Report as of FY2006 for 2005NE83G: "The impact of rural water supply systems on property values"

Publications

Project 2005NE83G has resulted in no reported publications as of FY2006.

Report Follows

2006 Annual Report Project 2005NE83G
WBS# 25-6254-0019-001
Period: March 1, 2006 through February 28, 2007
Title: The impact of rural water supply systems on property values
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Completed Work Tasks:

1) Abandonment of the Agricultural Land Sale Aspects of the Study

2) Abandonment of the SW Study Areas in North Dakota

3) Expanding the number of rural residential sales in North Dakota

4) Expanding the Study to Nebraska (evaluating 145 sales in Washington County)

5) Characterizing the details of rural residential sales and rural water supply conditions in both study areas (ND & NE)

6) Measuring the impact of rural water supply systems on housing prices using hedonic regression modeling

7) Conclusions

Details on Completed Work Tasks:

1) Abandonment of the agricultural land sale component of the study

Preliminary hedonic regression modeling on 1040 agricultural land sales across 17 counties found no measurable relationships between rural water supply systems and agricultural land values. In fact only 22% of agricultural sales were within a mile of any rural water supply pipelines. While such relationships may occur in states with more urbanization pressure (residential development potential), it does not appear present in North Dakota. For these reasons the agricultural land value components of the study have been abandoned.

2) Abandonment of the SW study area in North Dakota

We obtained 85 rural residential sales from Morton and Stark counties in the southwestern part of the State but all of these homes are on rural water supply systems in this part of the State without groundwater resources. Since there are no sales without rural water and hence it is not possible to use regression to model the impact of rural water supply systems on home values in this part of the State and this component of the original research plan has therefore been abandoned.

3) Expanding the number of rural residential sales in North Dakota

An additional 55 rural residential sales were obtained for the adjacent counties of Stutsman, and Barnes Counties based on visits to county tax assessor offices. These sales were digitized using previously described approaches, cross-matched with rural water service records, and buyers/sellers were surveyed to confirm transaction, housing characteristics, and water supply information.

4) Expanding the Study to Nebraska (evaluating 145 sales in Washington County)

Washington County Nebraska was chosen as a location to expand the original study focus. This area was chosen due to the fact that it contains two rural water systems for which pipeline data was available and with its proximity to Omaha (a major population center), a relatively large number of rural residential sales data was also available. A total of 155 rural residential sales sales were successfully geo-coded and intersected with rural water supply maps to determine their water supply status.

5) Characterizing the details of rural residential sales and rural water supply conditions in both study areas (ND & NE).

Among the sample of sold rural residences in North Dakota (n=188) slightly more than half are signed up for rural water (public). Homes using private wells are less expensive, smaller, and older than homes served by rural water supply systems. This is expected as many lenders of new home construction loans are requiring rural water hook-ups as a requirement for mortgages

Private well homes also have higher water quality (as measured by total dissolved solids) compared to the wells near homes on rural water which indicates that those homes with the worse water quality in their wells are more likely to sign up for rural water.

These and other characteristics of homes are summarized in Table 1. Statistical differences between homes having private versus public water systems were tested using paired t-tests at the 95% and 99% confidence levels. Characteristics that are statistically different across water supply types are denoted in bold.

Table 1. Characteristics of the Sample of Sold Rural Properties in North Dakota

Variable	Private (n=92)	Public (n=96)	All (n=188)
Sale Price ($)	59,206*	71,956	66,168
Total Dissolved Solids*	1,756*	2,479*	2,151
Lot Size (acres)	12.2	9.5	10.8
House Sq. Ft.	1,255**	1,483**	1,380
D Central Air	0.26**	0.47**	0.38
Bathrooms	1.32	1.73	1.55
Bedrooms	2.83	3.04	2.94
Age	37	32	34
D Oil Furnace	0.03	0.17	0.11
D Gable Roof	0.84	0.75	0.79
D Gas Fireplace	0.09	0.20	0.15
Outbuilding Sq. Ft.	680	863	780
Distance to Hospital [miles]	14.28	11.03	12.51
Dist to Large City [Miles]	9.29	9.38	9.34
D Block Basement	0.38	0.34	0.36
D 2001	0.14	0.12	0.13
D 2002	0.16	0.22	0.19
D 2003	0.23	0.18	0.20
D 2004	0.16	0.19	0.18
D 2005	0.14	0.14	0.14

Bold Variables Tested for Difference Using a paired t-test
* Different across Water Supply Types at the 5% level
**Different across Water Supply Types at the 1% level

Similarly, in Nebraska rural water homes are less expensive, smaller and older than homes on public water. However, private well homes do have slightly more updated heating and cooling systems. Again, statistically significant differences in home features across waters supply type are tested using paired-tests and the results are summarized in Table 2.

Table 2. Characteristics of the Sample of Sold Rural Properties in Nebraska

Variable	Private (n= 103)	Public (n= 84)	All (n=187)
Sale Price ($)	222,710*	228,116 *	225,137
D Rural Water	0.00	1.00	0.45
Age	29.48 **	24.12**	27.18
House Sq. Ft.	2,543**	2,649**	2591
Garage Spaces	2.21	2.17	2.19
D Metal Siding	0.09	0.06	0.07
Bedrooms	3.53	3.43	3.49
Bathrooms	2.70	2.74	2.72
D Updated HVAC	0.72	0.70	0.71
Basement Finished Sq. Ft.	572	572	572
D Vinyl Siding	0.29	0.13	0.22
D Brick	0.09	0.14	0.11
D 1997	0.03	0.04	0.03
D 1998	0.04	0.08	0.06
D 1999	0.11	0.08	0.10
D 2000	0.12	0.14	0.13
D 2001	0.11	0.17	0.13
D 2002	0.05	0.12	0.08
D 2003	0.12	0.10	0.11
D 2004	0.12	0.07	0.10
D 2005	0.20	0.13	0.17
D 2006	0.09	0.04	0.06

Bold Variables Tested for Difference Using a paired t-test
* Different across Water Supply Types at the 5% level
**Different across Water Supply Types at the 1% level

6) Measuring the impact of rural water supply systems on housing prices using hedonic regression modeling

A hedonic based multiple regression model was estimated for each sample (state) to quantify whether rural water supply systems have a statistically significant impact on the sale prices of rural homes while accounting for an array of other housing and location-based characteristics. The results are summarized in Tables 3 and 4. Due to heteroskedacity found in each model, both ordinary least square (OLS) and variance weighted least (VWLS) squares results are reported.

Regression results indicate that rural water supply connections ***do not*** have a statistically significant impact on housing prices in ***any*** of the study locations. This may be the result of relatively small sample sizes (few arms-length rural residential sales) and highly heterogeneous housing and drinking water supply conditions across the study areas. It is also likely due to the fact that most lending institutions require rural water connections for the financing of all new home construction.

Table 3. Multiple Regression Results (North Dakota)

	OLS		VWLS	
Variable	Coef.	P>t	Coef	P>z
D Rural Water	-702	0.904	878	0.862
LN Lot Size	5,922	0.003	5,287	0.001
LN House Size	10,607	0.162	9,663	0.153
D Central Air	26,361	0.000	25,807	0.000
Bathrooms	8,199	0.073	5,940	0.166
Bedrooms	1,622	0.576	3,201	0.210
Age	-283	0.014	-312	0.001
D Oil Furnace	-15,719	0.092	-14,909	0.041
D Gable Roof	-15,193	0.025	-12,440	0.037
D Gas Fireplace	7,366	0.240	9,661	0.132
Outbuilding Sq. Ft.	2.01	0.328	1.50	0.454
Distance to Hospital [miles]	-1,168	0.051	-1,032	0.023
Dist to Large City [Miles]	-1,817	0.018	-1,505	0.017
D Block Basement	8,523	0.137	4,966	0.335
D 2001	-8,657	0.379	-7,427	0.384
D 2002	-5,671	0.541	-2,600	0.742
D 2003	-5,443	0.545	-1,802	0.813
D 2004	9,667	0.291	10,720	0.162
D 2005	16,439	0.087	17,214	0.034
Latitude	0.26	0.025	0.25	0.011
Longitude	-6.58	0.004	-5.45	0.003
Longitude^2	0.00	0.003	0.00	0.002
Constant	450,857	0.621	137,172	0.858
Obs.	152			150
F-Value	9.86		Chi^2	259.92
Prob> F	0.000		Prob>Chi^2	0.000
R^2	0.627			
Adj. R^2	0.5634			
Root MSE	30036			

Table 4. Multiple Regression Results (Washington County, Nebraska)

	OLS		VWLS	
Variable	Coef.	P>t	Coef.	P>z
D Rural Water	-1,770	0.855	-8,309	0.253
Age	-157	0.393	-27.77	0.813
House Sq. Ft.	79.10	0.000	82.44	0.000
Garage Spaces	16,686	0.000	18,780	0.000
D Metal Siding	-25,592	0.159	-29,558	0.017
Bedrooms	-26,163	0.000	-31,604	0.000
Bathrooms	21,609	0.006	14,360	0.022
D Updated HVAC	-14,603	0.191	-21,461	0.015
Basement Finished Sq. Ft.	-7.86	0.455	-8.18	0.441
D Vinyl Siding	11,297	0.370	7,121	0.462
D Brick	34,440	0.034	41,186	0.006
D 1997	21,559	0.556	19,596	0.413
D 1998	-6,251	0.841	15,226	0.457
D 1999	49,320	0.102	31,732	0.146
D 2000	21,871	0.447	18,693	0.370
D 2001	22,175	0.444	28,522	0.186
D 2002	13,014	0.674	5,503	0.810
D 2003	57,628	0.050	41,074	0.060
D 2004	78,906	0.010	58,988	0.012
D 2005	50,880	0.069	41,811	0.039
D 2006	79,370	0.013	76,314	0.002
Constant	-11,585	0.752	24,284	0.316
Obs.	176			175
F-Value	31.02		Chi^2	1163.01
Prob> F	0.000		$Prob>Chi^2$	0.000
R^2	0.8001			
Adj. R^2	0.7743			

7) Conclusions:

This research has demonstrated that the water quality of private wells is higher among non-connected versus connected homes (In North Dakota) which implies that property owners decisions to sign up for rural water services is likely to be influenced by property specific rather than regional water quality measures. Such factors should be quantified and evaluated prior to the funding and implementation of rural water supply projects to avoid lower than expected customer sign-ups.

However, difficulties associated with hedonic price modeling of rural water supply systems are not as statistically robust and informative for water policy decision-making as with other recent applications. For example, the authors have recently used hedonic multiple regression modeling to successfully quantify the impact of reservoir views on housing values, and the impact of low impact housing developments (from a storm water runoff perspective) on property values. Both studies were conducted in the metropolitan

area of Omaha, NE and were hence able to take advantage of much larger sample sizes and more heterogeneous housing characteristics.

Work Tasks Planned for 2007:

The inclusion of additional analyses in another part of Nebraska.

Present research results at the UCOWR/NIWR meetings in Boise Idaho

Alternative multiple regression modeling including running a fixed effect model.

Publications

None