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West Virginia Farm Direct Marketing: A County Level Analysis

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To understand the factors that influence farm direct marketing, a linear regression model is estimated to test the relationships between county-level direct market sales and socio-economic, agricultural production, and location characteristics for West Virginia. The results show that higher median housing value, increased population density, a younger population, a greater number of direct market farms, more diversity of fruit and vegetable production and closer proximity to Washington, D.C., increase direct market sales. The results have implications for other states with a large proportion of small and part-time farmers, many of whom are located in close proximity to metropolitan areas.

Key Words: direct market sales, direct marketing, farm sales, farmers' market

JEL Classifications: Q13, C21

Consumer demand for fresh, local food products along with the potential for increased farm income have led to an increase in direct marketing of farm products. In the United States, sales of agricultural products from the farmer directly to the consumer increased from approximately \$592 million in 1997 to \$812 million in 2002, and the number of direct-market farms increased from 110,639 to 116,733 over the same period (NASS 2004). The number of farmers' markets, an important direct-market venue, also increased from 1,755 in 1994 to 3,706 in 2004 (AMS 2005). West Virginia, the study area, has followed this trend, with the value of direct sales of agricultural products increasing from \$2.9 mil-

lion in 1997 to \$4.6 million in 2002, and the number of farms selling directly to consumers increasing from 1,303 to 1,434.

West Virginia is a rural state whose agriculture is largely comprised of small family farms. Ninety-five percent of West Virginia farms are family-owned and operated, and farms with annual sales of less than \$50,000 accounted for 95% of all farms in 2002 (NASS 2004). At an average of 172 acres, the land base for the state's farms is small compared to the national average of 441 acres (NASS 2004). While this high density of small farms in West Virginia preserves its rural character, it also means few farm families can take advantage of the economies of scale that make extensive agriculture viable (Steele). Preserving the state's agricultural base requires an attention to enterprises that are feasible on a small scale, such as fruits, vegetables, and other high-value alternative crops along with direct-marketing strategies that allow farmers to capture a greater share of the consumer's food dollar.

There is considerable research on the con-

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sumer characteristics that influence farm direct marketing. Much of the research has found that the typical consumer who purchases from a direct-marketing forum is well-educated, upper-middle class, middle-aged, and resides within a suburban area (Gallons et al.; Kezis et al.; Lockeretz). Consumers choose to purchase directly from farmers for multiple reasons, such as quality and variety of available produce and a desire to assist local farm owners (Brown 2003a; Eastwood, Brooker and Orr; FPC; Govindasamy and Nayga; Henneberry and Agustini; Kezis et al.; Schatzer, Tilly, and Moesel; Wolf).

Unlike the consumption or demand side, previous research relative to farm or farmer characteristics that influence direct marketing of farm products is limited. Gale claims that small farms (<\$10,000 annual sales), fruit and vegetable growers, and farms near metropolitan areas are more likely to sell directly to consumers, and that prices received can be significantly higher than wholesale and competitive with retail. Lyson and Guptill found that the type of crop grown on farms influences what they describe as "civic agriculture," which is characterized by more direct-market sales and a greater connection to local markets. In particular, civic agriculture farms are more likely to be fruit and vegetable farms. A Mississippi study (Morgan and Alipoe) concluded that fruits and vegetables were important for direct marketing, finding the amount of vegetable and melon acreage increased the number of pick-your-own operations, farm stands, and farmers' markets in a county. Lyson, Gillespie, and Hilchey found that farmers' markets were part of a diverse marketing strategy for farmers selling directly to consumers and were "an important source of economic livelihood" (p. 111). Buhr's case studies show that direct marketing of pork with a focus on product characteristics desired by consumers allowed several producers to find a niche that kept them competitive with commodity pork operations. The type of direct-marketing venue can also influence a farm's sales. Govindasamy, Hossain, and Adelaja analyzed how different farm income levels related to a variety of direct-farm-marketing fo-

rms, and concluded that direct retailing and the utilization of market outlets in urban areas positively influenced the probability that a farmer is within a higher income bracket.

Surveys of direct-market consumers and producers are the basis of most studies of direct marketing (Gallons et al.; Kezis et al.; Lockeretz; Brown 2003a; Eastwood, Brooker, and Orr; FPC; Govindasamy and Nayga; Henneberry and Agustini; Schatzer, Tilly, and Moesel; Wolf). Secondary demographic data along with surveys of county extension agents were used to understand factors affecting the number of direct-market outlets at the county level by Morgan and Alipoe. Thilmany and Watson highlight trends in direct marketing in the western United States using USDA Agricultural Census and Agricultural Marketing Service data but do not analyze the forces behind these trends. Our study appears to be a unique examination of the influences on farm direct marketing at the county level using USDA Agricultural Census data.

Methodology

Sales of directly marketed farm products in any county are the result of transactions between profit-maximizing producers and utility-maximizing consumers. The market supply of direct-market products obtained from profit maximization is the summation of supply from all direct-marketing producers, and market demand reflects the total utility-maximizing demand of all relevant consumers. Market equilibrium for farm products sold directly to consumers exists when quantity demanded is equal to quantity supplied.

Data are not available to estimate these structural supply and demand equations for directly marketed farm goods; therefore, we estimate a reduced form equation for direct-market sales by county that should capture both supply and demand characteristics. Both consumers and producers are mobile and could be buying or selling outside of their home county. Travel costs, however, will increase as farmers sell farther from the farm, reducing profits unless prices are also increasing. Prices could be higher in urban direct markets, so we include

in the model distance from some important cities in the region. Although our analysis is at the county level, consumers may be crossing county or even state lines to shop at a direct-market venue. In general, U.S. residents travel about 8 miles to shop for groceries (Blanchard and Lyson) so it is not expected that the results will be seriously affected by using county-level data. Tourists may be important customers at farmers' direct-market outlets; however, we have no way of knowing the extent of sales to these customers. Assuming that a majority of a farm's direct sales are to nearby consumers, we use data from each county for both supply and demand characteristics in that county. Tests for spatial dependence of the data did not indicate the presence of cross-county impacts (Anselin).

The per-county dollar value of direct-market sales represents the direct-market price times the market equilibrium quantity of directly marketed goods in that county. For any county, the direct-market sales equation is $DMS_i = \beta' x_i + u_i$, where DMS_i is the value of direct-market sales in county i and x_i is a vector of county characteristics related to supply and demand in that county; u_i is a random error component. The vector x_i includes characteristics relevant to market demand, such as consumer income, number of consumers, and tastes and preferences, and market supply—for example, number of farmers, input costs, and technology.

The model in this West Virginia study of direct-market sales uses a single equation linear model with consumer, farm, and market characteristics as explanatory variables. The dependent variable (DMS) from the 2002 Census of Agriculture is the value of agricultural products sold directly to individuals for human consumption for each of the 55 counties in WV in 2002 (NASS 2002). These products could be sold from roadside stands, farmers' markets, pick-your-own sites, or other similar direct-market venues. Products include vegetables, fruits, meats, fish and/or dairy products, but processed products are excluded.

Consumer characteristics used as explanatory variables include education, age, a measure of income, and the suburban nature of the

county of residence. Demographic data from the U.S. Census of 2000 is adjusted to match the 2002 Agricultural Census data. Education (EDUC) is measured as the percentage of residents in a county 25 years of age and older who have a bachelor's degree or higher (graduate or professional degree) (USCBa; PDUSCB). Age (PAGE65) is calculated as the percentage of the population in the county that is 65 years of age or older (USCBa; PDUSCB). A federal Farmers' Market Nutrition Program provides vouchers for low-income seniors to purchase locally grown produce, which could increase direct-market sales among the elderly. The value of an average home in an area has been linked to price sensitivity in supermarkets; thus, we use the median value of owner-occupied housing (HOUSE) in a county (adjusted from 2000 U.S. Census data by the housing consumer price index) to represent consumer buying power (USCBa; USBLSa; USBLSb). Median household income was also considered for inclusion but was highly correlated (correlation coefficient = 0.75) with median housing value and so was excluded. Because previous research found that direct-market consumers tended to live in suburban areas, we include a dummy variable (MSA) that is equal to one if the county is part of a metropolitan statistical area (USCBb) and a zero if it is not. To account for the number of potential consumers in a county we include a population density (POPD) variable that is measured as persons per square mile in each county (USCBa; PDUSCB).

On the supply side, we include the number of direct-market farms (DMFARM), which should impact the total value of direct-market sales in a county (NASS 2002). The importance of agriculture in a region is another factor that could influence direct-market sales, and this is captured by the percentage of land used for farming (PFARM), calculated from the 2002 Census of Agriculture. These sales-increasing agglomeration effects could come from impacts on demand or supply (Shaffer, Deller, and Marcouiller). As the number of farms in a county increases, consumers are more likely to have social interactions with

farmers and feel inclined to purchase their products. Brown (2003a) found that consumers with a farm background were more likely to prefer local farm products. In addition, it should be easier for customers to find a variety of directly marketed farm products in a region with more farms, and increased familiarity with buying and using local food should increase demand. A high percentage of land in farming in a county could be due to agglomeration effects from knowledge spillovers or characteristics of the natural resource base (Rosenthal and Strange; Ellison and Glaeser). Soil and climate favorable for production of direct-market products could result in higher sales. A farming region is also more likely to have an active Extension Service with educational programs on effective direct marketing as well as production methods and varieties which would improve direct-market sales.

Direct-market sales could be higher in areas growing a wide variety of fruits and vegetables, as these crops are often the majority of products sold at farmers' markets, pick-your-own operations, and roadside stands (Gale; Lyson and Guptill; Morgan and Alipoe). An index measuring the variety of fruit and vegetable production in the county (VARIETY) is created as the product of two ratios. One is the ratio of the sum of the number of farms in a county growing each of 56 fruits and vegetables (tracked in the Agricultural Census) relative to the number of farms in that county. The other ratio is the number of different fruits and vegetables grown in the county relative to the 56 possible. The highest the first ratio could be is 56, if all farms in the county grew each of the 56 fruits and vegetables. The maximum for the second ratio would be one, if all 56 fruits and vegetables were grown in the county. Thus the overall maximum for this index could be 56.

Farmers and consumers in a rural state, such as West Virginia, might have to travel either from the farm to a farmers' market in town, or from a town out to a you-pick operation. Consequently, highway availability could impact direct-market sales. We include a variable (HWYDEN) that measures the density of interstate, federal, and state roads in

West Virginia as the length per square mile in each county (NRAC). In addition to local sales, farmers might also travel to cities outside the state to sell their products. There are two metropolitan areas neighboring West Virginia—Pittsburgh, Pennsylvania, and Washington, D.C.—that could impact direct sales from West Virginia farms. This could be the result of residents from either of these cities traveling to West Virginia and purchasing West Virginia-grown farm products. Or, farmers in West Virginia counties closest to the Pittsburgh or Washington, D.C. markets could direct market their products at farmers' markets or other venues in those cities. The influence of Pittsburgh and Washington, D.C. is represented by two distance variables, PITDS and WDCDS, respectively. The distance variables are calculated as mileage from the Washington, D.C. and Pittsburgh, PA city limits to the respective West Virginia county lines in 2000 (NRAC).

Lastly, the most popular, advertised, and researched farm-direct-marketing forum is a farmers' market. The presence of a farmers' market could create an incentive for farm owners to directly market their products and provide a channel for consumer demand for locally grown food. Thus, a region's proliferation of farmers' markets should affect regional direct-market sales. The influence of farmers' markets (FRMMKT) is represented by the number of farmers' markets in a county, derived from a U.S. Department of Agriculture (USDA) list of farmers' markets by state for the year 2002 (AMS 2002).

The empirical model for county i is defined as follows:

$$\begin{aligned}
 (1) \quad DMS_i &= \beta_0 + \beta_1 EDUC_i + \beta_2 PAGE65_i \\
 &+ \beta_3 HOUSE_i + \beta_4 MSA_i + \beta_5 POPD_i \\
 &+ \beta_6 DMFARM_i + \beta_7 PFARM_i \\
 &+ \beta_8 VARIETY_i + \beta_9 HWYDEN_i \\
 &+ \beta_{10} WDCDS_i + \beta_{11} PITDS_i \\
 &+ \beta_{12} FRMMKT_i + u_i
 \end{aligned}$$

Table 1. Descriptive Statistics of Variables in the Direct Market Sales Model

Variable	Variable Definition	Mean	SD	Minimum	Maximum
<i>DMS</i>	Direct market sales (\$K)	83.41	197.11	0.00	1,432.00
<i>EDUC</i>	Percentage with bachelor's degree or higher (% of county population)	8.78	3.23	3.22	19.70
<i>PAGE65</i>	Percentage 65 years of age or older (% of county population)	15.43	1.94	10.71	19.95
<i>HOUSE</i>	Median value of owner-occupied housing (\$K)	74.74	16.52	25.07	129.50
<i>MSA</i>	Metropolitan Statistical Area (1 = yes)	0.38	0.49	0.00	1.00
<i>POPD</i>	Population density (persons per square mile)	94.66	99.48	9.51	435.76
<i>DMFARM</i>	Number of direct market farms	26.07	18.60	0.00	74.00
<i>PFARM</i>	Percentage of land in farming (% of county land)	25.05	14.35	0.25	53.59
<i>VARIETY</i>	Index of variety of fruits and vegetables grown	0.05	0.06	0.00	0.27
<i>HWYDEN</i>	Highway density (miles of road per square mile)	0.21	0.07	0.10	0.43
<i>WDCDS</i>	Distance to Washington DC (miles)	202.89	59.40	53.21	298.63
<i>PITDS</i>	Distance to Pittsburgh, PA (miles)	129.94	52.43	32.12	226.96
<i>FRMMKT</i>	Number of farmers' markets in the county	0.62	0.71	0.00	3.00

where u_i is the error term that is assumed to have a standard normal distribution. Variable definitions as well as descriptive statistics for the variables are presented in Table 1.

Table 2. West Virginia Direct Market Sales Model Estimates

Variable	Coef-ficient	Elasti-city	SE	<i>p</i> Value
<i>CONSTANT</i>	285.13	—	247.52	0.26
<i>EDUC*</i>	-31.46	-0.03	14.43	0.04
<i>PAGE65*</i>	-20.46	-0.04	11.88	0.09
<i>HOUSE*</i>	3.53	3.16	1.69	0.04
<i>MSA</i>	-62.09	—	49.39	0.22
<i>POPD*</i>	0.88	1.00	0.50	0.08
<i>DMFARM*</i>	3.85	1.20	1.41	0.01
<i>PFARM</i>	-4.16	—	151.31	0.98
<i>VARIETY*</i>	974.25	0.58	553.11	0.08
<i>HWYDEN</i>	474.23	—	390.28	0.23
<i>WDCDS*</i>	-1.27	-3.09	0.62	0.05
<i>PITDS*</i>	0.84	1.30	0.43	0.06
<i>FRMMKT</i>	-49.26	—	36.54	0.18
<i>R</i> ²	0.67			
Adjusted <i>R</i> ²	0.57			
<i>F</i> statistic	7.07			

* Significant at $\leq 10\%$.

Both the Breusch-Pagan test and the Koenker-Bassett test indicated the presence of heteroskedasticity (Anselin). The use of an ordinary least squares (OLS) estimator for a model that suffers from heteroscedasticity would result in unbiased and consistent estimates, but the standard errors of such a model would be invalid (Hill, Griffiths, and Judge). Consequently, the heteroscedasticity-corrected White estimator is used to estimate the direct-market sales model using LIMDEP software (Greene).

Results and Discussion

The estimated coefficients for the West Virginia farm-direct-market sales model, along with their standard errors and *p* values are presented in Table 2. Elasticities were calculated at the mean of the variables for those that were significant. Percentage of persons with a bachelor's degree or higher, median housing value, percentage of persons 65 years of age or older, and population density are significant demand-side factors influencing the level of direct-market sales. On the supply side, significant

variables are the number of direct-market farms, the variety index, and distance to Pittsburgh, PA, and Washington, D.C. Some of the signs are counter-intuitive; all are discussed below.

The education variable is statistically significant, but it has an unexpected negative sign. This result contradicts other studies, which found a positive relationship between education level and shopping at a direct market. One explanation for this counterintuitive result could be that farmers in counties with high direct-market sales but a low percentage of residents with a bachelor's degree or above are not selling their products within that county, but are either traveling to an out-of-county market or are selling to tourists from outside of the county. A second reason for this result could be the rural character of West Virginia. Previous studies finding education important for direct-market sales have mostly studied urban markets, and those findings may not be applicable to rural areas where residents with lower education levels may have a relatively high demand for locally grown produce. Brown (2003a) found that education did not influence the preference for local produce, but rural households were more willing to seek out locally grown foods.

The results indicate that as the percentage of the county population over age 65 increases direct-market sales decline. If the Senior Farmers' Market Nutrition Program was having a significant impact on farmers' market sales, we would expect the sign of this variable to be positive. This program is apparently too small in West Virginia to contribute to direct farm sales. In addition, consumers older than 65 may be growing their own produce. A recent study of farmers' market vendors in WV (Miller) found that 38% were over 60. The negative coefficient is consistent with studies that found the average farmers' market shopper to be middle-aged rather than elderly. If the percentage of the population over age 65 goes down 1%, farm-direct-market sales would increase in that county by over \$20,000.

As housing values increase, county-level direct-market sales also increase. More specif-

ically, a \$1,000 increase in median housing values will increase direct-market sales by \$3,530, holding all other variables constant; or a 1% increase in housing values will increase direct-market sales by 3.2%. Other studies have also found that direct-market sales or farmers' market sales are higher in higher-income areas (Schatzer, Tilly, and Moesel). County population density is also positive and significant, indicating that counties that are more urban will have higher direct-market sales. This impact is a combination of a greater number of potential customers for farmers and a more metropolitan consumer base that other studies have found are more likely to shop at farmers' markets and other direct-market outlets. Surprisingly, the other indicator of suburban consumers, the county being part of a metropolitan statistical area, was negative but was not significant.

The two variables representing the influence of out-of-state metropolitan areas (Pittsburgh, PA and Washington, D.C.) on farm-direct-market sales in West Virginia are both statistically significant; however, they have different signs. The negative coefficient associated with the distance from Washington, D.C. indicates that an increase of one mile away from Washington, D.C. decreases county-level farm-direct-market sales by \$1,270; or if distance increases by 1%, direct-market sales decrease by 3.1%. This means that West Virginia counties closer to the Washington, D.C. area will have greater farm-direct-market sales than counties farther away. Several farms from the eastern panhandle counties closest to Washington, D.C. are known to market their products at urban and suburban farmers' markets in that area. In addition, the eastern panhandle counties have become a recreation and second home destination for Washington, D.C. and surrounding area residents. The positive coefficient associated with the distance from Pittsburgh, PA variable is not what was expected. This result means that as distance away from the Pittsburgh metropolitan area increases, farm-direct-market sales increase. In other words, counties closer to Pittsburgh have lower farm-direct-market sales than counties located farther away. This may reflect the

greater importance of agriculture, and thus direct-market sales, in the economies of West Virginia counties that are quite a distance from Pittsburgh. The economy of the counties near Pittsburgh may also explain the sign of this coefficient. There are relatively fewer farms in this region, and the local economy of the northern panhandle region of West Virginia near Pittsburgh has historically been dominated by resource extraction (coal and timber) and manufacturing industries. Local public policies, Extension resources, and local businesses have probably not promoted farm direct marketing, in relation to more agriculture-based regions in the state. In addition, Pennsylvania has the second-largest number of Community Supported Agriculture (CSA) farms and farmers' markets in the northeastern U.S., along with highly publicized Amish communities, which directly market numerous farm products (NESAWG). Therefore, Pennsylvania citizens visiting West Virginia may choose not to purchase farm items (given their loyalty to and the availability of products from Pennsylvania farms) and farmers from West Virginia may have a difficult time gaining access to farmers' markets near Pittsburgh.

The number of farms selling direct has a positive and significant impact on direct-market sales. One additional direct-marketing farm in a county would increase direct-market sales by \$3,854. The variable created to capture the variety of fruits and vegetables grown in a county was also statistically significant and positive. This is similar to the result found by Lyson and Guptill that civic agriculture, which is characterized by direct marketing, is related to fruit and vegetable farming. This variable could increase if either the diversity of fruits and vegetables grown in the county increased, or if the number of farms growing fruits and vegetables increased. The small mean and maximum of this index reflect the small number of fruit and vegetable farms in West Virginia and help explain the \$9,742 increase in direct-market sales that would occur if this index increases. An examination of per capita consumption and production of 28 vegetables in West Virginia indicated a production deficit in every category (Brown 2003b). Nei-

ther highway density, percentage of land used for farming, or number of farmers' markets was significant.

Conclusions

The recent increase in farm direct marketing in West Virginia and across the country has led to a need for research to understand the factors affecting the level of direct sales. This study identifies significant consumer demographic, land use, marketing, and locational characteristics that impact the amount of direct-market sales by West Virginia farms at the county level using OLS econometric estimation.

The consumer demographic characteristics of age and education influenced county-level direct-market sales. Counties with a lower percentage of seniors (over 65) saw an increase in sales, however, counties with a higher percentage of residents with higher education degrees experienced lower direct-market sales. An increase in the median value of housing in a county raises direct-farm-market sales. Both the number of potential consumers, measured by population density, and the number of direct-market farmers increased direct-market sales. A positive impact on direct-market sales came from a measure of the diversity of fruit and vegetable production in a county, reflecting the relatively high value of these products as well as consumers' preferences for fresh locally grown produce and the short supply of these products in West Virginia. Two measures of the urban (part of a metropolitan statistical area) versus rural (percentage of land used for farming) characteristics of a county were not significant. Spatial factors, such as the distance to two out-of-state metropolitan markets, Pittsburgh, PA. and Washington, D.C., also influence the level of county direct-market sales in West Virginia. Counties farther from Washington, D.C. saw a decrease in direct-market sales while counties farther from Pittsburgh had higher direct-market sales. Highway accessibility and farmers' market availability were not significant factors in the level of direct-market farm sales.

While the model generally performs well

in terms of signs and significance, as with other models of this type, the availability of data was a limiting factor. For example, farmers who market directly to consumers are likely to be different from farmers who market through middlemen, yet there is no satisfactory data regarding these characteristics. The top five agricultural commodities in West Virginia are all animal products (Boone, Schaeffer, and Lewis), which may not be conducive to direct-market sales due to regulations regarding processing for sale; however, Brown (2003a) found that 46% of survey respondents in southeast Missouri had at some time purchased meat directly from a farmer. Analysis of existing data might not reflect the reality of direct-market sales in West Virginia if direct sales of animal products are underreported. Direct-market sales of animal products may also take place via different marketing venues or be impacted by characteristics not accounted for in the current model. Data on household-level food production is not available, yet the impact of gardening, raising meat, or hunting could be significant. Although out-of-state impacts are partially accounted for by the distance variables, there may be other influences from surrounding states that should be considered. Variables included in this analysis were based on studies mostly done in metropolitan areas where the important consumer and agricultural characteristics may be different from those in rural mountainous states such as West Virginia. Analysis of farm-direct-market sales in other Appalachian states may provide insight into important explanatory variables unique to the region. Investigation into the negative impact of a higher percentage of county residents with a bachelor's degree or above should be conducted to determine what is behind this result or if this effect could be reversed. To observe the trends of farm direct marketing, data from previous issues of the Agricultural Census could be used in a longitudinal analysis; however, the 1992 data have several missing values particularly from counties in southern West Virginia.

These results imply potential marketing and policy strategies. Direct markets should be targeted to more densely populated areas

where household incomes and housing values are higher, as well as to areas with a lower percentage of elderly. Preferences for locally produced food products could be encouraged through increased interaction between farmers and consumers (Brown 2003a). Agricultural counties should emphasize and capitalize on their agricultural heritage and promote their products to local consumers as well as tourists (WVDA). Counties could maintain their farm base through the use of agricultural policies that support and strengthen their agricultural producers. Some examples are farmland protection programs, Extension education regarding direct-marketing strategies for farmers, and inclusion of agriculture in economic development and tourism plans developed by the county. Fruit and vegetable production could be increased through farmer education regarding the potential for direct marketing of these products and successful production methods. In addition, increasing the variety of fruits and vegetables produced should be encouraged, including the use of season extension production methods. An increase in such production, and associated direct marketing, could help address the growing problem of obesity in states such as West Virginia, along with improving consumption of fruits and vegetables (Krummel et al.). Research into cultivars that can be grown successfully in the climate and soils of West Virginia should be conducted. Lastly, good transportation infrastructure will increase the potential for farmers to travel to the Washington, D.C. area markets or for tourists to travel to West Virginia. This, in turn, could contribute to increased economic development in the state.

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