Multifunctional Activities in New England Farms: Success and Continuation

Ioana (Julia) I. Marasteanu, The Pennsylvania State University
Dr. Chyi-Lyi (Kathleen) Liang, University of Vermont (Principal Investigator)
Dr. Stephan Goetz, The Pennsylvania State University, Northeast Regional Center for Rural Development
Dr. Mary Ahearn (USDA ERS)
Dr. Jason Brown (Federal Reserve Bank)

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In collaboration with Dr. Mary Ahearn (USDA ERS), and Dr. Jason Brown (Federal Reserve Bank)
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Research Questions:

What factors are associated with the **perceived success** of Multifunctional Activities (MFAs)?

- Does the presence of other MFA farms in the area affect the perceived success?
- Does a high level of perceived success among other farms in the area impact a farmer's level of perceived success?
- Do self-reported personal characteristics impact the perceived success of MFAs?

What factors are associated with the desire for continued participation in MFAs?

The Data:
This research is based on a survey of farm operators in New England addressing farm practices, farmer characteristics, and MFA participation.

What is success?

Survey of New England Farmers:

To analyze the **farmers' perceived level of MFA success**, we focus on the following survey question:

"As the result of participating in agri-tourism, direct sales, value added, and off-farm work, I believe: 1) My family's financial situation has been improved; 2) My family's quality of life has been improved; 3) My family and I are happy and satisfied with our current farming operations; 4) I have a more positive outlook for my future as a farmer; 5) My family has a more positive outlook for our farming operation; 6) It has been more time consuming than I have expected; 7) I would continue participating in agri-tourism, direct sales, value added and/or off-farm work in the future."

Respondents were prompted to choose a number from 1-5, with 1 representing "Strongly Agree" and 5 representing "Strongly Disagree," for each of the seven options.

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
improvedfinance	Takes a value of 1 if the farmer answered "strongly agree" or "agree" (1 or 2) to "My family's financial situation has been improved"	946	0.403806	0.490919	0	1
improvedquallife	Takes a value of 1 if the farmer answered "strongly agree" or "agree" (1 or 2) to "My family's quality of life has been improved"	946	0.53277	0.499189	0	1
satisfiedcurrentfarming	Takes a value of 1 if the farmer answered "strongly agree" or "agree" (1 or 2) to "My family and I are happy and satisfied with our current farming operations"	946	0.478858	0.499817	0	1
morepositiveoutlookfarmer	Takes a value of 1 if the farmer answered "strongly agree" or "agree" (1 or 2) to "I have a more positive outlook on my future as a farmer"	946	0.37315	0.483897	0	1
familypositivefarm	Takes a value of 1 if the farmer answered "strongly agree" or "agree" (1 or 2) to "My family has a more positive outlook for our farming operation"	946	0.32241	0.467646	0	1
successrate	The number of the above mentioned questions to which the farmer answered 1 or 2	946	2.110994	1.869653	0	5
success	Takes a value of 1 if the farmer answered "strongly agree" or "agree" (1 or 2) to any of the 5 categories above	946	0.678647	0.467243	0	1

What drives MFA success?

Literature on factors affecting the success of small farms:

Category	Description	Sample of Sources
Sales and Acreage	Higher sales and acreage associated with higher levels of success	(Duffy and Nanhou, 2002)
Age and Experience	There are mixed results, with some papers reporting that youth and inexperience are associated with greater success, and others reporting that older and more experienced farmers are associated with greater success	(Duffy and Nanhou, 2002), (Safdar et al., 2004), (Mishra et al., 1999)
Advice	Some papers suggest that higher reliance on market services for advice is associated with greater success, while others argue that higher reliance on friends and family is associated with greater success	(Duffy and Nanhou, 2002), (Safdar et al., 2004)
Family	In a study, more successful farmers picked answers related to family when asked what was most important; family support is also shown to be important	(Duffy and Nanhou, 2002), (McLean-Meyinsse and Brown, 1994)
Ownership	Being the sole proprietor is associated with greater success	(Safdar et al., 2004) (Mishra et al., 1999)
Risk	Participating in crop insurance programs, as a form of risk management, is associated with greater success	(Mishra et al., 1999)
Gender	Some research suggests that male-owned businesses are more successful, particularly in rural communities	(Bird and Sapp, 2004)
Resources	Favorable conditions can boost success	(Mishra et al., 2004), (Ilberry, 1991)
Market Access/Urban Sprawl	Farms may benefit from proximity to urban centers/population centers because of market access, but may also benefit from being far away from sprawling development	(Mishra et al., 2004), (Brown et al., 2012)

Variable	Description	Obs	Mean	Std. Dev.	Min	Max	Rationale
college	Takes a value of 1 if principle operator has completed college and beyond	946	0.22833	0.419978	0	1	Age and Experience
yearfarm	Year started working on any farm	946	1974.766	16.61343	1912	2011	Age and Experience
age65plus	Takes a value of 1 if the principle operator is over 65	946	0.384778	0.4868	0	1	Age and Experience
age35_54	Takes a value of 1 if the principle operator aged 35-54	946	0.217759	0.412941	0	1	Age and Experience
age35less	Takes a value of 1 if the principle operator is under35	946	0.012685	0.11197	0	1	Age and Experience
hhsize	Household size	946	2.540503	1.232925	0	9	Family
female	Takes a value of 1 if the principle operator is female	946	0.197674	0.398456	0	1	Gender
soleproprietor	Takes a value of 1 if the farmer reports the legal business structure as "sole proprietor"	946	0.744285	0.402834	0	1	Ownership
totalacres	Total number of acres in the farm operation	946	166.1756	237.5486	0	2120	Sales and Acreage
dist_from_majorcity	Distance of the centroid of the zipcode in which the farm is located to the nearest major city	946	5689.05	10240.98	0	76231.01	Market Access/Urban Sprawl
naturalamenScale	Natural Amenities Scale (zipcode-level)	946	0.520962	0.830571	-1.16	2.89	Resources
family	Takes a value of 1 if the farmer reports at least one reason connected to family for being involved in MFAs	946	0.44926	0.497682	0	1	Family
govprog	Takes a value of 1 if the farmer reports participating in government or university farm programs	946	0.40592	0.491329	0	1	Risk
mktinfo	Takes a value of 1 if the farmer reports using the USDA or state agency statistical market information	946	0.12685	0.332981	0	1	Advice
friendfamadvice	Takes a value of 1 if the farmer reports getting advice from friends and family	946	0.343552	0.475145	0	1	Advice

What are the farmers like?

Self-reported farmer characteristics	Description	Obs	Mean	Std. Dev.	Min	Max
optimist	Takes a value of 1 if the farmer reports being optimistic	946	2.690275	2.189018	0	6
confident	Takes a value of 1 if the farmer reports being confident	946	0.721987	0.448257	0	1
resonablerisks	Takes a value of 1 if the farmer reports being willing to take reasonable risks	946	0.711417	0.453344	0	1
notafraidfailure	Takes a value of 1 if the farmer reports not being afraid of failure	946	0.662791	0.473007	0	1
considerbothsides	Takes a value of 1 if the farmer prefers to consider all sides of a decision	946	0.662791	0.473007	0	1
certainty	Takes a value of 1 if the farmer reports needing certainty in a decision	946	0.77907	0.415093	0	1
cautious	Takes a value of 1 if the farmer reports being cautious	946	0.783298	0.412216	0	1
infobeforedecide	Takes a value of 1 if the farmer reports needing all of the information before making a decision	946	0.834038	0.372243	0	1
creativeinnov	Takes a value of 1 if the farmer reports being creative or innovative	946	0.786469	0.410016	0	1
newopportunities	Takes a value of 1 if the farmer reports seizing new opportunities	946	0.846723	0.360445	0	1

What do surrounding farmers do?

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
wnummfazip	Weighted* number of farms in the zipcode who participate in MFAs (based on survey responses)	946	2.705082	2.105192	0.077223	12.97342
wsumother	Weighted number of farms in the zipcode where the farmer reports that MFAs were a success	946	0.971258	1.34376	0	9.266731

$$* weight_z = \frac{population_farms_z / total_population_farms}{number_respondents_z / total_respondents}$$

Who plans to continue with MFA participation?

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
continuedparticipation	Takes a value of 1 if the farmer reports that he/she plans to continue MFA participation	946	0.579281	0.493936	0	1

Results

What factors are correlated with high levels of different types of perceived success? Does the perceived success of surrounding farms or the participation of surrounding farms in MFAs impact perceived success?

Logit Regression*

Variable	improvedfinance	improvedquallife	satisfiedcurrentfarming	morepositiveoutlookfarmer	familypositivefarm	success
college	0.14887221	-0.10189974	-0.2294757	-0.21004928	-0.16858892	0.02862005
yearfarm	-0.00331912	.0080505*	0.00656126	0.00407415	0.00716709	0.00796669
age65plus	-0.21332915	-0.10159705	0.2344195	-0.20841246	-.32586965*	-0.1331957
age35_54	0.14181586	-0.18853991	-0.1985402	0.12924293	-0.00372074	-0.03641757
age35less	0.3547889	-0.82674756	-0.13920878	0.41502834	0.40470747	-1.1587712
hhsize	0.00823962	-0.07187535	-.13654321**	-0.09739769	-0.002237	-0.05988269
female	-.58519701***	0.00525615	-0.0476342	-0.11420138	-0.14480331	-0.03808216
solepropri~r	.38131589**	.36655633**	0.18642495	-0.17031842	-0.13679443	0.31753523
totalacres	-.00083604**	-.00159607***	-.00083733**	-.00067658*	-0.00055162	-.00124433***
dist_from_~y	9.26E-07	7.35E-06	-4.06E-06	-8.41E-06	-6.15E-06	-4.81E-06
naturalame~e	-0.03278246	0.00984358	0.00649244	-0.15114587*	-0.04256774	-0.06553476
wnummfazip	0.03550472	0.01588006	-0.06785494	0.06642448	0.03660348	-0.02575977
wsumother	-0.00359284	0.02080764	0.10979376	-0.05827483	-0.02022213	0.03745062
family	1.0590937***	1.3801947***	.88106702***	1.0508034***	.89894912***	1.6952023***
govprog	.49011794***	0.20766304	-0.02153297	0.14700529	0.0759021	0.18295723
mktinfo	-0.05300676	-0.30066634	-0.18305451	-0.34109927	0.04879558	-0.28238194
friendfama~e	0.03735865	0.18832061	-0.08778308	0.11171727	0.17038206	0.14632162
_cons	5.3236309	-16.302444*	-12.924482	-8.5328529	-15.091231	-15.37949
aic	1212.5983	1195.7835	1276.6706	1198.2985	1155.3953	1066.0125
bic	1299.9386	1283.1239	1364.011	1285.6389	1242.7357	1153.3528

Corresponding Marginal Effects

Variable	improvedfinance	improvedquallife	satisfiedcurrentfarming	morepositiveoutlookfarmer	familypositivefarm	success
college	0.03216642	-0.02161802	-0.05322103	-0.04466061	-0.03412634	0.00525636
yearfarm	-0.00071715	.00170791*	0.00152172	0.00086624	0.00145079	0.00146316
age65plus	-0.04609346	-0.0215538	0.05436762	-0.04431259	-.06596363*	-0.02446274
age35_54	0.03064178	-0.03999872	-0.04604633	0.02747959	-0.00075316	-0.00668846
age35less	0.07665829	-0.17539439	-0.03228592	0.08824319	0.08192225	-0.21282012
hhsize	0.00178031	-0.01524835	-.03166771**	-0.02070867	-0.00045282	-0.01099806
female	-.12644196***	0.00111509	-0.01104754	-0.02428146	-0.02931157	-0.00699418
solepropri~r	.08238991**	.07776488**	0.04323651	-0.03621305	-0.02769039	.05831857*
totalacres	-.00018064**	-.00033861***	-.0001942**	-.00014385*	-0.00011166	-.00022853***
dist_from_~y	2.00E-07	1.56E-06	-9.42E-07	-1.79E-06	-1.24E-06	-8.84E-07
naturalame~e	-0.00708322	0.00208831	0.00150576	-0.03213658*	-0.0086167	-0.01203613
wnummfazip	0.00767141	0.00336895	-0.01573722	0.01412315	0.0074094	-0.00473104
wsumother	-0.0007763	0.00441434	0.02546386	-0.01239038	-0.00409343	0.00687819
family	.22883556***	.29280813***	.20434101***	.22342147***	.18196831***	.31134114***
govprog	.10589848***	0.04405569	-0.00499402	0.03125622	0.01536436	0.03360196
mktinfo	-0.01145303	-0.06378633	-0.04245482	-0.07252441	0.00987737	-0.05186231
friendfama~e	0.00807198	0.03995219	-0.02035905	0.02375329	0.03448931	0.02687345

legend: * p<.1; **
p<.05; *** p<.01

*Note, we ran a Wald test for the endogeneity of nummultiw and sumother, but were not able to reject the null hypothesis of exogeneity; Instrumental variable probit models with the aforementioned two variables as endogenous yield similar results

What factors are associated with the level of MFA success?

Ordered Logisic Regression	Success Levels (dy/dx)					
	0	1	2	3	4	5
college	-0.14728	0.027627	0.003148	-0.00033	-0.0044	-0.00783	-0.01822
yearfarm	0.004761	-0.00089	-0.0001	1.07E-05	0.000142	0.000253	0.000589
age65plus	-0.16568	0.031079	0.003542	-0.00037	-0.00495	-0.0088	-0.0205
age35_54	0.024992	-0.00469	-0.00053	0.000056	0.000747	0.001328	0.003092
age35less	-0.00227	0.00426	4.86E-05	-5.1E-06	-6.8E-05	-0.00012	-0.00028
hhsize	0.014989	-0.0799	0.001708	-0.00018	-0.00239	-0.00425	-0.00989
female	-.31943657**	0.0599227**	0.0068287**	-0.00072	-0.0095417**	-0.0169728**	-0.0395219**
soleproprietor	0.105994	-0.01988	-0.00227	0.000237	0.003166	0.005632	0.013114
totalacres	-.00120171***	0.0002254***	0.0000257***	-2.7E-06	-0.0000359***	-0.0000639***	-0.0001487***
dist_from_majorcity	-5.06E-06	9.5E-07	1.08E-07	-1.1E-08	-1.5E-07	-2.7E-07	-6.3E-07
naturalamenScale	-0.08394	0.015747	0.001795	-0.00019	-0.00251	-0.00446	-0.01039
family	1.2506382***	-0.2346057***	-0.0267353***	0.0028	0.037357***	0.0664507***	0.1547336***
govprog	0.22588	-0.04237	-0.00483	0.000506	0.006747	0.012002	0.027947
wnummfazip	-0.01489	0.002793	0.000318	-3.3E-05	-0.00044	-0.00079	-0.00184
wsumother	0.042873	-0.00804	-0.00092	0.000096	0.001281	0.002278	0.005305
mktinfo	-0.18395	0.034507	0.003932	-0.00041	-0.00549	-0.00977	-0.02276
friendfamadvice	0.136856	-0.02567	-0.00293	0.000306	0.004088	0.007272	0.016932
newopportunities	0.03695	-0.00693	-0.00079	8.27E-05	0.001104	0.001963	0.004572
optimist	.83802919***	-0.1572049***	-0.0179148***	0.001876	0.0250322***	0.0445274***	0.103684***
confident	0.080599	-0.01512	-0.00172	0.00018	0.002408	0.004283	0.009972
resonablerisks	0.140887	-0.02643	-0.00301	0.000315	0.004208	0.007486	0.017431
notafraidfailure	-0.15749	0.029544	0.003367	-0.00035	-0.0047	-0.00837	-0.01949
considerbothsides	0.002589	-0.00049	-5.5E-05	5.79E-06	7.73E-05	0.000138	0.00032
certainty	.38990175*	-0.0731412*	-0.0083351*	0.000873	0.0116465*	0.0207168*	0.0482401*
cautious	0.121842	-0.02286	-0.0026	0.000273	0.00364	0.006474	0.015075
infobeforedecide	0.060735	-0.01139	-0.0013	0.000136	0.001814	0.003227	0.007514
creativeinnov	.30414733*	-0.0570546*	-0.0065019*	0.000681	0.009085*	0.0161604*	0.0376302*
aic	3096.187						
bic	3251.459						

Some estimation issues to address in the future:
The self-identified characteristics may be endogenous. Unfortunately, because they are in the form of binary variables, we were unable to use an instrumental variable probit model, which only works for continuous endogenous regressors. We, therefore, attempted to estimate two equations via Seemingly Unrelated Bivariate Probit regression, in which one of the dependent variables was success, and the other was a self-identified characteristic. However, in all cases, we were unable to reject the null hypothesis of no correlation between the residuals of the two equations, which implies that the two equations can be estimated separately. In the future, we need to examine in greater depth our model specification and the endogeneity of the aforementioned variables.

Methodology

(Cameron and Trivedi 2005)

Factors affecting presence of success:

Logit:

When F is the cdf for ε_i,

$\Pr[y_i = 1] = \mathrm{F}[\boldsymbol{x}, \boldsymbol{\beta}]$.

Where y_i takes on a value of 1 if the farmer reports success associated with MFAs and 0 otherwise. When ε_i follows a logistic distribution, the model is a logit.

Factors affecting success rate:

Ordered Logit:

For the ordered logit regression, consider the following linear model

$$y_i^* = \mathbf{x}_i'\boldsymbol{\beta} + \varepsilon_i ,$$

where y_i^* is a latent variable that might reflect the actual but unobserved value of success, and $\mathbf{x}$ is a vector of farm and zipcode-specific attributes (Cameron and Trivedi, 2005).

The observed variable y_i is defined as the following:

$$y_i = j \text{ for } j = 0,1,2,3,4 \text{ or } 5 \text{ if } \alpha_{j-1} < y_i^* \le \alpha_j ,$$

where $\alpha_0 = -\infty$ and $\alpha_5 = \infty$. When F is the cdf for ε_i,

$$\begin{aligned}\Pr[y_i = j] &= \Pr[\alpha_{j-1} < y_i^* \le \alpha_j] = \Pr[\alpha_{j-1} < \mathbf{x}_i'\boldsymbol{\beta} + \varepsilon_i \le \alpha_j] \\ &= F(\alpha_j - \mathbf{x}_i'\boldsymbol{\beta}) - F(\alpha_{j-1} - \mathbf{x}_i'\boldsymbol{\beta})\end{aligned}$$

When ε_i follows a logistic distribution, the model is an ordered logit.

What factors are associated with the continuation of participation in MFAs?

Variable	Logistic Regression	dy/dx
college	0.024668	0.004687
yearfarm	0.005083	0.000966
age65plus	-.33383246*	-.06342846*
age35_54	0.17931	0.034069
age35less	0.084158	0.01599
hhsize	-0.10994	-0.02089
female	0.12702	0.024134
solepropri~r	0.179862	0.034174
totalacres	-.00102567***	-.00019488***
dist_from_~y	-.00002035**	-3.867e-06***
naturalame~e	-0.06788	-0.0129
family	1.6939617***	.3218542***
govprog	0.264042	0.050168
wnummfazip	0.06487	0.012325
wsumother	-0.07197	-0.01367
mktinfo	-0.08824	-0.01677
friendfama~e	0.079582	0.015121
optimist	.40193651**	.07636829**
confident	0.004081	0.000775
resonabler~s	0.291194	0.055327
notafraidf~e	-.44074326**	-.0837416**
considerbo~s	0.355778	0.067598
certainty	.4571538*	.08685962*
cautious	-.4173828*	-.07930309*
infobefore~e	0.059068	0.011223
creativein~v	.6377631***	.12117554***
newopportu~s	-0.00775	-0.00147
_cons	-11.1841	
aic	1117.386	
bic	1253.248	

How are self-reported characteristics associated with success of MFAs?

Variable	Logistic Regression	dy/dx
college	0.001416	0.000249
yearfarm	0.006335	0.001114
age65plus	-0.20578	-0.0362
age35_54	-0.01697	-0.00299
age35less	-1.3836496*	-.24339473*
hhsize	-0.06878	-0.0121
female	-0.05277	-0.00928
solepropri~r	0.296945	0.052235
totalacres	-.0013274***	-.0002335***
dist_from_~y	-6.22E-06	-1.10E-06
naturalame~e	-0.08568	-0.01507
family	1.7598767***	.309576***
govprog	0.193821	0.034095
wnummfazip	-0.03086	-0.00543
wsumother	0.047935	0.008432
mktinfo	-0.26212	-0.04611
friendfama~e	0.149942	0.026376
optimist	.70506186***	.12402586***
confident	0.32091	0.056451
resonabler~s	0.180553	0.031761
notafraidf~e	-0.26642	-0.04687
considerbo~s	0.230964	0.040628
certainty	0.433485	0.076253
cautious	-0.02768	-0.00487
infobefore~e	0.024593	0.004326
creativein~v	0.194492	0.034213
newopportu~s	-.360504*	-.06341546*
_cons	-13.2558	
aic	1049.612	
bic	1185.475	