SENSITIVITY OF RURAL HOUSING VALUES TO AGGREGATE ECONOMIC POLICY

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Abstract

This paper has a two-fold contribution, 1) Examine the importance of aggregate economic policy on housing prices and rural housing prices, and 2) delineate factors resulting in divergent housing prices between urban and rural markets. Empirical application to US state level data from 1975-2006 indicates general economic variables are consistently influencing both urban and rural housing prices. While the farm economic variables do have differential influences on the housing and rural housing prices, their effects are transitory. Finally regional effects have greater impact on differential effects on urban rural housing price indexes than national farm programs.

Keywords: US state data, rural housing prices, 1975-2007.

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INTRODUCTION

A recent invited paper series sought to delineate the importance of macroeconomic policy on agricultural trade, local school financing, and rural real estate values. Kwon and Koo (2009) investigated the nexus of macro and agricultural economic policy. In particular, both domestic and international effects of macroeconomic policy change are jointly captured in their model which allows them to conclude that the exchange and federal fund rates are main macroeconomic shocks causing variation in agriculture economic performance. Although they did not focus on asset valuations directly, changes in macroeconomic policy were found to have a significant impact on agricultural prices and incomes, which in turn affected investment values. Ahearn, Kilkenny, and Low (2009) studied the impact of macroeconomic policy on local school financing and concluded that the diverse funding base of local school districts insulates them from national macroeconomic policy change. Using Office of Federal Housing Enterprise Oversight data, they find declines in rural housing values and property taxes have been less than those in comparable urban regions, but mixed across the country and not necessarily correlated with agricultural land value trends. Finally, Gustafson and Shaik (2009) form a pooled triangular-structure simultaneous equation econometric model and find that disposable personal and agricultural incomes, real interest rates, non-farm transfer payments, and bio-fuel policy significantly affects state agricultural land values. Together, these studies find macroeconomic policy has a strong influence on rural agricultural land values, and that local property taxes on those changing values impact the composition of local school financing. However, none of the studies directly investigate the impact of macroeconomic policy on rural housing values, which Ahearn, Kilkenny, and Low find divergent with agricultural land values.

This study develops an asset-market model to more succinctly quantify the impact of changing macroeconomic policy on rural housing values using data from Office of Federal Housing Enterprise Oversight data, BEA, BLS, and USDA. State-level data for rural housing values is available for the period 1995-2007 and will be used in the analysis. Results of study will be used to develop a forecast outlining the recovery path of rural housing values.

DETERMINANTS OF HOUSING ASSET VALUE

Houses are capital assets that provide a stream of annual services to owners. A house owner may consume those services directly (e.g. shelter) or rent the service to others. In theory, the capitalized value (R) of these services determines the assets value (V). This can be represented as V=R/r, where r is the nonimal interest rate adjusted for expected inflation (Topel and Rosen, 1988). Alternatively this can be thought as the user cost defined by Himmelber, Mayer and Sinai (2005). The user cost is impacted by interest rates, mortgage lending decisions, annual depreciation policies, property tax rates, risk premiums and asset appreciation. Macroeconomic policy changes likely affect consumers' abilities to pay for shelter (demand) as well as the user cost of capital (i). Consequently, housing values are subject to annual change which provides owners with corresponding capital gains/losses and is a second source of income over the investment period to housing investors. Costs to construct a house are also sensitive to alternative macroeconomic policy. Inflation potentially affects all resource costs while interest rates impact carrying costs because house erection is not immediate. Credit in the form of net deposit inflow to savings and loan institutions could also affect housing values (Poterba, 1984).

Modeling Rural Asset Values

In this study rural asset values are modeled using an income capitalization approach with macroeconomic economic activity segregated between non-farm and farm dependent explanatory variables. General macroeconomic expenditure variables capture statewide economic non-farm influences (consumption and government transfers). Following Shaik, Atwood, and Helmers (2005), traditional farm income capitalization explanatory variables include real interest rates, net farm returns, and farm program payments. Given recent growth of the biofuel industry and petroleum exploration in rural areas, oil income is modeled as an independent variable.

State-level housing prices or values (*HPI*) are chosen as the model's dependent variable:

(1) $$HPI = f\left(econ,\ farm, biofuel\right)$$

where *econ* are state-level economic variables (excluding farm), *farm* and *biofuel* are state-level agricultural variables impacting capitalization. The state-level economic variables include consumption, income from oil and non-farm government transfer payments. The state-level farm variables include the traditional farm income, government farm payments.

Equation (1) can be expanded to include specific data variables of interest as:

(2) $$HPI = f\left(econ\left(C, oil, nfp\right), farm\left(fi, gp\right), r^{-1}, biofuel\right)$$

where *C* is consumption, *fi* is farm income, *oil* is income from oil, *gp* is government farm payments, *nfp* is non-farm government transfer payments, *r* is the real interest rate, and *Biofuel* is a dummy variable reflecting the introduction of the Renewable Fuel Standard's biofuel policy in 2005 (P.L.109-58, 109th Congress). Under the current model setting, government farm payment was found to be an exogenous variable rather than an endogenous variable. However, a second equation delineates consumption as a function of farm disposable personal income (*fDPI*) and non-farm disposable personal income (*nfDPI*) and taxes *Tax* as

$$C = f\left(fDPI,\ nfDPI, Tax\right).$$

Jointly estimating the two equations overcomes identification, endogeneity and provides a more accurate estimate of income capitalization, and can be represented as:

(3) $$\begin{aligned} HPI &= f\left(econ\left(C, oil, nfp\right), farm\left(fi, gp\right), r^{-1}, biofuel\right) \\ C &= f\left(fDPI,\ nfDPI, Tax\right) \end{aligned}$$

Use of the income capitalization model to explain land or farm real estate values is prevalent in agricultural economics literature. Both theoretical models (see Burt 1986) and empirical analyses include applications to specific farm programs and crops. Here, we extend the model to include general macroeconomic variables (excluding farm activities), traditional agricultural, oil, and biofuel variables impacting capitalization.

To examine the extended income capitalization model as defined in equation (3), the following pooled triangular-structure simultaneous equation econometric model, with i and t representing the cross-sectional states in each region and time series dimensions respectively, is proposed:

$$\begin{aligned} &HPI = \alpha_1 + \alpha_C C_{it} + \alpha_{fi} fi_{it} + \alpha_{Oil} Oil_{it} + \alpha_{fp} fp_{it} + \alpha_{nfp} nfp_{it} + \alpha_r r_{it} + \alpha_{bio} Biofuel_{it} + \varepsilon_{1,it} \\ &C_{it} = \alpha_2 + \alpha_{fDPI} fDPI_{it} + \alpha_{nfDPI} nfDPI_{it} + \alpha_{tax} Tax_{it} + \varepsilon_{2,it} \end{aligned} \qquad (4)$$

Equation (4) is estimated regionally (Northeast, Midwest, South, and West) with individual state data from 1975-2007. The four U.S. region classifications were chosen based the availability of Bureau of Labor Statistics (BLS) consumption data. The Northeast region was comprised of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The Midwest region was comprised of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia constituted the South region. Finally, the West region included Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Data for the remaining variables were collected from United States Department of Agriculture (USDA), Bureau of Economic Analysis (BEA), and Federal Deposit Insurance Corporation (FDIC).[1] Table 1 summarizes these data in

[1] The date is available from authors.

logarithms for each of the regions. All the variables were converted to real dollars using the implicit gross domestic product price deflator.

EMPIRICAL RESULTS

Regression results of rural housing price index pooled model (equation 4) for the Midwest, Northeast, South, and West regions are presented in table 2. Table 3 presents factors influencing the difference between the housing price index and rural housing price index. Since the model was estimated in logs, parameter coefficients can be interpreted as elasticities.

Model results presented in table 2 generally conform to *a priori* expectations with the exception of Northeast region. To illustrate, a 10 percent increase in farm income raises rural housing prices by less than a percent in Midwest region, 3.2 percent in West region, and 6.5 percent in the South region, all positive and significant as expected.

Real interest rates and farm land values were inversely related ($p<0.01$) in all regions with the exception of Northeast. Oil income did significantly affect rural housing prices in Northeast and West regions and negatively in Midwest and South regions. Rural housing prices were positive and significantly impacted by consumption expenditures in all regions with the exception of Northeast.

Government farm payments were only found to positive (negative) and significantly impact rural housing price in the Northeast (South) region. The differential impact might be due to the recent changes with an emphasis on problems of food availability to disadvantaged people, food safety, rural development, and environmental resource management (Johnson, 2008). While funds appropriated to the Farm Bill have escalated, they remain a small share of local economic expenditures – and only mildly related to farm income. Using BEA data, agricultural program transfers to states average less than 1.89 percent of total state GDP. Similar to farm, the government non-farm transfers were only found to positive and significantly impact rural housing price in the Midwest region.

Finally, growth of the biofuel industry has positively impacted rural housing price in the Midwest and Northeast. From 2005-07, this industry has raised rural housing prices by 4.9 and 70 percent in Midwest and Northeast regions, respectively. It is questionable whether this industry will continue to impact rural farm land values. Since mid-2006, ethanol plant margins have steadily deteriorated, and prospects for cellulosic biofuel also appear to be marginal near term (Gustafson 2008). Ethanol prices have declined as the increasing numbers of plants entering the industry have expanded supply and depressed ethanol prices. Likewise, the greater number of plants have bid up corn feedstock costs, which in turn has raised costs of production, lowered profitability, and driven ethanol plant margins to near zero. When plant margins approach zero in any industry, the point is reached where existing firms continue to operate at breakeven levels, but new firms are not encouraged to enter. While federal biofuel legislation may have stimulated growth of the industry from 2005-2007, increased competition among firms and declining margins now result in the reduced contributions to rural economic stability and asset values. Swenson and Eathington (2008) also note the declining rural economic impact of the biofuels industry.

As expected, non-farm disposable personal income and tax variables in the consumption equation indicate significant positive and negative relationships, respectively. Farm disposable personal income was positive and significant only in the Midwest, and negative in the remaining three regions. A 10 percent increase in disposable personal income is expected to increase consumption by 22.6 percent in the Midwest region, 12.1 percent in Northeast region, 9.4 percent in the South region, and 16.6 percent in the West region. A negative and significant relationship exists between consumption and tax in all regions. A 10 percent increase in taxes paid is expected to decrease consumption by 21.9 percent in the Midwest region, 10.1 percent in Northeast region, 8 percent in the West region, and 15.3 percent in the South region. Model results for farm program payments and biofuels warrant more in-depth review.

CONCLUSION

In summary core economic activity as reflected by net farm income and consumer personal income, coupled with traditional monetary (interest rates) and fiscal (tax and transfer payments) policy, are primary determinants of rural housing prices. Second, the factors affecting the difference in the housing and rural housing prices are also examined. Empirical application to US state level data from 1975-2007 indicates general economic variables are consistently influencing the housing price and rural housing prices. While the farm economic variables do have differential influences on the housing and rural housing prices. Finally regions have differential effects on housing price and rural housing price index.

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Table 1. Mean and Standard Deviation of the Variables in logs for the Period, 1995-2006

	Midwest		Northeast		South		West	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Rural Housing Price index (HPI)	4.888	0.170	4.933	0.305	4.892	0.212	4.897	0.221
Difference between HPI and Rural HPI	-0.491	0.108	-0.848	0.155	-0.473	0.164	-0.581	0.157
General Macroeconomic variables								
Consumption	10.463	0.083	10.526	0.078	10.434	0.051	10.608	0.077
Non Farm Disposable personal income	18.171	1.115	18.292	1.273	18.385	0.831	17.832	1.194
Non-farm payments	16.133	1.119	16.258	1.287	16.426	0.775	15.722	1.177
Income from Oil	10.709	2.018	9.715	3.076	11.371	2.585	11.189	2.068
Tax	16.122	1.127	16.253	1.362	16.217	0.842	15.714	1.230
Traditional Farm variables								
Farm Disposable personal income	15.672	0.411	13.299	1.247	14.915	0.860	14.725	1.050
Farm Receipts	15.626	0.413	13.289	1.232	14.874	0.851	14.691	1.053
Farm payments	13.205	0.640	8.977	1.672	11.716	1.396	11.510	1.244
Real interest rates	1.754	0.251	1.754	0.251	1.754	0.251	1.754	0.251

Table 2. Rural Housing Price Index Regression Results of the Simultaneous Equation Model by BLS Regions

	Midwest		**Northeast**		**South**		**West**	
Variable	Parameter	Pr > |t|	Parameter	Pr > |t|	Parameter	Pr > |t|	Parameter	Pr > |t|
Intercept	-13.584	0.000	13.136	0.464	-162.358	0.040	-24.325	0.064
Real interest rate	-0.271	0.000	-0.293	0.023	0.605	0.225	-0.228	0.003
Farm income	0.008	0.771	-0.279	0.000	0.065	0.370	0.032	0.549
Farm payments	-0.018	0.286	0.089	0.024	-0.045	0.286	-0.017	0.578
Non-farm payments	0.028	0.000	0.044	0.183	-0.001	0.990	0.000	0.996
Income from Oil	-0.010	0.011	0.043	0.019	-0.010	0.308	0.012	0.006
Consumption	1.772	0.000	-0.573	0.734	15.870	0.034	2.741	0.025
Dummy for Biofuel	0.049	0.328	0.703	0.073	-1.191	0.073	-0.142	0.563
Intercept	9.603	0.000	10.211	0.000	10.204	0.000	10.138	0.000
Non-farm disposable personal income	0.226	0.000	0.121	0.001	0.094	0.000	0.166	0.000
Farm disposable personal income	0.023	0.056	-0.015	0.041	-0.010	0.030	-0.003	0.767
Tax	-0.219	0.000	-0.101	0.002	-0.080	0.000	-0.153	0.000

Table 3. Factors Explaining the Difference between Housing and Rural Housing Price Index by BLS Regions

	Midwest		Northeast		South		West	
Variable	Parameter	Pr > |t|	Parameter	Pr > |t|	Parameter	Pr > |t|	Parameter	Pr > |t|
Intercept	7.720	0.108	-26.617	0.098	197.266	0.042	15.069	0.424
Real interest rate	0.217	0.043	-0.026	0.851	-1.195	0.054	-0.050	0.605
Farm income	-0.066	0.178	0.059	0.389	-0.179	0.042	0.070	0.235
Farm payments	0.011	0.749	-0.049	0.233	0.103	0.042	-0.057	0.089
Non-farm payments	-0.049	0.003	-0.099	0.031	0.045	0.424	-0.133	0.000
Income from Oil	-0.015	0.150	0.022	0.274	0.052	0.000	0.020	0.002
Consumption	-0.644	0.148	2.549	0.093	-18.718	0.041	-1.321	0.453
Dummy for Biofuel	0.386	0.001	-0.535	0.155	1.703	0.042	0.297	0.408
Intercept	9.625	0.000	10.203	0.000	10.204	0.000	10.141	0.000
Non-farm disposable personal income	0.221	0.000	0.124	0.001	0.094	0.000	0.165	0.000
Farm disposable personal income	0.022	0.065	-0.015	0.038	-0.010	0.030	-0.003	0.760
Tax	-0.214	0.000	-0.104	0.002	-0.080	0.000	-0.152	0.000