The Role of Spatial and Demographic Characteristics in Direct Farm Marketing: An Econometric Approach

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The Role of Spatial and Demographic Characteristics in Direct Farm Marketing: An Econometric Approach

Jesse E. Gandee, Cheryl Brown, and Gerard D'Souza

Direct farm marketing sales in the Northeastern region of the U.S. and more specifically in the state of West Virginia increased during the 1990s. To understand the factors that influence recent trends in direct farm marketing, this analysis uses a regression function to test the statistical relationships between county direct farm marketing sales and county spatial and socio-economic characteristics. Data from West Virginia is used to analyze the relationship between the consumer, land characteristics, and farm sales. The results reveal that the model is relatively accurate and multiple consumer characteristics and land use variables significantly influence sales of farm goods marketed directly to consumers.

Key Words: Farmers' Markets, Farm Sales, Direct Marketing

Introduction

Currently, food products travel from the farm-gate to the consumer through an efficient but complex marketing system. In this conventional food system raw food products are planted and harvested by farm owners and are then processed and marketed by agribusinesses. In addition, farm prices are a fraction of the retail food price, and farm establishments maximize profits by means of an "economies of scale" business strategy (Gale, 1997). In this food system, small farm establishments with limited land and capital resources are unable to compete in national and global farm commodity markets (Gale, 1997).

Farm establishments in the state of West Virginia, the study area, have been adversely affected by the structure of the conventional food system. Raw food products grown in the "Mountain State" are typically exported outside of the state to firms that add value to food items by means of processing and packaging (Lewis, 2002). Thus, farm establishments in West Virginia are price takers. Additionally, West Virginia's mountainous landscape disallows farm establishments from applying an economies of scale profit strategy. In fact, farm establishments in West Virginia are much smaller than farms in the U.S., consisting of nearly 40% less acreage than the U.S. average (WVDA, 1997). Given that West Virginia farms are smaller and are unable to capture a price greater than the farm level price, the West Virginia farm production industry has experienced a decline, and farm owners have sought additional income sources. The number of farms in West Virginia decreased by 72% from 1954 to 1997, and in 1997, 60% of farm owners had secondary occupations (Jung, 2002; Lewis, 2002). In addition, the amount of the consumer dollar received by West Virginia farm establishments decreased by 26% from 1913 to 1997 (Lewis, 2002).

In response to the decline in West Virginia's farm production industry, many farm establishments in West Virginia have chosen an alternative business strategy to increase farm income: direct farm marketing. Direct farm marketing is characterized by farm establishments selling food products and services directly to consumers, bypassing food wholesale, processing and marketing firms. Farm establishments that market farm items

directly to consumers receive a greater proportion of the consumer dollar by means of vertical and horizontal integration, and through agri-tourism (Gale, 1997).

Direct farm marketing during the 1990s increased in popularity in the Mountain State and in the Northeastern region of the U.S. To illustrate, direct farm marketing sales increased 11% from 1992 to 1997, and the number of farms that sell directly to consumers increased by 21% in West Virginia (WVDA, 1997). In addition, 30% of farmers' market sales are generated in the Northeast, although the region represents only 4% of U.S. farms. From 1992 to 1997, five of the top ten states with the greatest increase in the number of farms that directly market appeared in the Northeast: Vermont 46%, New Hampshire 35%, West Virginia 26%, Maine 17%, and New York 17% (NESAWG, 2002).

Given the change in the West Virginia farm production industry and the positive trends in direct farm marketing, there is a lack of research on direct farm marketing. For example, the macro-level consumer demographic characteristics that influence direct farm marketing are unknown. Regional variation in direct farm marketing has not been previously analyzed. Therefore, the purpose of this study is to analyze regional revenue factors that influence direct farm marketing in West Virginia. More specifically, this study identifies significant factors that influence consumer expenditures on directly marketed farm items in West Virginia for the year 2000. The results have implications for the industry and for policy makers. The state of West Virginia represents an ideal area for this study because of the mix of rural areas, urban proximity, development pressure, and small scale agriculture.

Background

There is considerable research on the consumer characteristics that influence direct farm marketing. A large body of the research has found that the typical consumer who purchases from a direct marketing forum is well educated, female, upper middle class, middle-aged, and resides within a suburban area (Kezis et al., 1998; Gallons et al., 1997). Thus, education, gender, income, and proximity to metropolitan areas have been

shown in the literature to influence the consumer's decision to purchase directly from farm establishments.

Consumers choose to purchase directly from farmers for multiple reasons, such as quality of raw food products, produce variety, and the motivation to assist local farmers (Govindasamy and Nayga, 1997; Kezis et al., 1998). In fact, Kezis et al. (1998) claim that in Orono, ME, farmers' market patrons do not consider price as a critical factor in the decision to purchase food items. However, the authors also note that other researchers have found that price is an influential factor in the purchasing decision of consumers.

Unlike the consumption or demand side, previous research relative to farmer characteristics that influence direct marketing of farm products is limited. Gale (1997) offers the following reasons that farm owners choose to market farm items directly to consumers. First, the farm price for produce sold directly to consumers can be significantly higher than the wholesale price but competitive with retail prices. Secondly, small farm establishments constrained by land and capital resources are unable to meet the volume needed by food wholesale establishments i.e., small farm establishments are often unable to capture an economies of scale advantage and, in turn, seek a different profit maximizing strategy. Third, the spread of urban residential property and development of former farming regions means that farm establishments and consumers are now within close proximity of one another in such areas. Thus, the supply of direct marketed farm items is directly related to the distance between farms and urban or suburban areas, a spatial aspect that in explicitly tested in this research.

An approach developed by Schatzer et al. (1989) to analyze consumer expenditures at a produce market is adapted in this study to statistically test the factors that influence direct farm marketing sales. Schatzer et al. (1989) used generalized least squares to estimate a single linear regression model. The dependent variable in the Schatzer et al. model is per-captia direct farm marketing sales and the right hand side variables are consumer characteristics such as income, age, frequency of shopping, and distance to the farmers' market.

The Model

An econometric model is used to analyze the influence of consumer demographic, spatial and land characteristics upon direct farm marketing sales. The direct farm marketing sales regression model is based upon economic theory and results from previous research on direct food marketing forums, especially Schatzer et al. (1989).

The West Virginia direct farm marketing sales (DMS) model has some similarities with the Schatzer et al. model. The DMS model is a single equation linear model that uses consumer characteristics as right hand side variables. The right hand side variables that describe consumer characteristics are income, education and urban population. Conceptually both of the models describe the relationship between the consumer and farmers' revenues. In the West Virginia DMS model, however, a more disaggregated relationship between farm establishments and consumers is represented. In other words, the DMS model observes each West Virginia county as a direct marketing forum, where consumers bypass the retail food market to purchase directly from farm establishments.

In addition, other variables that have been omitted by previous research are included here to better explain county level variation of direct farm marketing sales. First, the amount of transportation infrastructure within a county could affect the amount of direct farm marketing sales that are generated in the county. A considerable amount of transportation infrastructure in a rural county could decrease the transaction costs of farm establishments that directly sell to consumers, and simultaneously increase the farm establishment's access to consumers that demand locally grown farm items.

There are, however, differences between the data and variables used for the West Virginia DMS model and the Schatzer et al. model. First, this analysis employs county level data from year 2000. Secondly, the right hand side variables are real numbers, not discrete choice variables. In addition, the percentage of land in farms in a county is hypothesized to influence county direct farm marketing sales. Communities and consumers within counties located in farming regions of a state could feel obligated to assist local farmers. The farmland variable also expresses social activity of farm owners with the local citizenry. A greater amount of farms within a county could increase the social relations farmers have with consumers. In addition, a region that has a greater

percentage of farm land could also have a substantial amount of county extension dollars and direct marketing forums, thus stimulating direct sales. Farmers from a rural state, such as West Virginia, also travel to metropolitan areas to sell farm products directly to out of state urban consumers.

We hypothesize that two metropolitan areas neighboring the Mountain Sate, Pittsburgh and Washington D.C., directly impact farm marketing sales in West Virginia. This hypothesis assumes that residents of Pittsburgh and Washington D.C. travel to West Virginia for recreational purposes and, during their visit, purchase West Virginia grown farm products. In turn, West Virginia counties closest to the Pittsburgh and Washington D.C. areas are likely to be characterized by considerable amount of direct farm marketing sales due to tourism.

There are two interaction effects that could also influence county direct farm marketing sales. The combined influence of an urban population and the percentage of land used for farming could account for much of the variation in direct marketing sales across the northern area and the "Eastern Panhandle" region of the State. Within these regions of West Virginia suburban sprawl has diminished the spatial distance between farmer and consumer, and urban population has simultaneously increased with farm production. In addition, the combined effect of personal income and the county percentage of land used for farming could also influence direct farm marketing sales. The population in the Eastern Panhandle and Ohio River Valley are typically wealthier than other regions in the state and are also historically the primary farming areas of West Virginia. On the other hand, the southern coal fields of West Virginia have typically less per-capita income and minimal farm production in comparison with other regions of the Mountain State. The regional variation in consumer demographics and farm land across West Virginia may provide insight into the changes in direct farm marketing across the state.

Lastly, the most popular, advertised, and researched direct farm marketing forum is a farmers' market. A farmers' market could create an incentive for farm owners to directly market farm products and provide a channel for consumer demand for locally grown farm products. Thus, we hypothesize that a region's proliferation of farmers' markets affects regional direct farm marketing sales.

Data and Estimation

Data to estimate the DMS model were obtained from the latest available (1997) West Virginia Agricultural Census. The direct farm marketing sales for 54 out of 55 counties (one county, Wyoming, was omitted due to the lack of direct marketing data for this county) observations are adjusted for inflation from 1997 to 2000 using the general consumer price index. Thus, the dependent variable for the West Virginia DMS model is direct farm marketing sales for each county in year 2000.

The demand related factors utilized to estimate the variation in direct farm marketing sales are income (Y), population (P) and education (E). All data on income, population and education were obtained from the 2000 U.S. Census. The income variable that will be used for the DMS model is year 2000 per capita income. The variable, "percentage of land used for farming" (N) accounts for the influence of farm conglomeration effects (extension services, social relations, and direct farm marketing forums) upon direct farm marketing sales. The percentage of acreage used for farming within a county is obtained from the Agricultural Census. The data for this variable is adjusted assuming a linear trend from 1992 to 1997, to predict a value for 2000.

The "transportation infrastructure" (HWY) variable captures the impact of roadway systems upon county direct farm marketing sales. This variable is represented by the total amount of federal and state owned highway per square mile for a county in 2000. The data for this variable, "transportation infrastructure", was estimated using GIS-ArcView by the Natural Resource Analysis Center at West Virginia University, Davis College of Agriculture, Forestry, and Consumer Sciences (NRAC, 2003).

The influence of tourism from the metropolitan regions of Pittsburgh and Washington D.C. is represented by two distance variables, DP and DW, respectively. The metropolitan distance variable is equivalent to the mileage from Washington D.C and Pittsburgh lines to the respective adjacent West Virginia county line in 2000. The data for these variables, "distance to neighboring metropolitan area", was also estimated using GIS ArcView by the Natural Resource Analysis Center at West Virginia University (NRAC, 2003).

The interaction variables, (PA) and (PI), that are within the direct farm marketing model are generated by multiplying two right hand side variables. The "2000 persons per square mile" variable multiplied by the "2000 percentage of county acreage used for farming" variable is presented as an interaction variable. Secondly, "2000 county per capita income" multiplied with "percentage of land in farm acreage" is also expressed as an interaction variable.

The data for the variable representing the influence of farmers' markets (FRMT) is derived from the list of West Virginia advertised farmers' markets by the U.S.D.A in 2002 (U.S.D.A, 2002). The variable is equivalent to 1 if a county has a farmers' market advertised by the U.S.D.A and 0 otherwise. There is no historical data for farmers' markets in West Virginia for the year 2000. Therefore, this analysis assumes that farmers' markets in 2002 were active in 2000 or counties that did not have farmers' markets in 2000 have the community support and/or consumer demand to support a farmers' market.

The empirical DMS model for West Virginia is as follows:

$$DMS_i = B_1 + B_2(PI_i) + B_3(P_i) + B_4(Ed1_i) + B_5(Ed2_i) + B_6(DP_i) + B_7(DW_i) + B_8(HWY_i) + B_9(N_i) + B_{10}(PA_i) + B_{11}(IPFA_i) + B_{12}(FRMT_i) + e_i \quad (1)$$

where DMS = Direct Farm Marketing Sales; PI = Income per Capita; P = Persons Per Square Mile; ED1 = Percentage of Persons with a Bachelors Degree; ED2 = Percentage of Persons with a Professional Degree; DP = Distance to Pittsburgh; DW = Distance to Washington DC; HWY = County Automobile Infrastructure; N = County Percentage of Farm Acreage; Interaction effects: (a) PA = Population and Percentage of Land in Farm Acreage; and (b) IPFA = Income and Percentage of Land in Farm Acreage; and FRMT = Farmers' Market. The (i) subscript denotes the observation for an individual county for year 2000.

A single-equation linear regression model that utilizes county and spatial data is susceptible to heteroskedasiticity and multicollinearity. Ordinary least squares (OLS) estimates of a model that suffers from heteroskedasticity are unbiased and consistent but the standard errors of such a model are invalid (Hill et al., 1997). In such cases, the e^2 term (sigma squared is defined as the model's error variance, $\sum e^2$/T-K (where e is equal

the model's residual, T is equal to total observations, and K is equal to number of coefficients) is systematically related to one or more explanatory variables and therefore, the model's variance is not constant over all observations (Griffith et al., 1993). In turn, a basic OLS assumption is violated and hypothesis testing for such a model is incorrect. For the West Virginia direct farm marketing model the Breusch-Pagan (B-P) test for heteroscedasticity is used. If the null hypothesis for the B-P test is rejected, the White's estimator is used to estimate the direct farm marketing model coefficient's standard errors (Hill et al., 1997). The White's estimator, or robust standard errors, replaces e^2, the model's error variance, with the least squares residual, e^2_t (Hill et al., 1997). White's technique creates consistent estimates of the coefficient's variance, in turn, as the sample size increases, the coefficient's variance estimate converges to the accurate value.

The descriptive statistics of variables within the direct farm marketing model are presented in Table 1. To test for multicollinearity, correlation estimates of the right-hand side variables are estimated. If any of the correlation statistics are more than 0.8, multicollinearity could exist and a right-hand side variable could be dropped (Griffith et al, 1993). The computer software LIMDEP is used to estimate the Direct Farm Marketing Model and additional estimation details are provided in Gandee (2003).

Table 1 Descriptive Statistics of Variables in the Direct Farm Marketing Model

Definition of Variable	Variable	Mean	Std.Dev.	Minimum	Maximum	Observations
Direct Farm Marketing Sales *(in thousands of dollars)*	DMS	52.84	65.56	0.00	333.43	54
Per Capita Income *(in dollars)*	PCI	19467.44	3542.25	14246.00	28681.00	54
Population Density *(Persons Per Square Mile)*	POP	91.61	90.52	9.70	394.40	54
Percentage with a Bachelor Degree *(Percentage of Persons)*	PBACH	7.46	2.66	3.10	15.10	54
Percentage with a Professional Degree *(Percentage of Persons)*	PDOC	4.78	2.39	2.20	17.40	54
Percentage of Land in Farming *(Proportion of County Land)*	PERACRE	24.35	13.51	0.00	54.39	54
Distance to Washington D.C. *(In Mileage)*	DCDI	201.78	59.38	53.21	298.64	54
Distance to Pittsburgh *(In Mileage)*	PITSD	128.39	51.62	32.12	226.96	54
Highway Density *(Highway Per Square Mile)*	HWYDEN	0.02	0.04	0.00	0.17	54
Population Density (X) Percentage of Land in Farm	POPXPERA	2194.95	2515.09	0.00	10953.94	54

Acreage						
Income (X) Percentage of Land in Farm Acreage	INCXPA	477742.74	288531.59	0.00	1461921.14	54
Farmers' Market	FRMMRKT	0.39	0.49	0.00	1.00	54

Results

Before the results are discussed, some model corrections were performed as described next.

The B-P heteroskedasticity test is used when the model's error variance could be related to one or more of the right-hand side variables. The West Virginia DMS model is likely to have multiple right hand side variables related to the model's error variance, given the drastic spatial and demographic differences in the counties of West Virginia. The B-P test has a Chi-squared distribution with eleven degrees of freedom, $\chi^2_{(11)}$ and a χ^2_c value of 18.54 (Griffith et al., 1993). The B-P test statistic is equivalent to 46.19, which is greater than the χ^2_c value. Therefore, the null hypothesis (Ho_1) is rejected; heteroskedasticity exists in the West Virginia direct farm marketing model. Given the results of Ho_1, the least squares estimator is not the best linear unbiased estimator. Heteroskedasticity disallows the estimator to have the minimum variance required of the Gauss-Markov assumptions (Griffith et al., 1993). White's correction is therefore imposed upon the West Virginia direct farm marketing model to generate consistent estimates of the coefficient's standard errors.

Once again, the test for multicollinearity is dependent upon the right hand side variable correlation estimates (Griffith et al., 1993). If at least one of the estimates are greater than 0.8, a right hand side variable may be dropped. The only correlation estimate that is greater than 0.8 is between the two educational variables, county percentage of persons with a bachelors degree, PBACH, and county percentage of persons with a masters, law or professional degree, PDOC. However, the preliminary regression coefficient estimates have differing signs and both are significant. Coefficient estimates of the direct farm marketing model, adjusted for heteroskedasticity error and using different combinations of educational variables, reveal that educational variables are not significant without including both variables, PBACH and PDOC. The DMS model was also estimated using the variable, "total percentage of persons with a degree greater than high school diploma", or PTOT. This variable did not significantly influence

direct farm marketing sales. Thus, the variables, PBACH and PDOC, are capturing the effect of two different consumer preference factors on direct farm marketing sales and neither variable is dropped from the model. In addition, there are multiple coefficients that are significant, and the R^2 and F-statistic are not large in relative terms. Multi-variable multicollinearity, therefore, does not influence the direct farm marketing model (Griffith, 1993).

Given White's Correction, the 2000 West Virginia direct farm marketing model coefficient estimates, estimated coefficient's standard errors, and P-values are presented in Table 2.

Table 2 Direct Farm Marketing Model Estimates

Variable	Coefficient	Standard Error	P-value
Constant	-98.69	78.17	0.21
PCI	0.009*	0.00	0.06
POP	-0.28	0.25	0.27
PBACH	-8.38*	3.70	0.03
PDOC	5.10*	2.89	0.09
PERACRE	8.75*	4.27	0.05
DCDI	-0.48*	0.17	0.01
PITSD	0.62*	0.20	0.00
HWYDEN99	-26.63	189.53	0.89
POPXPERA	0.03*	0.01	0.03
INCXPA	0.00*	0.00	0.09
FRMT	-23.97*	11.62	0.05
R^2	0.65	**F-Statistic**	7.91

* Significant at the 10% or higher level.

Using a significance level of 10% and observing the West Virginia DMS model P-values, the following variable significantly influence county-level direct farm marketing sales: county per capita income, percentage of persons with a bachelors degree, county percentage of persons with a professional degree, percentage of county acreage dedicated to farming, distance from Washington D.C and Pittsburgh in miles, the combined impact of population density and county percentage of acreage dedicated to farming, and combined impact of per capita income and percentage of county acreage dedicated to farming. There is also a significant difference between direct farm marketing sales in counties with a farmers' market and those without.

Discussion

As income increases spatially across West Virginia, county direct farm marketing sales also increase. More specifically, a $1 increase in county per capita income will increase direct farm marketing sales by $9.30, holding all other right hand side variables constant. The numerically small coefficient (.0093) is due to the difference in data units, (direct farm marketing sales is in thousands of dollars, county per capita income is in dollar units). The marginal effect is not only significant but also relatively large. The size of the income influence could be due to the drastic variation in income and direct farm marketing sales in West Virginia. For example, counties in the coal fields of West Virginia (Mingo, McDowell, and Logan) have relatively low per capita income[1] and minimal direct farm marketing sales[2] On the other hand, in the Eastern panhandle counties (Jefferson, Berkley, and Morgan) of West Virginia income is relatively high[3] and there are considerable amount of direct farm marketing sales[4].

The sign and magnitude of the coefficients representing income reveals whether a good is normal, superior, or inferior (Griffith et al., 1999). In terms of farm products sold to consumers in West Virginia, the positive and significant income coefficient reveals that direct farm marketing products are, as expected, normal goods. The results from the parameter estimates also reinforce the findings by Schatzer et al. (1989). The latter concluded that higher income patrons spend more per-capita at direct marketing forums.

County population density is the explanatory variable representing the influence of an urban population in the DMS model. This variable does not statistically influence county direct farm marketing sales in West Virginia. There are three possible reasons why this variable does not significantly affect direct marketing sales. First, the three major urban areas in West Virginia (Charleston, Huntington, and Wheeling) are not within counties that are historically farm oriented. Thus, farm production and direct farm marketing sales are minimal and population density is relatively high in comparison to other counties in West Virginia.

[1] Average per capita income for Mingo, McDowell, and Logan counties is $12,240
[2] Average direct farm marketing sales for Mingo, McDowell and Logan counties is $2,300
[3] Average per capita income for Jefferson, Berkley, and Morgan counties is $18,844
[4] Average direct farm marketing sales for Jefferson, Berkley, and Morgan counties is $189,667

Secondly, type II error could influence the amount of the variability of direct farm marketing sales accounted for by the population density variable. Type II error occurs when an explanatory variable statistically affects a dependent variable, but the explanatory variable is represented by data that does not statistically affect the left hand side variable (Hill et al., 1997). In terms of the direct farm marketing model, county population density data may not accurately represent the influence of an urban area on direct farm marketing sales.

Lastly, the data representing direct farm marketing sales includes out-of-state sales and foreign county direct farm sales. There could be a considerable amount of direct farm sales generated in urban or well populated regions that have direct farm marketing forums but the sales are recorded in neighboring or more farm oriented counties. In such a scenario, farm oriented areas would record high levels of direct farm sales, while urban areas would not have minimal direct farm sales.

The two variables representing the influence of out-of-state metropolitan areas, Pittsburgh and Washington D.C., upon direct farm marketing sales in West Virginia are statistically significant. Nevertheless, the distance variables "mileage from Pittsburgh to the county" and "mileage from Washington D.C to the county" have differing signs. An increase of one mile away from the Washington D.C metropolitan area decreases West Virginia county direct farm marketing sales by $480. An increase of one mile away from the Pittsburgh metropolitan area increases county direct farm marketing sales by $620. More specifically, the Washington D.C. distance coefficient signifies that the West Virginia counties nearest to the Washington D.C. area have generated greater direct farm marketing sales than the counties located at a greater distance. Therefore, as distance increases away from the counties nearest to the Washington D.C region (Berkley, Morgan, and Jefferson) direct farm marketing sales diminish.

The Washington D.C. distance variable conceptually represents the influence of tourists from Washington D.C visiting the state and attending West Virginia direct farm marketing forums and farm establishments. Given that the data for direct farm marketing sales includes out-of-state direct sales, the coefficient also represents the impact of farm owners transporting products to the metropolitan area. Farm owners in the Eastern Panhandle probably attend direct farm marketing forums in the metropolitan area,

including the Maryland and Virginia suburbs surrounding Washington D.C.. Once again, as distance decreases to Washington D.C. farm owners have less transportation costs and, in turn, greater direct farm marketing sales relative to other counties in West Virginia.

The Washington D.C. distance variable could also be capturing the impact of the historic farming area of West Virginia's Eastern Panhandle, upon direct farm marketing sales. The counties nearest to the Washington D.C. metropolitan area historically and presently are considered an agricultural region. Nevertheless, the variable "percentage of land used for farming" should capture a proportion of the influence of geographical and historical factors that affect direct farm marketing sales.

On the other hand, the sign of the Pittsburgh distance coefficient reveals that as distance increases away from the counties nearest to the Pittsburgh metropolitan area (Ohio, Wetzel, and Marshall) direct farm marketing sales increase. In turn, the counties nearest to the Pittsburgh area have less direct farm marketing sales than counties located at a greater distance. The economy of the counties near Pittsburgh may explain the sign of the coefficient. The Northern Panhandle area of West Virginia near the Pittsburgh region does not contain a large number of farm establishments. Historically, the economy has been dominated by resource extraction industries (e.g. coal and timber) and manufacturing industries. Local public policies, extension resources, and local businesses have probably not promoted direct farm marketing, relative to more farm oriented regions.

In addition, Pennsylvania has the second largest amount of CSAs and farmers' markets in the Northeast, and highly publicized Amish communities which directly market farm products (NSAWG, 2002). Therefore, Pennsylvania citizens visiting West Virginia may choose not to purchase farm items, given their loyalty to, and the availability of, products from Pennsylvania farm establishments.

The two educational variables within the direct farm marketing model are both statistically significant. A one percent increase in the number of persons with a bachelor's degree in a West Virginia county decreases the amount of county direct farm marketing sales by $8,380. A one percent increase in the amount of persons with a graduate, law, or doctorate degree increases direct farm marketing sales by $5,100. The sign of the professional degree coefficient is supported by previous research and theory.

The bachelor's degree coefficient, however, has a negative sign and is not supported by previous research.

There are two possible conceptual reasons the bachelor's degree coefficient is negative. First, the more urban counties of West Virginia (Kanawha, Cabell, Ohio) have a greater proportion of persons with bachelor's degrees. These counties also have minimal direct farm marketing sales in comparison to other West Virginia counties. Secondly, many rural counties in the coalfields and in the eastern mountainous areas have limited employment opportunities, with the majority of the existing industries (education and medical) requiring a bachelor's degree. These counties may have a relatively large average percentage of persons with a bachelor's degree and also have a minimal amount of direct farm marketing sales in comparison to other West Virginia counties.

The professional degree coefficient is positive and significant. The sign of the coefficient could be the result of the impact of colleges upon direct farm marketing sales. Previous research by Kezis et al. (1998) also found a positive relationship between direct farm marketing and a higher proportion of persons with a professional degree. There are multiple communities in the Mountain State that have higher institutions of learning and subsequently a higher proportion of the county population with an advanced degree. Professionals working at colleges such as Marshall University, Davis and Elkins College, and Glenville College may have certain preferences for locally grown raw-food products, in turn, stimulating county direct farm marketing sales.

The percentage of a county's acreage used for farmland significantly influences county direct farm marketing sales. A one percent increase in the amount of farm land within a West Virginia county increases direct farm marketing sales by $8,750. This result supports the hypothesis that the greater amount of farms within a county creates farm conglomeration effects. Communities in a county that have a considerable amount of land resources used for farming support farm establishments by creating direct farm marketing forums or citizens purchase food products directly from local farmers. In addition, farm-based counties could also have well financed farm extension services, and well established political and social networks that assist local farm owners by increasing direct farm marketing opportunities.

The variable representing the amount of highway density in a county is statistically insignificant. The actual variable has very little variation and therefore, statistically, highway density can not explain the change in county direct farm marketing sales. Type II error could also affect the coefficient's standard error, e.g., the variable HWYDEN within the model does not appropriately represent the influence of automobile infrastructure upon direct farm marketing sales.

The interaction variable county population density and percentage of land used for farming and the interaction variable per-capita income and percentage of land used for farming both positively and significantly influence county direct farm marketing sales. A simultaneous increase of county population density and county percentage of land used for farming increases county direct farm marketing sales. In addition, a simultaneous increase of per-capita income and county percentage of land used for farming increases direct farm marketing sales. The significance of these variables support Gale's theory that urban areas, suburban areas, and high income regions in close proximity to farm land promote direct farm marketing sales.

West Virginia counties with farmers' markets have a significantly different amount of direct farm marketing sales. In fact, counties with a farmers' market generate $23,970 less than counties without a farmers' market. Farmers' markets theoretically could stimulate county direct farm marketing sales but the results reveal that the direct marketing forum negatively influences direct farm marketing sales. The counties with minimal direct farm sales could use a farmers' market as a policy to stimulate farm income. For example, in such counties with limited direct farm marketing sales, such as Logan, Raleigh, and Ohio[5] direct farm marketing sales are relatively low in comparison to counties without a farmers' market such as, Monroe, Hampshire, and Roane[6]. Therefore, political and community groups in counties with minimal farm production could utilize farmers' markets to affect county farm vitality. Nevertheless, given that farmers' markets are established in counties with minimal direct farm marketing sales, the dummy variable coefficient is negative.

[5] Average Direct Farm Marketing Sales in Logan, Raleigh, and Ohio counties are $10,753
[6] Average Direct Farm Marketing Sales in Monroe, Hampshire, and Roane counties are $162,054

The effect of this public program could, however, change over time. The data utilized in the West Virginia DMS model is cross sectional, thus, direct farm marketing sales trend is not observed. This public policy tool could in the future stimulate county direct farm marketing sales, in turn, causing the farmers' market coefficient to be insignificant or positive and significant.

Conclusions

The historic changes in the farm production industry and the recent increase in the amount of direct farm marketing sales in West Virginia has led to a need for research information on direct farm marketing. This analysis is therefore pertinent to farm establishments, agricultural researchers, and policy makers in the Mountain State and other predominantly rural states. The analysis addresses a research objective relative to direct farm marketing in West Virginia: to identify significant consumer demographic, land, and spatial characteristics that influence state-level direct farm marketing sales.

The results from the West Virginia direct farm marketing model reveal that consumer demographic, land and spatial county characteristics significantly impact the amount of direct farm marketing sales received by farm establishments in West Virginia counties. In fact, consumer demographic characteristics such as education and income positively influence county direct farm marketing sales. As expected, an increase in the percentage of persons with a professional degree (law, masters or doctorate) in a county increases the amount of county direct farm marketing sales. The percentage of land used for farming also significantly affects county direct farm marketing sales. This variable accounts for the positive impact of farming conglomeration effects, which vary from farm extension services to local consumers' desire to purchase farm items in order to support local farm establishments. Spatial factors, e.g., the distance to two adjacent, but out-of-state, metropolitan regions, Pittsburgh and Washington D.C., also influence county direct farm marketing sales in West Virginia. An increase in mileage away from the Pittsburgh metropolitan area increases county direct farm marketing sales. An increase of mileage away from the Washington D.C metropolitan area decreases county direct farm marketing sales in the Mountain State. Thus, West Virginia counties surrounding the Pittsburgh metropolitan area have less direct farm marketing sales than the rest of the

state and counties surrounding the Washington D.C. metropolitan area have greater amounts. Lastly, variables that represent the combination of the amount of county farmland and income, and a combination of the amount of county farmland and county population density both significantly influence direct farm marketing sales. A simultaneous increase of county per-capita income and percentage of land used for farming increases county direct farm marketing sales. A simultaneous increase of county population density and percentage of land used for farming also stimulates county direct farm marketing sales. These results imply potential marketing strategies. While the model generally performs well in terms of signs and significance the direct farm marketing sales model could be more efficient if estimated using a two stage least squares model or as a discrete choice model.

There could also be missing right-hand side variables within the model which influence county direct farm marketing sales. There are some data on the total number of direct marketing farms by state. Previous research, however, has not included the number of farms in food expenditure or direct farm marketing analyses.

To observe the trends of direct farm marketing, data from previous Agricultural Census could also be used in a longitudinal analysis. However, the data have several missing values particularly from counties in the Southern Coalfields of West Virginia for direct farm marketing sales and percentage of land used for farming in 1992.

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