Adoption of Beef Care Management Practices and Its Determinants: Analysis of the U.S. Grass-Fed Beef Industry.

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Abstract

Using data from a 2013 survey, we provide a summary of 15 farm operations and management practices adopted by U.S. grass-fed beef producers. We analyze farm management practices classified in three broad groups/categories: animal reproductive, management, and technological. Multivariate probit and joint Poisson models are used to analyze adoption determinants.

Introduction

A report from the Food Market Institute (2005) indicates an increase in the domestic supply of grass-fed beef and highlights trends in the demand for grass-fed beef in the U.S. Revenue from the sale of grass-fed beef was projected to increase from just under $5 million in 1998 to over $1 billion in 2010 (Food Market Institute, 2005). A report by Bauman (2013) in the *Drovers Cattleman Network* newsletter discusses comments by Dr. Allen Williams presenting at the annual Grassfed Beef conference in Bismark, ND. The report indicates the U.S. grass-fed beef industry had experienced a 25% annual growth rate and that Grass-fed beef accounted for 3-6% of beef sales in major U.S. metro areas in 2012 (Bauman, 2013). Increased consumer interest in healthy food, animal welfare, and environmental sustainability are cited as the main reasons for grass-finishing becoming a desirable beef option for consumers as well as producers (Kerth et al., 2007; Sitz et al., 2005; French et al., 2000).

The increase in demand for grass-fed beef can be attributed to many reasons. Increasing numbers of health-conscious beef consumers have boosted the demand for grass-fed beef. Media reports and results from studies dealing with beef attributes have improved consumer awareness and understanding on the implications associated with beef consumption choices they make (Katz and Boland, 2000). Kerth et al. (2007) found that finishing Angus-cross steers on forage resulted in a carcass with less fat compared to those finished on feeds that included grain. According to French et al. (2000), preference for healthy beef that comes from local producers and from animals that are considered by some to be more humanely treated is rising. Sitz et al. (2005) indicated that consumers rated highly the beef that is raised and produced domestically (in the U.S.). Increased awareness on matters associated with healthy food has influenced beef consumption patterns (Variyam and Golan, 2002). Harris (2002) found a 178% increase in the supply of new "all natural products" and a 57% increase in new organic products supply over the period, 1995-2000. As consumer preferences evolve, it is important for U.S. beef producers to understand such trends when considering producing specialty products such as grass-fed beef (McCluskey et al., 2005).

Discovery of Bovine Spongiform Encephalopathy (BSE) in 2003 in a cow imported from Canada altered the U.S. beef market in 2004 (USDA ERS, 2012). BSE is transmitted by feeding products derived from infected animals such as meat and bone meal. Grass-fed beef production practices are strictly forage-based and therefore qualify as BSE-free meat. A significant shift to consumption of grass-fed beef was expected following the discovery of BSE. McCluskey et al. (2005) confirmed the relevance of the BSE events on the grass-fed beef market.

On October 5, 2007, the USDA proposed the definition of grass-fed animals as livestock whose lifetime diet must consist only of grass and forage, with the exception of milk consumed prior to weaning. In 2009, the American Grass-Fed Beef Association (AGA) introduced a certification program outlining the standards and procedures followed in producing certified grass-fed beef. The AGA-certified grass-fed beef producers are required to embrace these standards in implementing their management and reproduction practices. The standards require that beef come from cattle that eat only grass from pastures—no grains in the animal diet. Cattle receive no hormones or antibiotics in their feed, the cattle are humanely raised and handled, and the cattle must be born and raised in the U.S. The USDA definition and the American Grass-fed Association definition are thus similar in that animals must be fed only grass and forage post-weaning (Gillespie et al., 2016).

Developing an understanding of the beef management practices typically adopted by U.S. grass-fed beef producers is part of evaluating the economic viability of the industry. This study provides a summary of farm operations and/or management practices adopted by U.S. grass-fed beef producers. Focus is on animal reproductive, management, and technological practices such as castration, animal identification, vaccination, deworming, pregnancy checks, body conditioning scoring, bull test, artificial insemination, and others (Table 1). General criteria that can be used to decide what constitutes beef care management practices are highlighted in Jensen & Oltjen (1992) and Stull et al. (2007) as practices that are in pursuit of ethically acceptable levels of cattle wellbeing. Included in the study is the analysis of key drivers that have influenced farmers' decisions in adopting certain farming practices.

Kim et al. (2005) conducted a similar study to analyze the effect of socioeconomic factors on the adoption of best management practices in beef cattle production. They found higher likelihood of adoption of these practices for farmers holding college bachelor's degrees, having more enterprises on their farms, and having higher percentages of income from beef cattle production. Other studies in agricultural economics that have focused on adoption include Nyaupane et al. (2012) and Rahelizatovo and Gillespie (2004), evaluating the adoption of best management practices by crawfish producers and Louisiana dairy producers, respectively.

Methods

Data from a 2013 mail survey of U.S. grass-fed beef producers were used. A survey package containing a personally addressed and signed cover letter, a ten-page questionnaire, and a postage-paid return envelope was mailed to 1,052 U.S. grass-fed beef producers. Names and addresses of grass-fed beef producers contacted were obtained via extensive search of the Internet. A return rate of 41% was obtained from a survey that involved two sets of questionnaires and two postcard reminders mailed to the sampled producers. To ensure we received responses from producers who strictly finished cattle on grass, a clear definition of grass-fed beef was provided at the beginning of the questionnaire. Questions regarding the farm and farmer characteristics were asked throughout the questionnaire on farm operation; breeding, reproductive, and management practices; goal structure; marketing; and producer demographics. Relevant to this study were the questions addressing the general management, reproductive, and technological practices used on the farm.

Joint Poisson Regression

A joint Poisson regression estimator, a special case of seemingly unrelated Poisson regressions, is used in this study. This type of estimator provides solutions to the problem of unknown covariance between parameter estimates of equations encountered in estimating equation-by-equation Poisson models. It improves efficiency by applying Zellner's (1962) "seemingly unrelated regression model" to the set of equations. This estimator provides a full information maximum likelihood solution that is consistent and asymptotically more efficient than an equation-by-equation exponential Poisson model (Moon and Perron, 2006; King, 1989). It is also possible to perform cross-equation hypothesis tests. The estimator is a "stacked" version of individual Poisson models $Y_j = X_j\beta_j + \epsilon_j$, j = 1, 2, …, M, where Y_j represents a set of dependent count variables and X_j is a vector of regressors that is identical in each equation. With k_j exogenous variables and N observations, we define $K = \sum_{j=1}^{M} k_j$ and let y, X, β, and ϵ be (MN × 1), (MN × K), (K × l), and (MN × 1) vertically stacked vectors of $Y_j,\ X_j,\ \beta_j\ and\ \epsilon_j$, respectively. Assume that $E(\epsilon_j) = 0$ and $E(\epsilon_i \epsilon'_j) = \sigma_{ij} I_n$. We assume that the four stacked equations are related to one another, so that the error terms should be correlated.

Before executing the joint Poisson regressions, variance inflation factors (VIF) were estimated to detect any problems with multicollinearity among independent variables. All VIF values obtained were less than 10, indicating that there was no serious correlation between the independent variables used. To estimate these equations in a multivariate model, we first estimated each of the Poisson regressions separately and then combined the results in a joint model via a Seemingly Unrelated Estimation (SUEST). A post-estimation cross-equation hypothesis to test if the disturbances were correlated was finally executed.

Multivariate Probit Regression

It is possible to estimate a stacked set of binary regression models using the *mvprobit* STATA command. The *mvprobit* fits multivariate probit models using the method of simulated maximum likelihood (Cappellari and Jenkins, 2003). Let y_{im} be the binary dependent variable in the M-equation multivariate Probit model representing the probability of a grass-fed beef producer adopting a farming practice.

$$y_{im^*} = \beta_m{}' X_{im} + \epsilon_{im}, m = 1, \ldots, M$$

$$y_{im} = 1 \text{ if } y_{im^*} > 0 \text{ and 0 otherwise;}$$

$\epsilon_{im}, m = 1, \ldots, M,$ are error terms distributed as multivariate normal, each with zero mean and variance-covariance matrix V (Cappellari and Jenkins, 2003), β'_m represents the coefficients for adoption, and X_{im} is a set of key drivers used in the analysis.

Results

Table 1 presents a summary of the three broad practices and their adoption rates. Castration, Internet search for grass-fed beef information, and access to shade during summer top the three categories in adoption. The three have adoption rates of 87%, 85%, and 93%, respectively. Other practices are shown in Table 1 from the most adopted to the least adopted practices.

A number of factors influence the adoption of various farm management practices. Table 2 presents the summary statistics of key drivers of adoption that were selected for the study. The mean operated hectares was 337 with 891 as its standard deviation. This indicates a diverse group of producers in terms of farm size. The average age of producers who responded was 55, with 70% holding a 4-year bachelor's degree. On average, 50% of annual net farm income came from the grass-fed beef operation.

To determine factors that affect the number of farm practices adopted by grass-fed beef producers, a joint Poisson regression was estimated. Major farm practices were analyzed in the three broad groups, general management, reproductive, and technological / informational practices. Interest was on key drivers that influenced farmers' decisions on the number of practices adopted on the farm. Results shown in Table 3 indicate that farm size was the key determinant of producer's decision to adopt management and reproductive practices. The parameter estimate for total acres operated, however, was not significant for technological / informational practices. Those producers who sold grass-fed beef as meat were more likely to adopt activities represented by the three broad categories.

Multivariate Probit regressions were used to estimate key drivers of adopting specific farm practices. As shown in Table 4, larger-scale producers (in terms of land acreage) were more likely to vaccinate their cattle, carry out pregnancy checks, and use a defined breeding season. Those who hired labor were more likely to adopt more management practices. As expected, those producers having multiple enterprises adopted fewer practices that were directly associated with grass-fed beef. Family labor and educational attainment also impacted numbers of practices adopted. Each of the factors impacted the adoption of at least one of the practices.

Summary and Conclusion

The goal of this study was to develop an understanding of the beef management practices typically adopted by U.S. grass-fed beef producers, a key component in evaluating the economic viability of the industry. Operating multiple agricultural enterprises and having a greater percentage of income from the cattle operation were significant factors in the adoption of farming practices—a finding consistent with Kim et al. (2005). Overall, adoption rates were higher for larger-scale producers in terms of farm size and number of enterprises operated. As expected, higher adoption was found for producers using hired labor and those holding 4-year college degrees.

References

Bauman, P. (2013). Bright future for grassfed beef industry. Drovers Cattle network magazine http://www.cattlenetwork.com/cattle-news/224574531.html?view=all

Cappellari, L., & Jenkins, S. P. (2003). Multivariate probit regression using simulated maximum likelihood. *The Stata Journal*, *3*(3), 278-294.

Food Marketing Institute. (2005). SuperMarket Research. Food Marketing Institute. 7(1). Washington DC. http://www.fmi.org/newsletters/super_research/index.cfm?year=2005

French, P., Stanton, C., Lawless, F., O'riordan, E. G., Monahan, F. J., Caffrey, P. J., and Moloney, A. P. (2000). Fatty acid composition, including conjugated linoleic acid, of intramuscular fat from steers offered grazed grass, grass silage, or concentrate-based diets. *Journal of Animal Science*, 78(11), 2849-2855.

Gillespie, J., Sitienei, I., Bhandari, B., & Scaglia, G. (2016). Grass-Fed Beef: How is it Marketed by US Producers? *International Food and Agribusiness Management Review*, *19*(2).

Harris, M. J. 2002. Food product introductions continue to decline in (2000). *Food Review*. *Economic Research Service*. 25: 24-27

Jensen, W., & Oltjen, J. (1992). Beef care practices. Davis: University of California Cooperative Extension. http://www.vetmed.ucdavis.edu/vetext/INF-BE_CarePrax.html

Katz, J. P., and Boland, M. (2000). A new value-added strategy for the US beef industry: the case of US Premium Beef Ltd. *Supply Chain Management: An International Journal*, 5(2), 99-110.

Kerth, C. R., Braden, K. W., Cox, R., Kerth, L. K., and Rankins, D. L. (2007). Carcass, sensory, fat color, and consumer acceptance characteristics of Angus-cross steers finished on ryegrass forage or on a high-concentrate diet. *Meat Science*, 75(2), 324-331.

Kim, S., Gillespie, J. M., & Paudel, K. P. (2005). The effect of socioeconomic factors on the adoption of best management practices in beef cattle production. *Journal of Soil and Water Conservation*, *60*(3), 111-120.

King, G. (1989). A seemingly unrelated Poisson regression model. *Sociological Methods & Research*, *17*(3), 235-255.

McCluskey, J. J., Wahl, T. I., Li, Q., and Wandschneider, P. R. (2005). US Grass-Fed Beef: Marketing Health Benefits. *Journal of Food Distribution Research*, 36(3).

Moon, H. R., & Perron, B. (2006). Seemingly unrelated regressions. *The New Palgrave Dictionary of Economics*, 1-9.

Nyaupane, N. P., Gillespie, J. M., & Paudel, K. P. (2012). Economic Impacts of Adoption of Best Management Practices by Crawfish Producers: The Role of the Environmental Quality Incentives Program. *Agricultural and Resource Economics Review*, *41*(2), 247.

Rahelizatovo, N. C., & Gillespie, J. M. (2004). The adoption of best-management practices by Louisiana dairy producers. *Journal of Agricultural and Applied Economics*, *36*(01), 229-240.

Sitz, B. M., Calkins, C. R., Feuz, D. M., Umberger, W. J., and Eskridge, K. M. (2005). Consumer sensory acceptance and value of domestic, Canadian, and Australian grass-fed beef steaks. *Journal of Animal Science*, 83(12), 2863-2868.

Stull, C. L., Payne, M. A., Berry, S. L., & Reynolds, J. P. (2007). A review of the causes, prevention, and welfare of nonambulatory cattle. *Journal of the American Veterinary Medical Association*, *231*(2), 227-234.

USDA ERS. (2012). *Cattle and Beef*. USDA Economic Research Service. Available from: http://www.ers.usda.gov/topics/animal-products/cattle-beef/trade.aspx

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association*, *57*(298), 348-368.

Table 1. Adoption Rates of General Farm Management Practices

Practices	N	Mean	Std. Dev.
Reproductive			
Defined Breeding Season	332	0.6596	0.4745
Breeding Records	331	0.5710	0.4957
Pregnancy Checking	332	0.4608	0.4992
Bull Test	332	0.3223	0.4681
Artificial Insemination	331	0.2115	0.4090
Technological/Informational			
Search Internet for Grass-fed Beef Information	383	0.8460	0.3615
Keep Individual Animal Records	383	0.7154	0.4518
Test the Quality of Forage	383	0.3577	0.4800
Body Conditioning Scoring	379	0.3377	0.4736
Management			
Castration	380	0.8658	0.3413
Access to Shade During Summer	383	0.9295	0.2563
Animal ID System	376	0.6117	0.4880
Vaccination	377	0.5676	0.4961
Deworming	377	0.5385	0.4992
Insect Control	378	0.4524	0.4984

Table 2. Summary Statistics of Farm and Farmer Characteristics

Variables	Variable Definition	Mean	SD
Totacres	Farm size in hectares	336.64	890.50
PNHI_GFB	Percent net household income from grass-fed beef	50.00	-
hired_lab	= 1 if using hired labor, 0 otherwise	0.38	0.49
enterprs	Number of other farm enterprises operated	1.73	1.59
family_wrk	= 1 if using family labor, 0 otherwise	0.72	0.45
offFarm_job	= 1 if have an off-farm job, 0 otherwise	0.43	0.50
Years_Opr	Number of years operating grass-fed beef	11.36	8.10
age	Age	54.66	13.73
postcollege	= 1 if holds a 4-yr college degree, 0 otherwise	0.70	0.49
MW	= 1 if Midwest, 0 otherwise	0.30	0.47
NE	= 1 if Northeast, 0 otherwise	0.21	0.41
SE	= 1 if Southeast, 0 otherwise	0.17	0.34
NW	= 1 if Northwest, 0 otherwise	0.17	0.38
SW	= 1 if Southwest, 0 otherwise	0.15	0.28

Table 3. Joint Poisson Regression on Key Drivers of Adoption

Producer Characteristics	Management Practices	Reproductive Practices	Technological / Informational Practices	All Practices
TotacresD	0.1123*	0.3838***	0.0075	0.1604***
	(0.0717)	(0.1162)	(0.0465)	(0.0598)
sell_GFBM	0.4932**	0.8922**	0.2481**	0.5862***
	(0.2130)	(0.3553)	(0.1084)	(0.1645)
PNHI_GFB	-0.0199	-0.0259	-0.0239	-0.0227
	(0.0211)	(0.0327)	(0.0148)	(0-0183)
hired_lab	0.1387**	0.2039**	0.1239***	0.1646***
	(0.0687)	(0.1039)	(0.0474)	(0.0576)
enterprs	-0.0528**	-0.0669*	-0.0226	-0.0491**
	(0.0266)	(0.0366)	(0.0150)	(0.0192)
family_hrs	0.0220	0.0529**	0.0098	0.0291**
	(0.0211)	(0.0253)	(0.0133)	(0.0153)
offFarm_job	0.0937	0.1183	0.0191	0.0855
	(0.0685)	(0.1062)	(0.0475)	(0.0582)
age	0.0013	-0.0029	-0.0024	-0.0015
	(0.0027)	(0.0041)	(0.0019)	(0.0023)
Years_Opr	-0.0077	0.0063	-0.0010	-0.0010
	(0.0053)	(0.00060)	(0.0031)	(0.0631)
postcolleg	0.0972	-0.0251	0.1590***	0.1016*
	(0.0794)	(0.1038)	(0.0541)	(0.0631)
NE	0.0119	-0.1492	-0.0243	-0.0820
	(0.0957)	(0.1352)	(0.0562)	(0.0782)
SE	0.1259	0.0480	0.0484	0.0783
	(0.0996)	(0.1533)	(0.0654)	(0.0874)
NW	0.0582	-0.1828	-0.0130	0.0060
	(0.0934)	(0.1372)	(0.0783)	(0.0761)
SW	0.0829	-0.1028	-0.0543	-0.1059
	(0.0964)	(0.2055)	(0.0873)	((0.1008)

Standard errors in parenthesis; ***, **, and * indicates statistical significance at 1%, 5%, and 10% respectively.

Table 4. Key Drivers of Adoption Using Multivariate Probit Regressions

	Castrate	Animal ID	Vacci-nations	Deworm	Preg Checking	Body C Scoring	Bull Test	Art Insem
totacresD	0.1870	0.2733	0.6427***	-0.1189	0.3415*	-0.0220	0.3193	0.1619
	(0.2481)	(0.1867)	(0.1838)	(0.1792)	(0.1922)	(0.1851)	(0.2069)	(0.2136)
PNHI_GFB	0.0590**	-0.1041*	-0.0305	-0.0555	0.0192	-0.0658	-0.1121*	-0.0260
	(0.0710)	(0.0563)	(0.0566)	(0.0554)	(0.0583)	(0.0566)	(0.0615)	(0.0648)
hired_lab	0.4093	0.3048	0.3393*	0.0141	0.3048	0.2768	0.2981	-0.1007
	(0.2638)	(0.1930)	(0.1936)	(0.1861)	(0.1956)	(0.1838)	(0.2081)	(0.2235)
enterprs	0.0405	-0.1484***	-0.1138**	-0.0682	-0.1104*	-0.0553	-0.0877	-0.0783
	(0.0853)	(0.0544)	(0.0566)	(0.0544)	(0.0606)	(0.0561)	(0.0618)	(0.0739)
family_hrs	0.0314	0.1589***	0.0230	0.0580	0.0563	-0.0132	0.1436**	-0.0770
	(0.0745)	(0.0615)	(0.0598)	(0.0582)	(0.0595)	(0.0580)	(0.0594)	(0.0684)
offFarm_job	-0.1819	-0.0120	0.1874	0.3118*	0.2022	0.0023	-0.2176	0.2589
	(0.2194)	(0.1885)	(0.1854)	(0.1796)	(0.1911)	(0.1816)	(0.2058)	(0.2107)
age	-0.0149	0.0141**	0.0059	-0.0004	-0.0054	-0.0128*	-0.0141*	0.0028
	(0.0097)	(0.0070)	(0.0071)	(0.0069)	(0.0073)	(0.0071)	(0.0078)	(0.0085)
Years_Opr	-0.0179	-0.0154	-0.0144	-0.0231**	0.0034	0.0112	0.0152	-0.0160
	(0.0135)	(0.0110)	(0.0108)	(0.0111)	(0.0111)	(0.0105)	(0.0117)	(0.0118)
postcolleg	-0.2052	0.1154	0.2067	-0.0280	-0.0649	-0.0516	-0.2805	-0.4131*
	(0.2824)	(0.1928)	(0.1901)	(0.1898)	(0.2039)	(0.1924)	(0.2108)	(0.2145)
NE	0.2410	0.3582	-0.1975	-0.0822	-0.5540**	0.1538	-1.0611***	0.4345*
	(0.3115)	(0.2512)	(0.2506)	(0.2329)	(0.2545)	(0.2455)	(0.2990)	(0.2583)
SE	0.7627*	0.1898	0.1608	0.5891**	0.1465	0.3289	-0.2707	0.3447
	(0.4513)	(0.2778)	(0.2784)	(0.2859)	(0.2807)	(0.2675)	(0.3244)	(0.3145)
NW	0.5715	0.1790	0.0096	0.0172	-0.4749*	0.0582	-0.1188	-0.3410
	(0.3665)	(0.2573)	(0.2567)	(0.2411)	(0.2672)	(0.2467)	(0.2775)	(0.3295)
SW	-0.0939	-0.0829	0.3554	0.3673	-0.2037	0.5242*	0.2813	-0.3659
	(0.3895)	(0.3384)	(0.3292)	(0.3271)	(0.3431)	(0.3158)	(0.3364)	(0.4438)
_cons	1.8775***	-0.4983	-0.3754	0.3772	0.0688	0.2580	0.4302	-0.3416
	(0.6408)	(0.4838)	(0.4781)	(0.4815)	(0.5133)	(0.4809)	(0.5288)	(0.5875)
N	245	242	242	242	216	244	216	215

Standard errors in parenthesis; ***, **, and * indicates statistical significance at 1%, 5%, and 10% respectively.

Cont. Table 4. Key Drivers of Adoption Using Multivariate Probit Regressions

	Def Breed Season	Insect Control	Shade Access	Test Forage	Keep Records	Internet for GFB Info	Breeding Records
totacresD	0.4012**	-0.1337	-0.5855*	0.0026	0.0428	0.2160	-0.1827
	(0.1936)	(0.1783)	(0.3052)	(0.1750)	(0.1935)	(0.2283)	(0.1913)
PNHI_GFB	-0.0191	-0.0093	0.0272	-0.0605	-0.0491	0.0786*	-0.0619
	(0.0607)	(0.0541)	(0.0790)	(0.0557)	(0.0600)	(0.0634)	(0.0579)
hired_lab	0.2563	-0.1173	0.7388**	0.3208*	0.0208	0.6030**	0.0988
	(0.1993)	(0.1876)	(0.3202)	(0.1854)	(0.2025)	(0.2549)	(0.1915)
enterprs	0.0058	-0.0636	-0.1336*	0.0044	-0.0943*	-0.0790	-0.0192
	(0.0605)	(0.0557)	(0.0725)	(0.0550)	(0.0553)	(0.0625)	(0.0597)
family_hrs	0.0297	0.0260	-0.0391	0.0097	0.1330**	0.0531	0.0562
	(0.0589)	(0.0567)	(0.0747)	(0.0560)	(0.0675)	(0.0705)	(0.0593)
offFarm_job	0.3540*	0.2382	-0.1797	-0.1269	0.0361	0.2476	0.2835
	(0.1938)	(0.1789)	(0.2639)	(0.1807)	(0.1872)	(0.2404)	(0.1883)
age	-0.0054	0.0033	0.0075	0.0044	-0.0039	-0.0201**	0.0074
	(0.0077)	(0.0069)	(0.0097)	(0.0069)	(0.0071)	(0.0099)	(0.0071)
Years_Opr	-0.0065	-0.0085	-0.0128	-0.0115	0.0117	-0.0144	-0.0123
	(0.0111)	(0.0113)	(0.0183)	(0.0118)	(0.0131)	(0.0112)	(0.0109)
postcolleg	0.2444	0.1210	0.3306	0.1851	0.4241**	0.4768**	0.1982
	(0.1993)	(0.1872)	(0.2827)	(0.1923)	(0.1949)	(0.2259)	(0.1988)
NE	-0.1150	0.5812**	0.1721	-0.3287	-0.1752	0.2445	0.0017
	(0.2457)	(0.2395)	(0.3977)	(0.2386)	(0.2457)	(0.3172)	(0.2469)
SE	-0.2456	0.2837	0.0001	0.0612	0.2954	-0.2807	0.4275
	(0.2926)	(0.2675)	(0.0020)	(0.2665)	(0.3077)	(0.3621)	(0.2963)
NW	0.2416	0.0664	-1.2074***	-0.2830	0.1902	-0.4781	0.0836
	(0.2769)	(0.2405)	(0.2793)	(0.2507)	(0.2755)	(0.3020)	(0.2678)
SW	-0.4128	-0.0555	0.3834	-0.2185	-0.3973	-0.2052	-0.1083
	(0.3488)	(0.3294)	(0.5008)	(0.3232)	(0.3278)	(0.4053)	(0.3411)
_cons	0.0599	-0.3491	1.6640**	-0.4241	0.4584	2.0890***	-0.1664
	(0.5392)	(0.4815)	(0.6902)	(0.4754)	(0.4958)	(0.6744)	(0.5048)
N	216	243	215	248	248	248	216

Standard errors in parenthesis; ***, **, and * indicates statistical significance at 1%, 5%, and 10% respectively.