

Farm Prices, Energy Prices and Rural Income in the U.S.

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ABSTRACT. Central place theory and economic base theory are used to specify a model that describes rural personal income in the U.S. OLS regressions using annual 1969-2005 data show that rural income is significantly determined by metropolitan personal income and farm prices, as well as energy prices. The parity index performs slightly better than farm prices in describing rural income. (R12, Q18, J21, Q43)

I. Introduction

Recent changes for prices for agricultural products, as well as coal and petroleum, have given focus to what is happening in rural regions of the United States. Drops in commodity prices helped to pull American rural regions into recession (Henderson and Akers, 2009, p. 65). While Bureau of Economic Analysis (BEA) data show that in 2005 only 12.7 percent of U.S. personal income arose in “nonmetropolitan” areas, farming and mining are at least perceived hallmarks of rural America. In 1999, 5.7 percent of the rural workforce was employed in farming, while in 1998, sixteen percent were employed in manufacturing and slightly over half in the service sector (Gibbs, 2002, pp. 58-61; Wood, 2008, p. 8). However, Partridge and Rickman (2006) state that “[t]he importance of agriculture and other resource-extractive industries for many isolated rural counties appears to have increased poverty because these sectors are associated with more seasonal employment and more volatile business cycles” (p. 255).

Interaction between American rural and urban areas has been studied in several recent articles. Leichenko and Silva (2004) looked at the impact of export and import prices on employment in rural counties, determining that lower U.S. export prices raise rural manufacturing employment, while lower U. S. import prices have the opposite effect; while lower

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export prices also raise urban manufacturing employment, lower import prices also raise such (as rural plants are closed). Looking at 1997 establishment-level data for the southeastern U.S., Eff and Livingston (2007) concluded that lack of human capital and educational facilities in rural areas (compared to urban areas) explained lower levels of exports from rural locations. Partridge and Rickman (2008), using U.S. county level data, determined that 1999 rural poverty rates increased with distance from large urban areas. However, Gunderson (2006), looking at 1989-2004 data, concluded that increases in the national unemployment rate cause larger increases in the poverty rate in urban areas compared to rural areas.

II. Theory

Both Economics and Geography provide theories as to urban-rural interactions. Central Place Theory (CPT) establishes a “hierarchy of places” that identifies major economic hubs (or “nodes”) and their surrounding, often rural hinterlands. CPT can be used to predict what types of economic activity will take place in a community of a given size. As a generalization, metropolitan areas can be seen as nodes surrounded by rural (nonmetro) regions. Maki and Lichty (2000, pp. 85-97) elaborate on CPT. Stimson et al. (2006, p. 25) note that CPT focuses on retail and service (nonbasic) activities, rather than basic ones (e.g., manufacturing). Furthermore, Isard (1960, pp. 222-227) draws a connection between CPT and economic base modeling. Insofar as farming and mining are basic (export-oriented) industries, these activities should add to rural income. Furthermore, Henderson and Akers note that the American rural economy has a “large concentration of commodity-based industries” (p. 74).

Recently, Partridge, Bollman, Olfert and Alasia (2007; henceforth PBOA) used a CPT-like approach to model urban-rural interaction in Canada. PBOA, using geographically disaggregated data, discussed “spread” effects, where urban economic activity benefits adjacent rural regions, and “backwash” effects, where urban growth occurs to the detriment of rural areas. In particular, Canadian rural areas close to urban ones are likely to enjoy “spread” effects, while rural communities far away from urban ones are likely to experience “backwash” impacts. In a study of the United States, Wu and Gopinath (2008) found that rural “remoteness” from major urban centers had a depressing effect on wages and employment density, that is, “exurban” locations (rural locations

abutting urban areas) fare better than more isolated rural places. Jelavich (2007) concluded that inward foreign direct investors in the U.S. prefer exurban over other rural locations.

To the extent that agriculture and mining are two “export” (economic base) industries in many rural areas, focusing on prices of these two determinants of rural income and employment makes sense, along with adjoining urban areas. Thus, from an eclectic viewpoint, rural income is specified as a function of urban income, as well as agricultural and mining output prices.

Finally, Ciccone and Hall (1996) argue that agglomeration economies in urban areas raise the marginal productivity of labor in cities; this should raise urban income over rural income. “Spread” effects in PBOA could be explained by workers living near urban areas, and their employers competing against urban firms for labor. Furthermore, as noted above, agriculture and mining as basic industries can add to rural economic activity.

III. Model and Estimation

Based on the above arguments, particularly the CPT-based dependency of rural on metropolitan areas, the following two equations are specified:

$$\text{RURPI} = f(\text{METROPI}, \text{PARITY}, \text{ENPRICE}) \quad \dots(1a)$$

$$\text{RURPI} = g(\text{METROPI}, \text{AGPRICE}, \text{ENPRICE}) \quad \dots(1b)$$

Where:

RURPI = total nonmetropolitan (rural) income in the U.S., in trillions of dollars;

METROPI = total metropolitan (urban) income in the U.S., in trillions of current dollars;

AGPRICE = Producer Price Index (PPI) for farm products (1982=100);

ENPRICE = PPI for fuels, as a proxy for mining output prices (1982=100; see “Data Sources” for fuels covered in this variable);

PARITY = the parity ratio for farming, as a measure of farm profitability.

Data are annual numbers for the years 1969 to 2005; the “Data Sources” section below identifies the data sources. Note that these are national data, not regional data as in PBOA. Current rather than constant dollars were used of lack of a “rural region” price deflator.

“Nonmetropolitan” (rural) refers to areas outside of Standard Metropolitan Areas (SMAs); hence “metropolitan” (urban) refers to MSAs. ENPRICE is a proxy for mining products. The parity ratio (PARITY) is defined by the “Ratio of Index of Prices Received to the Index of Prices Paid by Farmers for Commodities and Services, Interest, Taxes and Farm Wage Rates” (*Agricultural Statistics*, 2005, Table 553). As such, it measures farm profitability, rather than farm prices. One item addressed in this study is whether the parity ratio is a better predictor of rural income, compared to farm prices.

It is assumed that as METROPI increases, so will RURPI, that is, “spread” effects should dominate “backwash” effects. Similarly, rising energy prices and farm prices will raise rural income; rising parity ratios should also raise rural incomes, as farm profits improve.

Ordinary least squares (OLS) estimation of Equations (1a) and (1b) produced regression equations with serial correlation. To correct for this, the equations are respecified as follows:

$$\Delta \text{RURPI} = f(\Delta \text{METROPI}, \Delta \text{PARITY}, \Delta \text{ENPRICE}) \quad \dots(2a)$$

$$\Delta \text{RURPI} = G(\Delta \text{METROPI}, \Delta \text{AGPRICE}, \Delta \text{ENPRICE}) \quad \dots(2b)$$

The means and standard deviations for the first differences of the variables are given in Table 1.

VARIABLE	MEAN	ST. DEV.	MAXIMUM	MINIMUM
$\Delta \text{AGPRICE}$	2.041667	6.983220	21.10000	-10.40000
ΔPARITY	-0.944444	4.834072	17.00000	-10.00000
$\Delta \text{ENPRICE}$	4.225000	11.05052	39.80000	-21.60000
$\Delta \text{METROPI}$	0.229611	0.123826	0.570000	0.051000
ΔRURPI	0.032861	0.014609	0.067000	0.009000

Equations 2a and 2b were also estimated via OLS, using eViews, using

the White correction method for heteroskedasticity. The results are presented in Table 2.

TABLE 2—OLS Regressions of Equations 2a and 2b
Dependent Variable

(** = significant at 5 percent)

VARIABLE	EQUATION 2a	EQUATION 2b
Constant	0.010717 (4.883151)**	0.008184 (3.777202)**
Δ METROPI	0.094612 (9.207400)**	0.101648 (9.831877)**
Δ PARITY	0.000620 (3.645414)**	
Δ AGPRICE		0.000404 (3.157878)**
Δ ENPRICE	0.000238 (2.890178)**	0.000121 (1.222774)
R-squared	0.825163	0.816805
F-static	50.34239**	47.55922**
Durbin-Watson	1.775861	1.925910

Changes in metropolitan income (Δ METROPI) are significant in both equations. The Δ PARITY coefficient is significant in the first equation, and its Δ AGPRICE counterpart is significant in the second equation. However, the energy (mining) price change variable (Δ ENPRICE) is significant only in the first equation. There is no obvious evidence of multicollinearity in either estimated question, with the largest correlation between any two independent variables being 0.368 (between Δ AGPRICE and Δ METROPI). The Durbin-Watson numbers indicate lack of serial correlation. The slightly higher R-squared for Equation 2a suggests that Δ PARITY may be a better measure of farming's impact in rural regions compared to Δ AGPRICE; the correlation between Δ PARITY and Δ AGPRICE is 0.683.

IV. Conclusion

Not surprisingly, urban area economic activity has a significant impact in its rural hinterland. The above results suggest that agricultural prices remain overall important determinants for rural America, despite the percentage-wise small number employed in farming. Energy prices also appear to be important (at least from Equation 2a's results).

These results also buttress the points made in Henderson and Akers regarding the causes of the recession in the rural economy, as well as the importance of the farm and energy sectors to rural America.

V. Data Sources

Data on nonmetropolitan and metropolitan personal income (for RURPI and METROPI) are from the Bureau of Economic Analysis, (BEA) web site, www.bea.gov/regional/reis, series CA1-3. AGPRICE is the farm products producer price index (PPI), series WPU01, from the Bureau of Labor Statistics (BLS) web site, www.bls.gov. PARITY is from the parity ratio data in the U.S. Department of Agriculture, *Agricultural Statistics*, various years. ENPRICE is the Fuels and Related Products and Power PPI, series WPU05. This index covers coal, natural gas, crude petroleum, electric power and petroleum products (see ftp.bls.gov/special.requests/ppi/comrep09.txt).

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