha, \beta) - F_N(W, \gamma) + \varepsilon,$

where S is a function of capturing the effect of market size, represented by Y, on profits; V is a variable profit function, where Z and W are vectors of per-capita demand and costs shifters, respectively; F represents a fixed cost function, and W is a vector of cost shifters. α, β, γ, and λ are conformable vectors of parameters and ε represents the unobserved profit component, assumed to be zero-mean, constant variance i.i.d. normally distributed across markets. The subscript N indicates that, since variable profits and fixed cost are function of the equilibrium number of FM in a given area, so will be the profit.

In terms of model estimation, one should consider that the probability of observing N equilibrium FMs in a given area is the same as that of N FMs being profitable (instead of $N+1$). In other words:

(2) $\Pr(\pi_N \geq 0 \text{ and } \pi_{N+1} < 0) = \Phi(\bar{\pi}_N) - \Phi(\bar{\pi}_{N+1}),$

where $\Phi(.)$ is the cumulative normal distribution function and $\pi_N = \bar{\pi}_N + \varepsilon$. Given the assumptions regarding the distribution of the error terms (normality and i.i.d.) the parameters of equation (2) can be estimated via maximum likelihood using an ordered probit estimator.

Data and Data Manipulation

The data used to in this analysis come from different sources. We collect data regarding the presence and characteristics of FMs in every zip-code in the 6 New England states. We acquired data on FMs location and characteristics from LocalHarvest, Inc. (localharvest.org) which provides a nationwide registry of FMs free of charge and provides a brief description of each FMs features. The information collected includes: their zip-code, county and state; days of operation during the week, months of operation during the year, use of indoor facilities, and a link to an external website (if available). In addition, LocalHarvest indicates the last time the FM information was updated. While a large share of FMs update their LocalHarvest site regularly, for those which have not updated their site in the last 2 years, we determine whether the FM is still in operation relying on State-level department of Agriculture listings of FMs and general internet searches.[2] The initial data set identified 1830 zip codes with at least 1 FM.

The frequency of farmers' markets in New England is summarized in Table 1, while Figure 1 presents their geographic dispersion. From Table 1 and Figure 1 it emerges that circa

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[2] There is concern about whether or not the FMs registered on LocalHarvest are representative of the total number for each state. Since registration is voluntary, LocalHarvest provides free advertising, which should create a strong incentive to register (Berning 2012). At the same time, our data set only provides a cross-sectional representation of a dynamic process in which FMs enter and leave the market.

three quarters (76 percent) of the zip-codes in New England do not have a FM, circa 19 percent have one and the remaining 5 percent of the sample presents 2 or more FMs. In terms of their geographic distributions it appears that ZIP codes with FMs are mostly located along the coasts and in proximity of large urbanized areas.

For each zip-code in New England, we also gather extensive information to capture demand side and supply side variables that are likely to impact the location of a FM. We compile an extensive list of demographic characteristics for each zip code using the 2011 American Community Survey. First, we consider market size, which in this case will be the total population. The level of urbanization can have a role in impacting the likelihood of observing a FM (as suggested by Figure 1), although the impact may be indeterminate a priori. On one hand, densely populated area provide more concentrated demand; however, they may also offer limited or costly space for the establishment of an FM, in that case population density may play the role of a cost shifter. We calculate population density to assess whether FMs are more likely to locate in rural vis-à-vis urban areas dividing population by square miles of land from the 2010 U.S. Census Gazetteer of Counties. We also consider factors which can be characterized as shifters of the per-capita demand for FMs, including: percentage of females, median age, average household size, the share of households with children, measures of educational attainment, average household earnings, unemployment rate, SNAP participation, and ethnicity.

Figure 2 presents an overview of New England highlighting the areas with the largest population and the density of population SNAP recipients. From an immediate comparison of the let panel of Figure 2 (total population) with Figure 1, it appears that area with more population are more attractive to the location of one or more FMs, as intuition would point to. Also, from the right panel, areas with higher shares of SNAP recipients are less conducive to the

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establishments of a FM. However, that may be related to the higher poverty levels, and may not capture the additional demand that can be generated by household by low-income household participating in the program.

To capture supply side factors likely to impact FMs location we collect data from the 2011 American Community Survey on housing value and maintenance. Locations where building cost is high may result in higher opportunity cost of selling area. We use the 2007 Census of Agriculture to gather data on the different farm operations for each zip code. In particular, we determine for each zip code: the absence of farming operations, total area of farm operations, the number of fruit and vegetable operations. The number of farms is likely to impact the establishment of FMs as the greater the number of farmers in an area, the more likely that participation is the best response strategy for at least one farmer. Farm size can also impact the decision of a farm to join a FM, since small farms may not be able to satisfy the requests of large food stores and intermediaries, in terms of both volumes and prices. Consequently, direct-to-consumer marketing channels may be more appealing to small farms. Figure 3 presents a map of the location of fruits and tree nuts farms as well as vegetables (including seeds and transplants) location in New England along with the number of farmers markets, showing that, as expected, the number of FMs seem to be higher in areas where a larger number of farming activities related to products that can be sold via direct channels to consumer.

For the third group of supply-side variables, we collected data from the County Business Patterns database of the 2010 Census reporting the county-level number of establishments classified as grocery stores (NAICS 45110), fruit and vegetable markets (NAICS 45230) and convenience stores (NAICS 45120). Established wholesale industry that caters to traditional supply chains may discourage farmers from attempting direct-to-consumer distribution methods

like joining a farmers market. The presence of other food retailers may also impact the establishment of an FM. If food retailers and FMs benefit from the same demand-drivers but cater to different needs, they may benefit from colocation and act as complements. Alternatively, larger food retailers may substitute for FMs which are open less frequently and not as easily accessible to consumers. Summary statistics for these demand and supply side factors are provided in Table 2.

We also compare the summary statistics of the different zip codes based on the number of FMs they have in their county, reported in Table 3, and which in part mirror the highlights indicated in Figures 2 and 3. As can be seen, the population tends to increase with the number of FMs, as does the population density up to 4 FMs. The gender rate is fairly consistent, but the median age declines slightly with FMs. Interestingly, the percentage of the population that is white decreases with the number of FMs in a zip code. The other demographic variables and supply side variables do not display any other significant trends with changes in FMs, with the exception of farms with fruit and nuts operations whose presence seems overall more marked in zip codes with more FMs.

Estimation

As profits are unobserved, following equation (2) we treat them as latent variables and we specify linear models where the impact of different demand-side and supply-side drivers of profitability of FMs are considered. To that end we specify different definitions for the dependent variable*:*

$$NFM = count\ of\ FMs \qquad\qquad (4a)$$

$$FM\_123 = \begin{cases} 3 \text{ if number of } FMs \geq 3 \\ 2 \text{ if number of } FMs = 2 \\ 1 \text{ if number of } FMs = 1 \\ 0 \text{ if number of } FMs = 0 \end{cases} ; \qquad (4b)$$

$$FM\_12 = \begin{cases} 2 \text{ if number of } FMs \geq 2 \\ 1 \text{ if number of } FMs = 1 \\ 0 \text{ if number of } FMs = 0 \end{cases} ; \qquad (4c)$$

$$FM\_1 = \begin{cases} 1 \text{ if number of } FMs \geq 1 \\ 0 \text{ if number of } FMs = 0 \end{cases} . \qquad (4d)$$

The first variable (*NFM*) represents the count of FMs in the zip code. Estimating equation

(2) using *NFM* as dependent variables leads to the proper evaluation of the problem as described

in the previous sections as all the possible equilibrium number of FMs allowed in the data are

taken into account. However, as can be seen in Table 1, less than 1 percent of the zip codes in

our sample have 3 or more FMs, and circa 4 percent have 2 or more FMs. Thus, we create two

alterative indicators *FM_123* and *FM_12,* where FM counts greater than or equal to 3 and 2,

respectively, are aggregated. The variable *FM_1,* treats the presence of any number of FMs the

same in terms of their profitability. In other words, the presence of any FM is represented as a

discrete outcome and therefore identifies the extensive margin for the establishment of an FM.

As mentioned above, assuming that the distribution of the unobserved stochastic

component is distributed according to a Standard Normal CDF, we can estimate equation (3) for

all the dependent variables (4a - 4c) using an ordered probit estimator. We estimate the model

with *FM_1* (4d) using a Probit estimator.

Results

The estimates for equation (2) with the various dependent variables are reported in Table (4).

The first set of variables is demand related factors that could affect the establishment of FMs in a

given zip code. Across the different models, population, percentage of households with children, college graduates, the number of SNAP participants and home rental values are positively related to the establishment of FMs. As population increases, so does potential demand in a zip code. This is different from population density, however, which is not significant. A college degree could be associated with better choices (i.e. fruits and veggies from an FM) or they could be associated with a higher income level which allows for more purchases at FMs. SNAP participation is also associated with more FMs: even though SNAP participants have lower income levels, participating in the program gives participant an extra amount of income, therefore increasing their potential demand. Both median age and average household size are negatively associated with FMs. These results, along with the positive influence of the share of households with children, show that perhaps the target market that best caters to the formation of farmers' markets is a younger population comprised of smaller households with children. We discuss these implications below. The fact that average earnings are not a determinant of FMs creation is not surprising. Existing studies (e.g. Zepeda 2009; Wolf, Spittler, and Ahern 2005) found that income does not impact the probability of individuals shopping at a FMs.

The second set of variables is related to supply characteristics in a zip code. As the number of farmers producing fruits and nuts increases so does the probability of an FM establishment in a zip code. This suggests a certain complementarity between fruit operations and FMs, as the former likely contributes to the latter. An interesting finding is that as the size of farms increases, the establishment of FMs decreases. This suggests that a greater number of small farms is more conducive to the establishment of FMs, which makes intuitive sense since smaller farms are more likely to supply FMs than large scale operations. In addition, zip codes

with no farms present have fewer FMs, consistent with the necessary conditions discussed in the model section about farmer's participation for the existence of FMs.

Finally, there appears to be some advantage to the collocation of grocery stores in a particular zip code, as this is positively related with FMs. At the same time, this could just be indicative of demand for similar services. The presence of fruits and vegetables wholesalers appear negatively related to the probability of having one or more FMs in a zip code. The presence of a more pervasive traditional supply chain structure may gauge the opportunity cost for adopting direct channels therefore causing a decline in profitability of joining an FM.

Alternative measures of FM presence.

We next try to examine different specifications for the dependent variable beside the number of FMs. In particular, we estimate the number of FMs per person (*NFM per person*), the number of FMs per household (*NFM per house*) and the aggregate number of days the FMs are open in each zip code (*Days open*). Albeit departing from the evaluation of the problem as defined in the initial model, the estimation of these alternative models allows us to gain additional insights on the drivers of the FM phenomenon. The first two variables are used to examine how demand and supply characteristics impact the density of FM establishments. The *Days open* variable is used to examine the extent of operations. In particular, certain FMs may be open over longer periods of time, therefore offering more extensive coverage of the market since, to a certain extent one could consider every day a FM is open as one additional FM. We estimate these models using a tobit specification (Table 4).

The results from these models show that as population increases so do the number of FMs per person and per household as well as the number of days the FMs are open. Clearly,

demand has an effect on the extent to which FMs are available in a zip code. Median age and average household size are negatively associated with all three dependent variables, whereas households with children are positively associated. As the number of advanced degrees increases, so does the density of FMs. Finally, the supply side characteristics have similar effects on FM density and days open as with the previous models.

Comparing the four different specifications of the dependent variable using the pseudo R-squared value suggests that the more restrictive definition of FMs (*FM_1* and *FM_12*) perform at least as well as the more extensive definitions (*FM_123, NFM*). We also estimated equation (2) for the *FM_12* dependent variable using a generalized ordered probit (Williams 2006), to test whether the proportional odds / parallel lines assumption was violated. The results (omitted for brevity) show that the ordered probit model appears to be sufficient for this estimation[3].

Discussion

The results of our empirical analysis indicate that both demand side and supply side characteristics are significantly related to the establishment of FMs, the density of FMs in a zip code as well as the number of days the FMs are open. As might be expected, total market size appears to lead to the establishment of FMs in a particular zip code. At the same time, patrons of FMs do not have to come only from the county where the FM is located. Consequently, zip code population might also indicate a greater capacity to facilitate the establishment of a FM. A completely rural zip code may have available space, but no other structural characteristics to

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[3] The generalized ordered probit did not converge when *FM_123* or *NFM* were the dependent variables, due to the limited number of zip-codes showing more than two FMs.

support an FM. A more urban zip code may instead house a larger population and be able to support the establishment of FMs as well.

Our results seem to indicate that a younger and more educated population, comprised of smaller households and households with children are more conducive to the creation of FMs. Although our data focuses in a limited geographic area of the US, the question emerges if such characterization also would apply to other geographic area of the Country. If that was the case, it is worth noting that other studies (e.g. Morton and Blanchard 2007) find areas where populations tend to be relatively older and less educated are also less likely to have access to large food stores. As our results would suggest areas with such features to also be less likely to appeal to the creation of a FM, one is left to wonder whether food outlets of any type can be successfully sustained in areas subject to severe lack of access without considerable public intervention.

Another interesting finding is that home rental value is positively associated with the establishment of FMs, while average earnings do not seem to be important. Again, home rental value could be capturing structural characteristics of a zip code. That is, zip codes with higher housing costs also have other structural characteristics to support FMs. Importantly, such factors may influence the acceptance of FMs by the community in a particular zip code.

The extent to which supply side characteristics impact the establishment of FMs is telling as well. Clearly there are efficiencies gained by co-location of certain industries. These efficiencies could come from having a larger total demand in zip codes with certain types of stores. Alternatively, there could be supply chain factors that contribute to efficiencies as well.

Concluding Remarks

The number of farmers markets in the U.S. in the last two decades has tripled as they can present farmers the opportunity to acquire a larger share of the channel's margins and improve access to fresh food for consumers. As local planners and policy makers observe the expansion of farmers markets, a better understanding of what factors may facilitate the establishment of FMs and what investments may help foster their development appears to be needed.

In this analysis we assess the economic forces determining FMs existence, using a simple empirical Industrial Organization framework applied to zip-code level data in New England, evaluating the role of socio-economic, structural, and competitive features. Results suggest that market size, education level, presence of children in a household are demand characteristics that lend to the establishment of FMs; income does not seem to play a role in impacting FM location likelihood. Furthermore, FMs are more likely to locate in areas where there is a larger density of grocery stores, while the existence of more established traditional distribution channels (i.e. fruits and vegetables wholesaling) decreases the probability of observing FMs; increased farming activities and reduced farm size increase the likelihood of observing a FM.

Thus, the success of FMs is contingent on many characteristics of zip codes in which they establish. One aspect missing from this analysis is that we only examine a cross-sectional data set and are not able to capture the exit of FMs from a given zip code. As such, we are not able to model what characteristics contribute to the *failure* of FMs in a particular zip code. In addition, we treat FMs as a fairly homogeneous firm. There are important differences between FMs that could be modeled in the future as well. Last, spatial spillovers need to be taken into consideration: a more rigorous modeling approach should be implemented to account for spatial correlation among both observables and unobservable drivers of FMs location.

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Figure 1. Location of FMs in New England
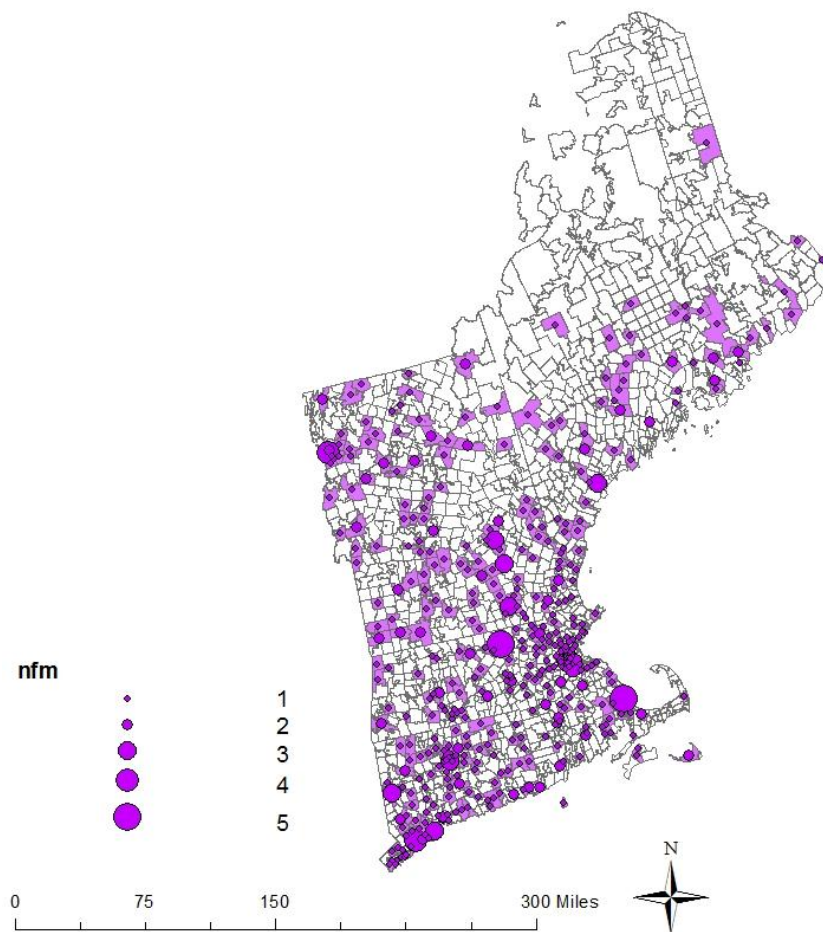
Source: Authors' elaboration of Data Collected from Local Harvest.

Figure 2. Zip-code level population (tot_pop) and share of SNAP recipients (SNAP) in New England
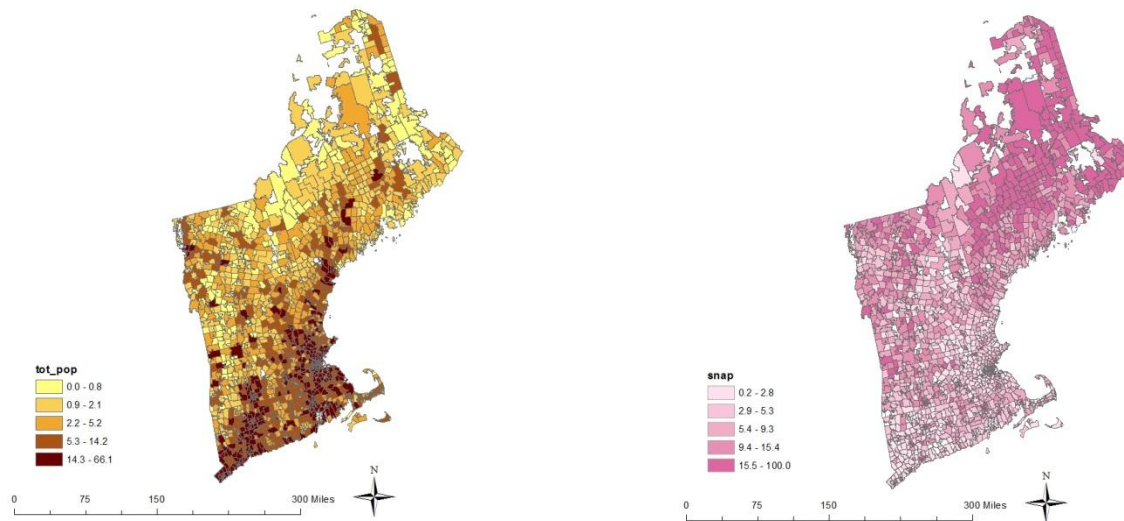
Source: Authors' elaboration of American Community Survey Data (2010).

Figure 3. Location and Number of Farms with Fruits and Nuts (fruit_Farms); Vegetables (veg_Farms) and Farmers markets (NFM) in New England
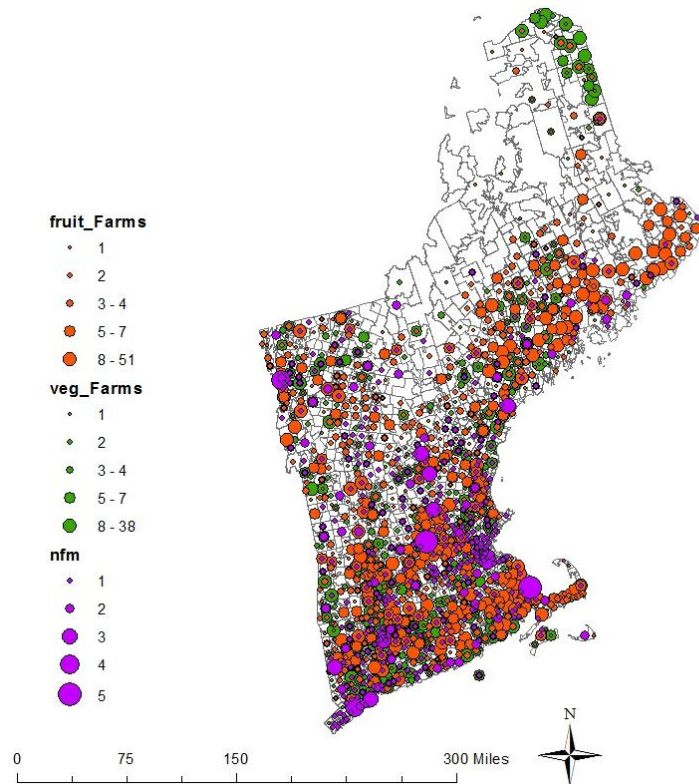
Source: Authors' elaboration of Census of Agriculture Data (2007)

Table 1. Frequency of FMs within zip codes

number of FMs	Freq.	Percent	Cum.
0	1,406	76.83	76.83
1	355	19.4	96.23
2	55	3.01	99.23
3	9	0.49	99.73
4	3	0.16	99.89
5	2	0.11	100
Total	**1,830**	**100**	

Table 2. Summary statistics

Variable	Mean	Std. Dev.	Min	Max
population (000's)	7.87	10.4	0.00	66.13
pop density	1.37	3.8	0.00	68.47
female perc.	50.58	5.9	0.00	100.00
median age	43.19	7.6	13.50	81.50
avg household size	2.44	0.3	1.16	5.53
HH w/children (%)	27.67	11.0	0.00	1000.00
HS grad (%)	30.67	12.3	0.00	100.00
college grad (%)	19.60	10.0	0.00	100.00
advanced degree (%)	13.83	10.8	0.00	100.00
white (%)	92.13	12.0	6.90	100.00
avg earnings (000's)	80.52	36.6	17.40	411.21
SNAP participation	0.29	0.6	0.00	5.51
unemp rate (%)	7.14	5.2	0.00	100.00
poverty rate (%)	6.92	8.4	0.00	100.00
home value (mills)	0.28	0.2	0.01	1.00
rent value (000's)	0.95	0.3	0.10	2.00
fruit operations	2.04	3.8	0.00	51.00
veggie operations	2.01	3.1	0.00	38.00
farm area	0.50	0.4	0.00	1.00
no farms present	0.14	0.3	0.00	1.00
grocery stores per pop	0.23	0.1	0.02	0.62
convenience stores per pop	0.18	0.2	0.01	0.92
fruit/veg markets per pop	0.01	0.0	0.00	0.14
fruit/veg wholesalers	0.01	0.0	0.00	0.04

Table 3. Summary statistics for zip codes with a specific number of FMs

Variable	specific number of FMs in zip code					
	0	*1*	*2*	*3*	*4*	*5*
population (000's)	5.69	14.31	15.86	27.62	32.49	48.09
pop density	1.03	2.26	3.57	4.54	5.69	0.96
female perc.	50.37	51.18	51.92	50.83	52.40	50.05
median age	43.89	41.33	39.22	38.02	33.37	37.80
avg household size	2.44	2.45	2.33	2.49	2.36	2.57
HH w/children (%)	27.32	29.18	26.28	30.19	25.55	31.07
HS grad (%)	31.70	27.44	27.19	26.00	15.27	32.05
college grad (%)	18.95	21.82	20.78	22.86	30.20	17.55
advanced degree (%)	13.04	16.42	16.39	14.19	27.67	9.00
white (%)	93.40	88.91	84.36	75.49	82.13	87.75
avg earnings (000's)	76.38	90.10	72.34	84.47	114.65	80.04
SNAP participation	8.71	8.73	11.18	13.57	9.40	11.20
unemp rate (%)	7.06	7.28	7.63	9.11	7.07	9.85
poverty rate (%)	6.79	6.90	9.35	11.38	9.77	9.05
home value (mills)	0.27	0.32	0.29	0.30	0.46	0.28
rent value (000's)	0.92	0.97	1.31	1.19	1.39	1.04
fruit operations	1.81	2.81	2.56	2.11	2.67	17.50
veggie operations	1.80	2.68	2.49	3.56	1.00	7.50
farm area	0.49	0.52	0.44	0.61	0.25	0.79
no farms present	0.15	0.10	0.15	0.11	0.33	0.00
grocery stores per pop	0.24	0.21	0.22	0.22	0.26	0.17
convenience stores per pop	0.19	0.16	0.16	0.17	0.22	0.20
fruit/veg markets per pop	0.01	0.01	0.01	0.01	0.01	0.01
fruit/veg wholesalers	2.27	2.85	2.09	3.44	1.00	0.00

Table 4. Estimation results

variable	FM_1	FM_12	FM_123	NFM
		dependent variable		
population (000's)	0.0447***	0.0401***	0.0410***	0.0416***
pop density	0.00488	0.00147	0.00056	-0.000226
female perc.	0.0176	0.0196*	0.0177	0.0175
median age	-0.0258***	-0.0270***	-0.0260***	-0.0262***
avg household size	-1.068***	-1.060***	-1.020***	-1.019***
HH w/children (%)	0.00163**	0.00173**	0.00165**	0.00163**
HS grad (%)	-0.00151	-0.00378	-0.00427	-0.00442
college grad (%)	0.0189**	0.0195**	0.0203**	0.0198**
advanced degree (%)	0.00867	0.00856	0.00729	0.0074
white (%)	0.000194	-0.00266	-0.0022	-0.00187
avg earnings (000's)	0.000314	-0.00107	-0.00052	-0.000465
SNAP participation	0.0219***	0.0213***	0.0220***	0.0217***
unemp rate (%)	0.00386	0.00147	0.0015	0.00142
poverty rate (%)	-0.00215	-0.00101	-0.000205	0.0000299
home value (mills)	0.502	0.463	0.42	0.413
rent value (000's)	0.637***	0.874***	0.827***	0.820***
fruit operations	0.0390***	0.0326***	0.0335***	0.0350***
veggie operations	0.0106	0.0109	0.0118	0.0117
farm area	-0.512***	-0.522***	-0.495***	-0.486***
no farms present	-0.947***	-0.951***	-0.908***	-0.891***
grocery stores per pop	0.895*	0.883*	0.939**	0.951**
convenience stores per pop	-0.426	-0.44	-0.419	-0.413
fruit/veg markets per pop	-0.666	-1.505	-1.448	-1.481
fruit/veg wholesalers	-0.0128	-0.0189*	-0.0196*	-0.0206**
Constant	-0.605			
cut1		0.299	0.392	0.393
cut2		1.642	1.733*	1.734*
cut3			2.642***	2.641***
cut4				3.181***
cut5				3.634***
Observations	1580	1580	1580	1580
Psuedo R2	0.22	0.198	0.194	0.193
estimation	*probit*	*ordered probit*	*ordered probit*	*ordered probit*
Robust standard errors				
*** p<0.01, ** p<0.05, * p<0.1				

Table 5. Tobit estimation using alternative dependent variables

	dependent variable		
	NFM per person	**NFM per house**	**Days open**
population (000's)	0.0107***	0.0150***	0.0764***
pop density	0.000332	0.000473	0.00219
female perc.	0.00143	0.00535	0.0333
median age	-0.00706*	-0.0142**	-0.0541***
avg household size	-0.581***	-0.639***	-2.201***
HH w/children (%)	0.00147***	0.00162***	0.00394**
HS grad (%)	0.00494	0.00141	-0.0021
college grad (%)	0.00997**	0.0103	0.0404**
advanced degree (%)	0.00927**	0.0134**	0.012
white (%)	-0.00174	-0.00188	-0.0028
avg earnings (000's)	-0.00235**	-0.00246	-0.00105
SNAP participation	0.00669	0.00905	0.0412**
unemp rate (%)	-0.00408	-0.00262	0.000936
poverty rate (%)	0.00186	0.00137	-0.00542
home value (mills)	0.525**	0.529	1.112
rent value (000's)	0.374***	0.554***	1.425***
fruit operations	0.0130***	0.0182***	0.0708***
veggie operations	0.00289	0.00502	0.0455*
farm area	-0.185**	-0.330***	-0.884***
no farms present	-0.397***	-0.610***	-1.586***
grocery stores per pop	0.687***	0.877***	2.341**
convenience stores per pop	-0.469**	-0.576**	-1.181
fruit/veg markets per pop	-0.697	-1.114	-3.132
fruit/veg wholesalers	-0.00577	-0.00886	-0.0313
Constant	-0.0941	-0.249	-0.496
Sigma	0.546***	0.787***	2.155***
Observations	1580	1580	1580
***** p<0.01, ** p<0.05, * p<0.1**			