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Education, Infrastructure, And Regional Income Performance In Arkansas

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By

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Table of Contents

Chapter 1

Introduction

Education and infrastructure are critical components of economic development. Education helps increase human capital stocks. Infrastructure investment expands public capital stocks. Infrastructure is categorized into Core infrastructure and Non-core infrastructure. The Core infrastructure is also known as Physical infrastructure and they include roads, airports, harbors, water systems and so forth. The Non-core infrastructure, also known as Social infrastructure and they include education, public buildings, hospitals etc. Together, education and infrastructure help increase productivity and personal income. Other variables also influence regional economic performance. They include institutions, policies, geographic area, resource endowments, and population density. Rauch (1993) indicates that productivity also benefits from the geographic concentration of human capital.

Education and physical infrastructure always play central roles in the development process. Income performance in Arkansas is below the national average. This is at least partially due to educational attainment. For example, Arkansas ranks last among the 50 states in the percentage of adults age 25 or older who hold bachelor degrees. Investment in public infrastructure for Arkansas may also lag behind the rest of the nation, although this is more difficult to ascertain.

The objective of this study is to analyze regional income performance in Arkansas and to quantify the impacts of education, infrastructure, and demographics on regional per capita income in Arkansas. The model will utilize a series of explanatory variables that have been shown to affect regional economic development in other areas of the nation. These include educational attainment measures as well as several demographic variables. The framework will also attempt to incorporate at least some infrastructure variables as public capital stock measures.

Chapter 2 provides summary of prior studies. Chapter 3 discusses data and methodology. Empirical results are presented in Chapter 4. Chapter 5 includes a conclusion and suggestions for future research. A data appendix tabulates all of the statistical information employed in the econometric analysis.

Chapter 2

Literature Review

A number of empirical studies document a positive relationship between education and income performance. Rauch (1993) indicates education is a local public good with positive externalities that increase overall economic efficiency. Metropolitan data from the United States are used to estimate hedonic wage and rent equations. Results confirm the central role of education in productivity and regional economic development.

Empirical research also indicates that high school non-completion is a burden to government and is a social concern. Rickman (1995) finds high school non completion to lower county per capita incomes in southeastern Georgia. Domanzlicky et al. (1996) report similar earnings losses for secondary school dropout rates in Southeast Missouri. Over all, for every percentage point increase in a county's high school noncompletion rate, per capita personal income falls by $52. That estimate is consistent with Rickman (1995).

Educational attainment is very important in metropolitan areas. As noted by Rauch (1993) firms pay higher wages for educated workers because they possess more knowledge and help increase productivity. A highly educated city will tend to have better communication links, and create, transmit, and exchange knowledge and skills more efficiently. Simon (1998) finds that cities with more educated individuals are more productive and attract population at a faster rate than cities with lower levels of learning.

Fullerton (2001) employs a cross section data sample for Texas counties. Empirical outcomes in that study confirm positive linkages between education and regional income performance. Jones (2001) examines the relation between education and productivity in Ghanaian manufacturing. Results indicate that educated workers in Ghana earn higher wages than uneducated workers because of higher productivity. Tertiary educated workers are found to exhibit higher output rates than those with secondary and primary schooling.

Gottlieb and Fogarty (2003) analyze the importance of an undergraduate college degree in metropolitan areas. A bachelor degree is viewed as separating professionally educated workers from manual workers. Among 75 large metropolitan areas in United States, a significant relationship between education, the rate of per capita income growth, and employment growth from 1980 until 1997 is documented. A significant difference in the incomes of more educated places and less educated places is observed. The most educated metropolitan areas exhibit real per capita incomes that are 20 percent above the national average. Likewise, the least educated metropolitan areas have real per capita incomes 12 percent below the national average. More rapid employment growth is also observed among the more educated economies.

Infrastructure development, along with education, helps eradicate poverty via increased income generation. There are at least two categories of infrastructure, social and physical. Fan and Zhang (2004) provide evidence on how infrastructure affects regional economic development in rural China. Nonfarm productivity is found to benefit more than agricultural productivity from increased investments in education and infrastructure.

Partridge and Rickman (2005) utilize logistic regression analysis and find that higher poverty rates in the previous decade naturally increase the probability of remaining in poverty. Every 1 percent increase in the initial poverty rate increases the probability of remaining in poverty by 2.3 percent. The results suggest that counties in high poverty regions can emerge from poverty by increasing educational attainment and investing in physical infrastructure.

Arellano and Fullerton (2005) use 2000 census data to analyze regional income performance in Mexico. A strong correlation between education and per capita gross state product across Mexico is reported. To account for agglomeration spillovers, population density in each state is utilized as an explanatory variable. Results indicate that increases in formal years of schooling will improve regional economic performance.

Destefanis and Sena (2005) find that public capital has a significant impact on total factor productivity across regional economies of Italy. Public capital is categorized into core infrastructure, non infrastructure, and total stocks. Core infrastructure includes roads, airports, harbors, railroads, and water systems. Non-core infrastructures include education, public buildings, and hospitals. Investment in core infrastructure is found to strongly increase total factor productivity.

Almada et al. (2006) utilize pooled cross section and time series data set for the years 1990 and 2000 to examine the relationship between education and income performance in Texas counties. Parameter heterogeneity indicates that the data should not be pooled, potentially due to structural changes in the Texas economy. Results obtained using 2000 data point to a positive correlation between income and education in Texas. The intensity of that linkage is found to be stronger than what existed in 1990.

Bronzini and Piselli (2009) examine regional economic growth between 1980 and 2001 across the Italy. Regional productivity is found to be affected by human capital, research and development activity, infrastructure, and geographical spillovers. Infrastructure such as roads and motorways are found to exercise stronger impacts on regional productivity than those for railways, water systems, and electricity. Empirical results indicate that a 1 percent increase in human capital increases total productivity by 0.3 percent. Increases in public capital stocks, and in research and development, also lead to increases in total productivity of 0.11 percent and 0.03 percent, respectively.

Empirical economic literature in this general area is expanding, but access to infrastructure data is problematic for many regions. Arkansas is one such regional economy. To examine the importance of education in Arkansas, income data are analyzed for all 75 of its counties. A small set of infrastructure data are also assembled to aid in this task. Various specifications are employed in order to allow for the possibility of diminishing returns. The model is discussed in detail in the next chapter.

Chapter 3

Data and Methodology

A variety of studies have analyzed education, income, and demographic variables in order to clarify the nature of regional income performance (Rickman1995; Domazlicky et al., 1996). The incorporation of infrastructure into these frameworks is difficult to achieve due to data constraints among counties. This study attempts to do so for Arkansas. A cross section data set for all 75 counties is assembled for purposes of carrying out the analysis.

Arkansas is still a rural state, with nearly half of its population living in non- metropolitan areas. Population density per square mile is included in the analysis as a explanatory variable. This variable is employed to capture agglomeration effects associated with greater interaction (Arellano and Fullerton, 2005).

The reason for employing seven educational variables in the model specification is to examine how education contributes to income growth. The state government has taken initiatives to promote education in Arkansas, especially at community colleges, technical colleges, and two year colleges that are a part of a university system (Watts, 2002). However, Arkansas stands last among all 50 states for the percentage of adults over the age of 25 who hold bachelors degrees.

Data collected for this study are analyzed in a manner similar to what is done in previous studies. The dependent variable in the model is per capita personal income (PCINC) for the 75 counties in Arkansas. The explanatory variables include seven measures of educational attainment for adults over the age of 25 in each county: the percentages with less than 9^{th} grade studies (LT9GRADE25), no diploma (NODIP25), high school graduates (HSGR25), some college (COLSOM25), associate degrees (ASSODDR25), bachelor degrees (BACHDR25), and graduate or professional degree (GRADGR25). Also included as explanatory variables are the numbers of persons per square mile (POPDENSITY), non interstate highway miles or other highway lane miles (OHWS), and distance to the nearest airport (AIRMILES). These are all numeric variables.

Physical infrastructure investment has been shown to improve regional economic performance and increase incomes (Fan and Zhang, 2004), but only four infrastructure variables are employed in the analysis due to data constraints. AIRPT is a dummy variable utilized to indicate the locations of the six largest commercial airports in Arkansas. AIRMILES measures distance to the nearest major commercial airport for each county. ISHW is a qualitative variable used to indicate whether a county is traversed by an interstate highway.

Table 1

Variable Names and Definitions

Mnemonic	**Definition**
PCINC	County per capita personal income
HSGR25	Percentage of adults 25 and over graduated from high school
COLSOM25	Percentage of adults 25 and over who attended some college
BACH25	Percentage of adults 25 and over who have bachelor degree.
GRAD25	Percentage of adults 25 and over who have graduated

	degrees
POPDENSITY	Numbers of persons per square mile.
AIRPT	Commercial airport (Dummy =1 if commercial airport exists; 0 otherwise)
AIRMILES	Distance to the nearest commercial airport
ISHW	Interstate Highways (Dummy = 1 if interstate highway traverse exists; 0 otherwise)
OHW	Other Highways, miles in lane

Table 2: Numeric Variable Summary 1990

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Number of Observations
PCINC						
Nominal	9,281	9,101	13,760	6,582	1,341	75
PCINC Real	7,100	6,963.3	10,528	5,036	1,025.8	75
HSGR25	34.1	34.3	42.3	22.4	3.6	75
COLSOM25	14.1	13.9	22.1	8.7	3	75
BACHDR25	6.7	6.2	15.3	3.2	2.2	75
GRADGR25	3.2	2.9	8.2	1.3	1.7	75
POPDENSITY	43.9	26.4	454	9.3	57.3	75

AIRMILES	57.1	57.1	132	1	28.8	75
AIRPTOLN	1.1	1	2.718282(1)	1(o)	0.4	75
ISHWSLN	1.5	1	2.718282(1)	1(o)	0.8	75
OHWS	210.3	207.5	397.3	129.9	53	75

Table 2: Numeric Variable Summary 2000

Variables	**Mean**	**Median**	**Maximum**	**Minimum**	**Std. Dev.**	**Number of Observations**
PCINC						
Nominal	15,276	15,216	21,466	10983	1786	75
PCINC Real	8,871	8,836.2	12,465.7	6378.1	1037.1	75
HSGR25	36.6	36.8	43.6	26.5	3.4	75
COLSOM25	18.5	18	24.5	12.9	2.8	75
BACHDR25	8.3	7.6	18	4.2	2.7	75
GRADGR25	4.1	3.7	10.1	1.8	1.6	75
POPDENSITY	50	28.3	469	9.1	63.7	75
AIRMILES	57.1	57.1	132	1	28.8	75
AIRPTOLN	1.1	1	2.718282(1)	1(o)	0.4	75
ISHWSLN	1.5	1	2.718282(1)	1(o)	0.8	75
OHWS	210.3	207.5	397.3	129.9	53	75

Table 2 and Table 3 report summary statistics for the variables in the sample for the years 1990 and 2000. The standard deviations and ranges for the different variables included in the sample exhibit relatively good variability. In Table 2, average per capita income (PCINC) in 1990 was $9,281. The percentage of high school graduates over the age 25 (HSGR25) is approximately 36.6 percent, while that for some college studies (COLSOM25) is 18.5 percent. The averages for bachelors degree (BACH25) and graduate degrees (GRAD25) in Arkansas are 6.7 percent and 3.2 percent, respectively. The standard deviations for these two variables indicate that they are widely dispersed across the 75 counties. The population density varies from 9.3 to 454 persons per square mile. The majority of the counties do not have commercial airports and distance to the nearest airport (AIRMILES) varies widely. Other highway miles (OHW) in each county range from 129.9 to 397.3, with a mean of 210.3.

In Table 3, average per capita income for 2000 is $15,276. The range is from $10,983 to $21,466. Percentages of adults over the age of 25 who graduated from high school (HSGR25) and who attended some college (COLSOM25) are 36.6 percent and 18.5 percentage, respectively. Similarly, the percentage of the population over 25 who holds bachelor degree (BACH25) or advanced degrees (GRAD25) is 8.3 percent and 4.1 percent, respectively. Population density has increased to 50 persons per square mile in 2000. Infrastructure variables exhibit the same results as those reported in Table 2.

Parameter heterogeneity testing is used to see whether the sample data can be pooled for modeling purposes (Almada et al., 2006). This is carried out using a Chow- F test. The model specification for the study in hand is similar to those employed by Rickman (1995) and Sloboda (1999). Parameter estimation is completed using least squares regression analysis. Because of the cross section of counties in the sample, heteroskedasticity tests are also completed (Fullerton, 2001; Almada et al., 2006).

In addition to parameter estimation, simulations are carried out to examine the potential impacts of different public policy efforts. At a minimum, the personal income gains associated with greater educational attainment will be simulated (Sloboda, 1999; Almada et al. 2006). Gains associated with greater infrastructure investment may be also be calculated.

As for the education variables, the expected signs for the no diploma and less than 9^{th} grade are negative because higher dropout rates will generally reduce worker productivity. All other variables are expected to be positively related to per capita income. Although most of the variables in the sample are expected to increase county per capita incomes in Arkansas, diminishing marginal returns are likely to be observed. To capture diminishing returns, logarithmic transformations are applied to the data prior to estimation.

The basic specification for PCINC takes the form shown in Equation (1). Per capita income is expressed as a function of the various regressors. Data sources include the University of Arkansas at Little Rock Institute for Economic Advancement, U.S Bureaus of the Census, U.S Bureau of Economic Analysis, Federal Aviation Administration, Arkansas State Highway and Transportation Department, and the U.S. Bureau of Transportation Statistics.

The per capita income specification is shown in Equation (1). The coefficients for all of the regressors except AIRMILES are hypothesized to be greater zero. To avoid perfect co-linearity, at least one of category of county education attainment or non attainment must be excluded prior to estimation. Exclusion of the high school non-completion percentage aggregates for each counties follows Almada et al. (2006). Estimation results are discussed in the next section.

$$\text{Log PCINC} = \beta_0 + \beta_1 \text{ Log HSGR25} + \beta_2 \text{ Log COLSOM25} + \beta_3 \text{ Log BACH25} + \beta_4 \text{ Log GRAD25} + \beta_5 \text{ Log POPDENSITY} + \beta_6 \text{ Log AIRPT} + \beta_7 \text{ Log AIRMILES} + \beta_8 \text{ Log ISHW} + \beta_9 \text{ Log OHW} + e \qquad (1)$$

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Chapter 4

Empirical Results

Table 1 reports the F-test for parameter heterogeneity. The data are logathrimically transformed prior to the estimation. Results for Equation (1) are generally as hypothesized, but it is not clear whether the data from 1990 and 2000 should be pooled. Accordingly, an F-test for parameter heterogeneity is carried out (Pindyck and Rubinfeld, 1998). Since the F calculated is greater than the critical value at the 1-percent level of significance, the model rejects the null hypothesis. This implies that the data cannot be pooled for estimation purposes.

Table 1: F- Test for Parameter Heterogeneity

ESS Unrestricted -1990 = 0.466184

ESS Unrestricted - 2000= 0.241546

Restricted – pooled ESS= 0.882582

ESSur = $ESS_1 + ESS_2$ = 0.466184 + 0.241546 = 0.70773

$\hat{F}$ = (ESSr – ESSur) / (k + 1) / ESSur / (n – 2(k) – 2)

$\hat{F}$= (0.882582 – 0.70773) / 6 / 0.70773 / (150 - 2(9) – 2) = 5.353

Fcv = critical value for Numerator d.f. = 6; Denominator d.f. =130; 1-percent significance level

F-hat is greater than critical F, the null hypothesis of parameter homogeneity is rejected.

Table 2 reports a chi-square test (White, 1980) performed using the 2000 data. Unlike what frequently occurs in cross sectional data samples, the chi-square test fails to reject the null hypothesis of homoscedasticity. Heteroscedasticity correction is not required for the data in this sample.

The central hypothesis tested is that Arkansas county incomes are affected by educational attainment and infrastructure variables in a manner similar to that of other regions of the United States. Estimation results for Equation (1) using data from 2000 are shown in Table 2. The coefficients of HSGR25, COLSOM25, BACH25, GRAD25, POPDENSITY and AIRPT are statistically significant at 5 percent level. As in neighboring Missouri, this implies that acquiring education beyond secondary school level yields positive returns (Sloboda, 1999). For every one percent increase in the high school graduation rate, per capita income increases by $2.03. The AIRPT coefficient is 0.10, indicating that the presence of a commercial airport increases county per capita by $1.11. The t-statistics for AIRMILES, ISHW and OHWS fall below the 5-percent significance level. Overall the model exhibits good economic traits, but the signs for the ISHW and OHWS coefficients are counter-intuitive

$$\text{Log PCINC} = \beta_0 + \beta_1 \text{ Log HSGR25} + \beta_2 \text{ Log COLSOM25} + \beta_3 \text{ Log BACH25} + \beta_4 \text{ Log GRAD25} + \beta_5 \text{ Log POPDENSITY} + \beta_6 \text{ Log AIRPT} + \beta_7 \text{ Log AIRMILES} + \beta_8 \text{ Log ISHW} + \beta_9 \text{ Log OHW} + e \quad (1)$$

Table (2): Equation (1), 2000 Data.

Dependent Variable: LOG(PCINC)

Method: Least Squares

Sample: 1 75

Included observations: 75

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	6.158286	0.446664	13.78730	0.0000
LOG(HSGR25)	0.706402	0.087492	8.073908	0.0000
LOG(COLSOM25)	0.134410	0.067050	2.004633	0.0492
LOG(BACH25)	0.154868	0.039473	3.923419	0.0002
LOG(GRAD25)	0.078030	0.032730	2.384062	0.0201
LOG(POPDENSIT Y)	0.053293	0.017706	3.009932	0.0037
LOG(AIRPT)	0.105572	0.045397	2.325528	0.0232
LOG(AIRMILES)	-0.002722	0.009648	-0.282160	0.7787
LOG(ISHW)	-0.023592	0.016207	-1.455711	0.1503
LOG(OHWS)	-0.011697	0.035362	-0.330795	0.7419

R-squared	0.794611	Mean dependent var	9.627450
Adjusted R-squared	0.766173	S.D. dependent var	0.115092
S.E. of regression	0.055654	Akaike info criterion	-2.815771
Sum squared resid	0.201327	Schwarz criterion	-2.506772
Log likelihood	115.5914	Hannan-Quinn criter.	-2.692391
F-statistic	27.94144	Durbin-Watson stat	1.821299
Prob(F-statistic)	0.000000		

Heteroskedasticity Test: White

F-statistic	0.648617	Prob. F(47,27)	0.9049
Obs*R-squared	39.77341	Prob. Chi-Square(47)	0.7635
Scaled explained SS	25.01156	Prob. Chi-Square(47)	0.9965

Given that, Table 3 excludes the ISHW and OHW variables. All of the coefficients for the numerical explanatory variables exhibit the hypothesized signs. The magnitude of the parameter estimates are more in line with earlier studies. The coefficient of determination is 0.78, adjusted for degrees of freedom it is 0.76, fairly high values for cross sectional data. The t-statistics for all the variables except AIRMILES are significant at the 5-percent level. Additional estimation results for alternative specifications are included in the appendix.

Log PCINC = $\beta_0 + \beta_1$ Log HSGR25 + β_2 Log COLSOM25 + β_3 Log BACH25 + β_4 Log

$$\text{GRAD25} + \beta_5 \text{ Log POPDENSITY} + \beta_6 \text{ Log AIRPT} + \beta_7 \text{ Log AIRMILES} + e \qquad (1)$$

Table 3: Equation (1), 2000 data.

Dependent Variable: LOG(PCINC)

Method: Least Squares

Sample: 1 75

Included observations: 75

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.130923	0.373653	16.40808	0.0000
LOG(HSGR25)	0.697742	0.087396	7.983714	0.0000
LOG(COLSOM25)	0.145543	0.061510	2.366174	0.0209
LOG(BACH25)	0.156041	0.039208	3.979867	0.0002
LOG(GRAD25)	0.071350	0.032124	2.221105	0.0297
LOG(POPDENSITY)	0.044474	0.016375	2.715961	0.0084
LOG(AIRPT)	0.094327	0.044857	2.102828	0.0392
LOG(AIRMILES)	-0.004160	0.009610	-0.432884	0.6665

R-squared	0.787314	Mean dependent var	9.627450
Adjusted R-squared	0.765093	S.D. dependent var	0.115092
S.E. of regression	0.055782	Akaike info criterion	-2.834192
Sum squared resid	0.208480	Schwarz criterion	-2.586993
Log likelihood	114.2822	Hannan-Quinn criter.	-2.735488
F-statistic	35.43118	Durbin-Watson stat	1.811130
Prob(F-statistic)	0.000000		

Heteroskedasticity Test: White

F-statistic	0.969277	Prob. F(31,43)	0.5298
Obs*R-squared	30.85069	Prob. Chi-Square(31)	0.4738
Scaled explained SS	17.53516	Prob. Chi-Square(31)	0.9750

The parameter estimation shown in Table 3 can be used to calculate potential gains associated with improved educational achievement for Arkansas counties. All of the calculations are summarized in Tables 4, 5, 6 and 7. For counties with educational achievement rates that exceed the state average, no calculations are performed. For the other counties, the impacts of raising the county educational attainment to the state averages are calculated. Aggregate income impacts are tallied by multiplying per capita gains by each county's population.

Table 4 reveals that raising Arkansas county high school graduation rates to the state average leads to a significant improvement. Pulaski County is expected to generate the estimated largest income per capita gain of $2,873.69. Similarly the largest aggregate income increase is also realized by Pulaski County, which is $ 1billion. The second largest income per capita gains is experienced by Phillips County at $2,310. On average, the weighted per capita gain of each county is $1,322.19. The state aggregate income gain exceeds $1.76 billion.

TABLE 4

INCOME GAINS FROM INCREASED HIGH SCHOOL GRADUCATION RATES

County	Per Capita Impact	Aggregate Impact
Arkansas	NC	NC
Ashley	NC	NC
Baxter	NC	NC
Benton	$445.48	$68,338,858.58
Boone	NC	NC
Bradley	NC	NC
Calhoun	NC	NC
Carroll	$23.79	$603,264.26
Chicot	NC	NC
Clark	$605.71	$14,261,934.40
Clay	NC	NC
Cleburne	NC	NC
Cleveland	NC	NC
Columbia	NC	NC

Conway	NC	NC
Craighead	$476.94	$39,179,443.65
Crawford	NC	NC
Crittenden	$288.09	$14,653,731.83
Cross	NC	NC
Dallas	NC	NC
Desha	NC	NC
Drew	NC	NC
Faulkner	$1,072.19	$92,223,278.01
Franklin	NC	NC
Fulton	NC	NC
Garland	$461.38	$40,633,180.70
Grant	NC	NC
Greene	NC	NC
Hempstead	NC	NC
HotSpring	NC	NC
Howard	NC	NC
Independence	NC	NC
Izard	NC	NC
Jackson	NC	NC
Jefferson	NC	NC
Johnson	NC	NC
Lafayette	NC	NC
Lawrence	NC	NC
Lee	$1,096.96	$13,799,803.62
Lincoln	NC	NC
LittleRiver	NC	NC
Logan	NC	NC
Lonoke	NC	NC
Madison	NC	NC
Marion	NC	NC
Miller	NC	NC
Mississippi	$564.38	$29,335,710.04
Monroe	NC	NC
Montgomery	NC	NC
Nevada	NC	NC
Newton	NC	NC
Ouachita	NC	NC
Perry	NC	NC
Phillips	$2,310.10	$61,090,593.83
Pike	NC	NC

Poinsett	NC	NC
Polk	NC	NC
Pope	$195.43	$10,644,737.55
Prairie	NC	NC
Pulaski	$2,873.69	$1,038,765,902.43
Randolph	NC	NC
Saint Francis	$366.98	$10,763,099.98
Saline	NC	NC
Scott	NC	NC
Searcy	NC	NC
Sebastian	$980.90	$112,873,007.98
Sevier	$74.70	$1,177,114.18
Sharp	NC	NC
Stone	NC	NC
Union	NC	NC
VanBuren	NC	NC
Washington	$1,368.01	$215,755,227.26
White	NC	NC
Woodruff	NC	NC
Yell	NC	NC
State	**$1,322.19**	**$1,764,098,888.29**

Note**:** All impacts are calculated in 2000 dollars for 2000 schooling rates relative to the Arkansas average**.**

Table 5 reports, the impact of increasing the percentage of adult 25 and over who attended at least some college. Dallas County exhibits the largest per capita gains of $912.23, followed closely by Clay County with $872.50. The aggregate income gains for White county alone exceed $22 million and Poinsett County with the second largest increase in aggregate income of $17million. The average state per capita gain is $309, while the state aggregate income gain is approximately $369 million.

TABLE 5

INCOME GAINS FROM INCREASED SOME COLLEGE ATTENDENCE RATES

County	Per Capita Impact	Aggregate Impact
Arkansas	$396.12	$8,219,070.33
Ashley	$517.19	$12,520,693.82
Baxter	NC	NC
Benton	NC	NC
Boone	NC	NC
Bradley	$604.47	$7,616,307.53
Calhoun	$733.74	$4,214,589.94
Carroll	$46.66	$1,183,204.98
Chicot	$658.32	$9,293,556.83
Clark	$79.49	$1,871,679.17
Clay	$872.50	$15,363,809.24
Cleburne	NC	NC
Cleveland	$512.49	$4,392,591.77
Columbia	$232.90	$5,962,820.82
Conway	$400.35	$8,141,584.34
Craighead	$55.16	$4,531,413.64
Crawford	$13.62	$725,323.16
Crittenden	$47.19	$2,400,307.20
Cross	$382.78	$7,474,105.19
Dallas	$912.23	$8,401,621.17
Desha	$522.18	$8,010,835.54
Drew	$223.57	$4,185,891.74
Faulkner	NC	NC
Franklin	$37.67	$669,380.52
Fulton	$69.30	$806,818.21

Garland	NC	NC
Grant	NC	NC
Greene	$328.54	$12,264,619.34
Hempstead	$458.59	$10,816,653.18
HotSpring	$244.64	$7,425,581.02
Howard	$300.57	$4,298,146.95
Independence	$170.03	$5,820,683.77
Izard	NC	NC
Jackson	$759.36	$13,985,913.59
Jefferson	NC	NC
Johnson	$575.04	$13,099,933.46
Lafayette	$429.19	$3,673,450.06
Lawrence	$569.91	$10,129,498.50
Lee	$490.63	$6,172,179.23
Lincoln	$437.63	$6,342,192.77
LittleRiver	NC	NC
Logan	$273.55	$6,151,088.58
Lonoke	NC	NC
Madison	$472.49	$6,729,729.14
Marion	NC	NC
Miller	NC	NC
Mississippi	$327.67	$17,031,722.57
Monroe	$765.92	$7,853,775.03
Montgomery	$310.01	$2,866,049.24
Nevada	$449.18	$4,471,601.17
Newton	$389.30	$3,351,123.44
Ouachita	NC	NC
Perry	$230.95	$2,357,789.92
Phillips	$185.14	$4,896,095.50
Pike	$383.49	$4,334,596.32
Poinsett	$702.72	$17,999,594.41
Polk	NC	NC
Pope	NC	NC
Prairie	$360.61	$3,439,861.26
Pulaski	NC	NC
Randolph	$403.38	$7,339,488.02
Saint Francis	$225.13	$6,602,919.12
Saline	NC	NC
Scott	$464.52	$5,107,897.46
Searcy	$610.34	$5,042,037.18
Sebastian	NC	NC

Sevier	$269.12	$4,240,517.39
Sharp	NC	NC
Stone	$363.20	$4,176,395.68
Union	$66.83	$3,049,242.48
VanBuren	$35.93	$581,739.06
Washington	NC	NC
White	$341.37	$22,928,041.14
Woodruff	$720.12	$6,294,603.02
Yell	$551.11	$11,650,007.21
State	**$309.00**	**$368,510,371.37**

Note: All impacts are calculated in 2000 dollars for 2000 schooling rates relative to the Arkansas average**.**

Table 6, examines the impact of increased bachelors degree rates for Arkansas counties. The largest per capita gain is $2,016.18 for Poinsett County, while the largest aggregate income gain is $64 million for Crawford County. The weighted average per capita income gain is $755.50 and the state aggregate gain is roughly $1.16 billion.

TABLE 6

INCOME GAINS FROM INCREASED BACHELOR RATES

County	Per Capita Impact	Aggregate Impact
Arkansas	$649.37	$13,473,841.57
Ashley	$1,106.08	$26,777,098.82
Baxter	$624.87	$23,986,375.51
Benton	NC	NC
Boone	$555.39	$18,854,252.69
Bradley	$829.98	$10,457,687.78
Calhoun	$1,913.32	$10,990,112.15
Carroll	$414.09	$10,500,041.45
Chicot	$475.16	$6,707,871.53
Clark	NC	NC
Clay	$1,612.52	$28,394,835.92
Cleburne	$507.88	$12,212,474.90

Cleveland	$862.28	$7,390,575.38
Columbia	NC	NC
Conway	$1,186.22	$24,122,990.28
Craighead	NC	NC
Crawford	$1,204.12	$64,115,708.65
Crittenden	$456.87	$23,238,985.97
Cross	$1,303.51	$25,452,346.27
Dallas	$729.53	$6,718,991.99
Desha	$567.28	$8,702,614.73
Drew	NC	NC
Faulkner	NC	NC
Franklin	$848.34	$15,075,781.83
Fulton	$1,372.66	$15,980,508.75
Garland	NC	NC
Grant	$1,091.71	$17,973,960.04
Greene	$968.69	$36,162,155.27
Hempstead	$1,007.58	$23,765,857.03
HotSpring	$803.24	$24,380,894.64
Howard	$732.20	$10,470,447.39
Independence	$640.35	$21,921,223.37
Izard	$914.64	$12,117,999.96
Jackson	$1,072.11	$19,746,156.35
Jefferson	$42.00	$3,539,407.03
Johnson	$587.44	$13,382,396.51
Lafayette	$1,141.57	$9,770,737.70
Lawrence	$1,973.35	$35,074,338.45
Lee	$1,357.46	$17,076,785.13
Lincoln	$1,364.40	$19,772,871.15
LittleRiver	$890.72	$12,138,710.30
Logan	$1,175.41	$26,430,249.44
Lonoke	$232.15	$12,264,216.63
Madison	$1,054.43	$15,018,311.81
Marion	$1,031.41	$16,646,981.94
Miller	$655.28	$26,501,572.12
Mississippi	$744.75	$38,711,349.60
Monroe	$1,546.00	$15,852,708.83
Montgomery	$1,767.45	$16,340,096.28
Nevada	$978.05	$9,736,448.15
Newton	$740.76	$6,376,424.80
Ouachita	$521.02	$15,000,190.10
Perry	$938.16	$9,577,630.05

Phillips	$496.36	$13,126,302.52
Pike	$1,279.76	$14,465,125.77
Poinsett	$2,016.18	$51,642,379.05
Polk	$1,232.06	$24,923,442.15
Pope	NC	NC
Prairie	$1,264.45	$12,061,592.06
Pulaski	NC	NC
Randolph	$1,322.64	$24,065,478.25
Saint Francis	$1,182.49	$34,681,306.68
Saline	NC	NC
Scott	$1,531.34	$16,838,608.78
Searcy	$1,667.46	$13,774,876.92
Sebastian	$46.76	$5,380,873.16
Sevier	$1,137.99	$17,931,265.86
Sharp	$1,053.24	$18,030,420.52
Stone	$1,413.12	$16,249,503.43
Union	$80.54	$3,674,923.38
VanBuren	$749.72	$12,139,463.83
Washington	NC	NC
White	$212.96	$14,303,609.57
Woodruff	$1,143.57	$9,995,932.39
Yell	$960.36	$20,300,957.16
State	**$755.50**	**$1,162,489,277.71**

Note**:** All impacts are calculated in 2000 dollars for 2000 schooling rates relative to the Arkansas average**.**

The impact of increasing the percentage of adults 25 and over who graduated in Arkansas counties is reported in Table 7. The largest estimated per capita gain for Dallas County $2,682.45. Poinsett County experiences the largest aggregate income gain of $51 million. The state per capita gain is $937.57 and the state aggregate income exceeds $1.45 billion.

TABLE 7

INCOME GAINS FROM INCREASED GRADUATE SCHOOL COMPLETION RATES

County	Per Capita Impact	Aggregate Impact
Arkansas	$1,058.44	$21,961,622.90
Ashley	$1,597.24	$38,667,480.98
Baxter	$763.94	$29,324,760.54
Benton	NC	NC
Boone	$881.74	$29,933,363.81
Bradley	$692.95	$8,731,218.07
Calhoun	$1,907.01	$10,953,848.07
Carroll	$494.15	$12,530,049.74
Chicot	$1,522.75	$21,496,729.67
Clark	NC	NC
Clay	$1,797.96	$31,660,216.96
Cleburne	$359.31	$8,639,889.93
Cleveland	$2,265.68	$19,419,170.26
Columbia	$353.81	$9,058,621.09
Conway	$545.46	$11,092,508.05
Craighead	NC	NC
Crawford	$1,279.11	$68,108,881.39
Crittenden	$915.83	$46,584,762.77
Cross	$1,070.78	$20,908,121.92
Dallas	$2,682.45	$24,705,396.51
Desha	$1,741.31	$26,713,464.22
Drew	$394.30	$7,382,419.62
Faulkner	NC	NC
Franklin	$1,157.40	$20,568,147.60
Fulton	$757.88	$8,823,186.14
Garland	NC	NC
Grant	$1,071.77	$17,645,554.07
Greene	$1,226.88	$45,800,665.60

Hempstead	$968.58	$22,845,894.48
HotSpring	$1,355.45	$41,142,102.03
Howard	$1,134.52	$16,223,694.29
Independence	$275.50	$9,431,175.44
Izard	$755.45	$10,008,986.87
Jackson	$1,152.08	$21,218,941.35
Jefferson	$376.77	$31,753,042.71
Johnson	$531.91	$12,117,423.80
Lafayette	$1,380.72	$11,817,619.78
Lawrence	$757.48	$13,463,416.25
Lee	$1,673.23	$21,049,233.12
Lincoln	$2,300.54	$33,339,461.44
LittleRiver	$2,025.94	$27,609,461.78
Logan	$1,628.72	$36,623,367.96
Lonoke	$554.60	$29,298,599.36
Madison	$1,430.54	$20,375,240.64
Marion	$1,367.12	$22,065,391.02
Miller	$772.17	$31,228,995.99
Mississippi	$982.00	$51,043,333.71
Monroe	$1,369.16	$14,039,358.01
Montgomery	$1,033.56	$9,555,297.15
Nevada	$1,220.89	$12,153,994.14
Newton	$991.88	$8,538,103.81
Ouachita	$881.60	$25,381,262.98
Perry	$1,240.73	$12,666,626.35
Phillips	$718.28	$18,994,948.51
Pike	$1,062.36	$12,007,851.45
Poinsett	$2,023.63	$51,833,297.89
Polk	$624.52	$12,633,412.95
Pope	NC	NC
Prairie	$1,677.46	$16,001,317.26
Pulaski	NC	NC
Randolph	$681.08	$12,392,201.06
Saint Francis	$1,100.65	$32,280,840.73
Saline	$347.41	$29,019,225.82
Scott	$1,416.35	$15,574,138.75
Searcy	$1,428.96	$11,804,652.02
Sebastian	NC	NC
Sevier	$1,450.57	$22,856,690.24
Sharp	$1,391.62	$23,823,112.47
Stone	$986.10	$11,339,188.44

Union	$708.45	$32,325,779.16
VanBuren	$1,172.91	$18,991,815.91
Washington	NC	NC
White	$106.75	$7,170,174.86
Woodruff	$2,319.76	$20,277,049.80
Yell	$927.64	$19,609,463.87
State	**$937.57**	**$1,454,635,265.59**

Note: All impacts are calculated in 2000 dollars for 2000 schooling rates relative to the Arkansas average**.**

As shown in the above tables, raising educational attainment tends to improve county income performance. The coefficients of HSGR25, COLSOM25, BACH25, and GRAD25 are statistically significant at the 5-percent level. Results for the infrastructure variables are ambiguous. The coefficients for the highway variable are statistically indistinguishable from zero, but the airport coefficients are more in line with expectations. Estimation and simulation results underscore the importance of educational attainment in Arkansas. Additional research is needed, however, to assess the impact of infrastructure investment on regional economic performance in this state.

Chapter 5

Conclusion

The object of this study is to analyze regional income performance in Arkansas and to quantify the impacts of education, infrastructure, and demographics on regional per capita income in Arkansas. A pooled cross section data set for all 75 counties in Arkansas is utilized for the analysis. An F-test for parameter heterogeneity indicates that the data should not be pooled. The empirical results detailed above are consistent with prior studies for other regions of the United States. Empirical results indicate that regional income and educational attainment are closely linked in Arkansas.

In spite of data constraints, the results are potentially useful to policy analysts. In particular, there are several counties that may benefit from raising educational achievement up to the state averages across several categories. Statewide income gains potentially exceed $4.74 billion.

Infrastructure data constraints are fairly binding but the presence of commercial airports helps raise per capita incomes. More data regarding county level physical infrastructure would be useful. Data regarding private capital stocks might also be helpful in terms of more completely describing regional income behavior in Arkansas and other regions.

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Appendix A: Data

Name	CPOPGT 25	HSGR2 5	COLSOM 25	BACH2 5	GRAD2 5	POP DENSIT Y	Land Area (sq miles)
Arkansas	13,888	39.8	17.27	8.47	3.72	21	988.5
Ashley	15,722	43.24	16.36	7.05	3.01	26.3	921.1
Baxter	28,861	37.53	22.54	8.59	4.19	69.2	554.4
Benton	99,436	32.83	22.67	14.52	5.8	181.3	846
Boone	23,070	35	23.98	8.73	3.94	57.4	591.2
Bradley	8,368	36.83	15.54	7.72	4.21	19.4	650.6
Calhoun	3,906	43.55	14.41	4.81	2.48	9.1	628.3
Carroll	17,207	34.03	20.09	9.23	4.6	40.2	630.3
Chicot	9,062	35.27	14.81	8.82	2.86	21.9	644
Clark	13,735	32.38	19.85	11.24	8.58	27.2	865.4
Clay	12,175	37.81	12.85	5.02	2.37	27.5	639.3
Cleburne	17,299	36.36	20.57	8.98	4.9	43.5	553
Cleveland	5,659	43.36	16.29	7.69	2.3	14.3	597.7
Columbia	16,039	35.8	18.6	11.87	4.93	33.4	766.1
Conway	13,480	41.39	17.33	6.97	4.57	36.6	556.1
Craighead	50,725	32.76	20.07	13.32	7.62	115.6	710.8
Crawford	33,765	35.99	20.39	6.47	3.23	89.4	595.4
Crittenden	30,251	33.14	20.06	8.98	3.79	83.4	610.2
Cross	12,412	38.17	17.13	6.3	3.57	31.7	615.8
Dallas	5,989	41.14	13.09	7.85	1.77	13.8	667.4
Desha	9,574	35.96	15.83	8.46	2.61	20.1	765
Drew	11,553	34.33	18.63	12.43	4.83	22.6	828.2
Faulkner	50,849	31.3	22.69	16.68	8.53	132.9	647.4
Franklin	11,654	35.36	20.16	7.59	3.43	29.2	609.6
Fulton	8,243	39.01	19.9	6.33	4.15	18.8	618.2
Garland	62,694	32.76	23.12	11.69	6.28	130	677.2
Grant	10,824	42.28	20.92	7.27	3.77	26.1	631.8
Greene	24,510	40.55	17.75	7.43	3.46	64.6	577.5
Hempstead	14,869	38.33	16.63	7.2	3.77	32.4	728.8
HotSpring	20,260	39.66	18.4	7.91	3.28	49.4	614.9
Howard	9,271	37.86	17.89	8.09	3.54	24.3	587.4
Independen ce	22,705	39.73	19.14	8.64	5.1	44.8	763.8
Izard	9,524	36.51	20.85	7.54	4.14	22.8	580.7
Jackson	12,204	38.34	14.32	6.88	3.43	29.1	633.5

Jefferson	53,132	34.82	21.06	10.81	4.87	95.3	884.8
Johnson	14,901	36.66	15.86	8.6	4.53	34.4	662.2
Lafayette	5,692	35.98	16.53	6.52	3.02	16.3	526.5
Lawrence	11,824	36.72	15.38	4.52	3.97	30.3	586.6
Lee	7,924	29.61	15.03	5.07	2.21	20.9	601.7
Lincoln	9,533	37.76	16.25	5.71	1.94	25.8	561.2
LittleRiver	9,009	38.16	21.74	7.48	2.43	25.6	531.7
Logan	15,004	38.41	17.98	6.58	2.81	31.7	709.9
Lonoke	33,468	35.69	22.09	10.02	4.54	69	766
Madison	9,327	38.85	16.43	6.98	3.08	17	836.8
Marion	11,593	38.3	22.57	7.19	3.24	27	597.7
Miller	25,790	35.77	22.03	8.39	4.12	64.8	624
Mississippi	31,612	32.11	17.33	7.73	3.57	57.9	898.2
Monroe	6,602	38.17	13.95	5.42	3.01	16.9	606.6
Montgomery	6,464	39.25	17.71	5.21	3.62	11.8	780.9
Nevada	6,575	39.24	16.71	7.3	3.41	16.1	620
Newton	5,814	37.82	17.2	8.07	3.75	10.5	823
Ouachita	18,975	34.9	20.95	8.82	3.91	39.3	732.5
Perry	6,859	41.45	18.57	7.6	3.48	18.5	550.9
Phillips	15,420	26.46	18.46	8.47	3.89	38.2	692.7
Pike	7,653	39.16	17.2	6.44	3.62	18.7	603
Poinsett	16,674	39.46	14.03	4.17	2.14	33.8	757.7
Polk	13,505	36.19	21.48	6.6	4.35	23.5	859.4
Pope	34,297	33.53	21.47	12.77	6.22	67.1	811.9
Prairie	6,550	38.82	17.22	6.31	2.73	14.8	645.9
Pulaski	235,921	27.09	24.48	18	10.11	469	770.8
Randolph	12,207	38.37	17.06	6.36	4.24	27.9	651.8
Saint Francis	18,173	32.76	18.22	6.26	3.35	46.3	633.8
Saline	55,796	37.69	23.21	11.38	4.98	115.5	723.5
Scott	7,141	37.17	16.2	5.46	2.95	12.3	893.9
Searcy	5,792	40.63	15.31	5.35	3.04	12.4	667.1
Sebastian	74,601	31.18	22.43	10.79	5.81	214.6	536.2
Sevier	9,828	33.82	17.8	6.38	2.85	27.9	563.9
Sharp	12,294	38.34	20.58	7.08	3.18	28.3	604.4
Stone	8,119	38.48	17.31	6.05	3.71	19	606.6
Union	29,986	35.51	19.93	10.64	4.26	43.9	1,038.90
VanBuren	11,602	36.8	20.19	8.02	3.47	22.8	711.5
Washington	94,019	30.5	20.96	14.76	9.79	166.1	949.7

White	42,366	35.67	17.72	10.1	5.42	65	1,034.00
Woodruff	5,716	36.74	13.84	6.19	1.85	14.9	586.6
Yell	13,659	35.68	15.71	7.17	3.74	22.8	927.9
State	1,731,200	34.1	20.53	10.99	5.66	50.3	52,068.17

Name	Nominal PCINC	ISHW	OHWS	AIRPT	AIR MILES	POP
Arkansas	16,401	1	291.28	1	85.9	20,749
Ashley	15,702	1	221.17	1	132	24,209
Baxter	16,859	1	202.37	1	1	38,386
Benton	19,377	2.718282	357.51	2.718282	1	153,406
Boone	16,175	1	182.31	1	53.8	33,948
Bradley	13,895	1	136.69	1	104	12,600
Calhoun	15,555	1	156.16	1	96.4	5,744
Carroll	16,003	1	213.24	1	68.2	25,357
Chicot	12,825	1	197.83	1	128	14,117
Clark	14,533	2.718282	221.07	1	64.5	23,546
Clay	14,512	1	178.5	1	50.3	17,609
Cleburne	17,250	1	199.16	1	73.3	24,046
Cleveland	15,362	1	161.97	1	71.4	8,571
Columbia	15,322	1	207.51	1	63.8	25,603
Conway	16,056	2.718282	208.39	1	65.9	20,336
Craighead	17,091	1	283.67	1	1	82,148
Crawford	15,015	2.718282	162.15	1	23.3	53,247
Crittenden	14,424	2.718282	211.84	1	35.2	50,866
Cross	15,726	1	247.93	1	41.6	19,526
Dallas	14,610	1	183.48	1	67.5	9,210
Desha	13,446	1	169.14	1	90.2	15,341
Drew	16,264	1	204.16	1	107	18,723
Faulkner	17,988	2.718282	236.39	1	38.4	86,014
Franklin	14,616	2.718282	207.97	1	44.3	17,771
Fulton	15,712	1	161.21	1	45.6	11,642
Garland	18,631	1	212.63	1	71.1	88,068
Grant	17,547	2.718282	172.33	1	38.3	16,464
Greene	16,403	1	208.46	1	27.2	37,331
Hempstead	14,103	2.718282	247.62	1	33.1	23,587
HotSpring	15,216	2.718282	193.65	1	54.9	30,353
Howard	15,586	1	162.95	1	59.4	14,300

Independence	16,163	1	232.41	1	79.5	34,233
Izard	14,397	1	147.91	1	60.1	13,249
Jackson	14,564	1	251.99	1	35.4	18,418
Jefferson	15,417	2.718282	263.83	1	56.7	84,278
Johnson	15,097	2.718282	178.15	1	70.2	22,781
Lafayette	14,128	1	137.13	1	37.8	8,559
Lawrence	13,785	1	210.1	1	40	17,774
Lee	10,983	1	185.12	1	70.1	12,580
Lincoln	12,479	1	176.64	1	84.1	14,492
LittleRiver	15,899	1	146.01	1	24.3	13,628
Logan	14,527	1	208.67	1	44.2	22,486
Lonoke	17,397	2.718282	289.75	1	26	52,828
Madison	14,736	1	215.09	1	54.5	14,243
Marion	14,588	1	154.14	1	29.2	16,140
Miller	16,444	2.718282	222.41	2.718282	1	40,443
Mississippi	13,978	2.718282	385.67	1	40.7	51,979
Monroe	13,096	2.718282	209.28	1	93.7	10,254
Montgomery	14,668	1	166.75	1	93.1	9,245
Nevada	14,184	2.718282	211.31	1	57.8	9,955
Newton	13,788	1	202.64	1	70.2	8,608
Ouachita	15,118	1	207.57	1	77.1	28,790
Perry	16,216	1	166.54	1	58.2	10,209
Phillips	12,288	1	215.66	1	83.7	26,445
Pike	15,385	1	174.91	1	80.6	11,303
Poinsett	13,087	1	279.21	1	18.1	25,614
Polk	14,063	1	199.82	1	86.1	20,229
Pope	15,918	2.718282	275.89	1	86	54,469
Prairie	15,907	2.718282	200.83	1	46.8	9,539
Pulaski	21,466	2.718282	268.76	2.718282	1	361,474
Randolph	14,502	1	188.82	1	52.5	18,195
Saint Francis	12,483	2.718282	216.99	1	53.4	29,329
Saline	19,214	2.718282	129.9	1	24.1	83,529
Scott	13,609	1	179.24	1	53.3	10,996
Searcy	12,536	1	163.43	1	57.1	8,261
Sebastian	18,424	2.718282	230.02	2.718282	1	115,071
Sevier	14,122	1	135.31	1	53.8	15,757
Sharp	14,143	1	158.06	1	69.2	17,119
Stone	14,134	1	166.56	1	69.2	11,499
Union	16,063	1	253.07	1	97.3	45,629

VanBuren	16,603	1	217.31	1	80.7	16,192
Washington	17,347	2.718282	295.07	1	37.2	157,715
White	15,890	1	397.26	1	55.3	67,165
Woodruff	13,269	1	201.83	1	62.5	8,741
Yell	15,383	1	255.05	1	74.2	21,139
State	16,904					

Appendix B: Alternative Specification Estimates

Empirical results obtained from ordinary least squares estimation using 2000 data indicates a significant positive relationship between education, infrastructure and income performance in Arkansas.

Appendix (1)

Dependent Variable: LOG(PCINC)

Method: Least Squares

Sample: 1 75

Included observations: 75

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.235713	0.447230	13.94298	0.0000
LOG(HSGR25)	0.696612	0.087970	7.918785	0.0000
LOG(COLSOM25)	0.133762	0.067614	1.978321	0.0521
LOG(BACH25)	0.158128	0.039742	3.978906	0.0002
LOG(GRAD25)	0.073979	0.032887	2.249507	0.0278
LOG(POPDENSITY)	0.046702	0.017261	2.705559	0.0087
LOG(AIRPT)	0.094502	0.045134	2.093837	0.0401
LOG(AIRMILES)	-0.004251	0.009671	-0.439587	0.6617
LOG(OHWS)	-0.015386	0.035569	-0.432575	0.6667

R-squared	0.787915	Mean dependent var	9.627450
Adjusted R-squared	0.762208	S.D. dependent var	0.115092
S.E. of regression	0.056124	Akaike info criterion	-2.810356
Sum squared resid	0.207890	Schwarz criterion	-2.532258
Log likelihood	114.3884	Hannan-Quinn criter.	-2.699315
F-statistic	30.64954	Durbin-Watson stat	1.806484
Prob(F-statistic)	0.000000		

Note: Equation using 2000 data. ISHW is excluded in the above estimation.

Appendix (2)

Dependent Variable: LOG(PCINC)
Method: Least Squares
Date: 11/07/09 Time: 13:12
Sample: 1 75
Included observations: 75

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.077767	0.371976	16.33912	0.0000

LOG(HSGR25)	0.707416	0.086846	8.145614	0.0000
LOG(COLSOM25)	0.143331	0.060971	2.350803	0.0217
LOG(BACH25)	0.153235	0.038898	3.939428	0.0002
LOG(GRAD25)	0.076108	0.031992	2.378976	0.0203
LOG(POPDENSITY)	0.051715	0.016936	3.053594	0.0033
LOG(AIRPT)	0.105620	0.045090	2.342444	0.0222
LOG(AIRMILES)	-0.002628	0.009578	-0.274397	0.7846
LOG(ISHW)	-0.023976	0.016056	-1.493337	0.1401

R-squared	0.794265	Mean dependent var	9.627450
Adjusted R-squared	0.769328	S.D. dependent var	0.115092
S.E. of regression	0.055277	Akaike info criterion	-2.840756
Sum squared resid	0.201666	Schwarz criterion	-2.562657
Log likelihood	115.5283	Hannan-Quinn criter.	-2.729714
F-statistic	31.85021	Durbin-Watson stat	1.825282
Prob(F-statistic)	0.000000		

Note: Equation using 2000 data. Excluding OHW in the above estimation

Appendix (3)

Dependent Variable: LOG(PCINC)

Method: Least Squares

Sample: 1 75

Included observations: 75

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.124011	0.426821	14.34795	0.0000
LOG(HSGR25)	0.710194	0.085849	8.272645	0.0000
LOG(COLSOM25)	0.136357	0.066227	2.058954	0.0434
LOG(BACH25)	0.152973	0.038625	3.960453	0.0002
LOG(GRAD25)	0.077886	0.032497	2.396724	0.0194
LOG(POPDENSITY)	0.055299	0.016102	3.434298	0.0010
LOG(AIRPT)	0.114072	0.033725	3.382392	0.0012
LOG(ISHW)	-0.024090	0.015998	-1.505861	0.1369
LOG(OHWS)	-0.011404	0.035099	-0.324901	0.7463

R-squared	0.794360	Mean dependent var	9.627450
Adjusted R-squared	0.769434	S.D. dependent var	0.115092
S.E. of regression	0.055264	Akaike info criterion	-2.841213
Sum squared resid	0.201573	Schwarz criterion	-2.563115
Log likelihood	115.5455	Hannan-Quinn criter.	-2.730172
F-statistic	31.86858	Durbin-Watson stat	1.836561
Prob(F-statistic)	0.000000		

Note: Equation using 2000 data. Excluding AIRMILES in above estimation.

Appendix (4)

Dependent Variable: LOG(PCINC)

Method: Least Squares

Sample: 1 75

Included observations: 75

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.347278	0.453638	13.99193	0.0000
LOG(HSGR25)	0.673955	0.089210	7.554700	0.0000
LOG(COLSOM25)	0.128396	0.069201	1.855415	0.0680
LOG(BACH25)	0.166215	0.040457	4.108453	0.0001
LOG(GRAD25)	0.073591	0.033748	2.180613	0.0328
LOG(POPDENSITY)	0.049914	0.018226	2.738644	0.0079
LOG(AIRMILES)	-0.017610	0.007455	-2.362180	0.0211
LOG(ISHW)	-0.017279	0.016503	-1.047036	0.2989
LOG(OHWS)	-0.011958	0.036523	-0.327399	0.7444

R-squared	0.777523	Mean dependent var	9.627450
Adjusted R-squared	0.750556	S.D. dependent var	0.115092
S.E. of regression	0.057482	Akaike info criterion	-2.762517
Sum squared resid	0.218077	Schwarz criterion	-2.484418
Log likelihood	112.5944	Hannan-Quinn criter.	-2.651475
F-statistic	28.83242	Durbin-Watson stat	1.823321
Prob(F-statistic)	0.000000		

Note: Equation using 2000 data. Excluding AIRPT in the above equation.

Curriculum Vita

Phuntsho Wangmo was born on November 11, 1983 in Thimphu, Bhutan. The youngest daughter of Nima Gyeltshen and Late Pema Lhamo, she holds a bachelor's degree in Economics (2006) from University of Pune, India. She joined the Royal Institute of Management, the premium Management Institute of Bhutan in 2007. She presently works as one of the faculty members in the Department of Finance and Business. She teaches Economics and Business Mathematics.

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