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Abstract: This paper examines the degree to which per capita incomes have converged across counties in West Virginia over the last thirty years. The increase in government transfers and, possibly, other government assistance programs would suggest that incomes in spatially dispersed regions/counties within nation-state should become similar over this period. However, the interrelation between business cycles, migration, employment structure and changes in per capita earnings over time reduces this possibility. Comparable county data are obtained for two dissmilar regions: southern and eastern panhandle. The empirical results differ across the different measurement techniques used, but in general, the findings concur with the conclusions reached by previous studies that the convergence observed in earlier decades was replaced by divergence in the 1980s.

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Introduction

Economic theory tells us to expect that differences in regional incomes will lessen over time (in a market economy), particularly within nation-states (Hicks, 1932; Drennan and Tobier, 1996). In the historical experience of the US, the convergence of regional income, whatever the measure of income used, has been persistent and strong (Barro and Sala-i-Martin, 1991; Borts, 1960; Perloff, 1963; Garnick and Friedenberg, 1982). In the 1980s, however, convergence of incomes was replaced by divergence. This interruption of the long-term convergence trend is widely documented (Barro and Sala-i-Martin, 1991; Browne, 1989; Carlino, 1992; Garnick, 1990). The most thorough analysis of divergence in the 1980s is found in Garnick (1990). He decomposed per capita personal income growth into its components and found that divergence was fully accounted for by three factors: growth in regional earnings, the employment to adult population ratio, and less important, the industry mix. Browne (1989) identified changes in per capita earnings as the primary source of regional income divergence in the 1980s, particularly in what is labeled as locally oriented industries. Carlino (1992) argues that convergence is the long-term norm and that the divergence observed in the 1980s is due to shocks whose effects are not likely to be repeated.

In light of previous studies on convergence, the current paper serves several purposes. First, it examines the comparative growth of per capita incomes in the southern and eastern panhandle counties of West Virginia. Second, income is identified in the literature as one of the key variables in explaining how individuals form their needs to create life satisfaction. Therefore, investigating the differences in income distribution among individuals across the two regions is tantamount to examining regional differences in quality of life satisfaction. Third, the exercise reinvestigates the apparent contradiction between the convergence results obtained in recent research (Drennan and Tobier, 1996; Cheshires and Carbonaro, 1995; Neven and Gouyette, 1995; Barro and Sala-i-Martin, 1991) and the pessimistic view that prevailed in the early 1980s (Baumol, 1986; Garnick, 1990). Does the contradiction follow from the improvement of statistical techniques used in recent studies or from the historical record? While an analysis of this nature could be indeterminate, its results may serve to motivate a more detailed analysis of regional disparities. Lastly, examining the evolution of county disparity patterns can provide insight into the appropriate theoretical framework for understanding county growth trends.

Methods of Analysis

Several statistical approaches are available for evaluating the correlation and convergence of household income variables over time (Jeong, 1995; Baffes and Ajwad, 1998; Sala-i-Martin, 1996). Of these approaches, the current study employs (1) σ-convergence test, (2) correlation analysis, (3) F-test for convergence, (4) time series analysis and (5) β-convergence test, to examine the degree of income disparity between the counties in the southern and eastern panhandle counties of West Virginia.

The three types of per capita real income used in the analysis are personal income (PI), personal income minus government transfers (PIT), and personal disposable income (PDI), which is personal income minus personal direct taxes. The county data on these income indexes are obtained from the Bureau of Economic Analysis (BEA, 1999) covering the period from 1969 to 1998. To get an accurate representation of each county's per capita real income, Persson's method is followed, the counties' incomes is adjusted and deflated by the state consumer price index, to account for differences in price levels across counties (Persson, 1994). Data on the state consumer price index are obtained from the Bureau of Business and Economic Research (BBER, 1999).

To control for sectoral shocks that affect growth in the short run, Sala-i-Martin's method is used and included measures of the relative proportions of employees in agriculture and industry for various years (Sala-i-Martin, 1996). Data on these variables are obtained from the Regional Economic Information System (REIS, 1999). Another variable assumed to affect the process of convergence, is migration across regions (Barro and Sala-i-Martin, 1995, Ch.9). To control for the effects of migration, measures of the average annual rate of migration into county *i* between time *t-T* are included. The migration data are obtained from the U.S. Census Bureau (USCB, 1999).

Non-parametric testing for σ-convergence

The first concept of convergence examined is unconditional convergence. The concept of unconditional convergence describes how income distribution among regions evolves over time. If the coefficient of variation for a given variable (e.g., per capita real income) decreases over time, the regions in question are said to have converged (Barro and Sala-i-Martin, 1995). On the other hand, if per capita real income in all regions has increased, convergence in this sense means that the poorer regions have grown faster than the initially rich ones (Sala-i-Martin, 1996). In retrospect, using the standard deviation as the measure of dispersion qualifies unconditional convergence as σ-convergence (Sala-i-Martin, 1996).

To test for σ-convergence, the data are separated in 10-year periods: 1969, 1979, 1989, and 1998. Then the mean values are calculated for each year and are used to determine the multiplier, which is required to convert all the data to an index based on a mean of 100. By doing so, it is possible to retain the original variation and proportionality in the data while at the same time allowing changes in the dependent variables to be examined from a common reference point over time (Nixon, 1997). Having standardized the data for each of the years, the standard deviation is then calculated and used in trend analysis to determine the presence, or otherwise, of σ-convergence.

The estimates of σ-convergence for the southern and eastern panhandle counties are presented in Figure 1 and Table 1. The available data, starting in 1969, show an increasing trend in per capita incomes across the regions until the early 1980s. It is not until mid-1980s that we start observing a continuous declining trend. Overall, however, the estimated dispersion as indicated by the standard deviation show a fall in the dispersion of the income indexes. These results as depicted in Figure 1, for instance, imply that per capita real incomes in the southern counties moved closer to income levels in the eastern panhandle counties, up until the early 1980s. However, the observed fall in the standard deviation is not monotonic over time.

In Table 1, the tests of the mean indexes as well as the σ-convergence estimates for the sub-periods are reported. The results show an increasing trend in the mean indexes since 1969. In particular, the estimated mean index for per capita personal real income, for instance, in the southern counties increases from 14.47 in 1969 to 96.69 in 1998, whereas the mean index for the eastern panhandle counties increases from 13.8 to 97.15. Similarly, the mean indexes for disposable real income per capita and personal real income minus government transfer per capita increase in both regions.

Perhaps the most interesting observation from Table 1 is the reversal in trend. Until the 1980s, mean indexes of per capita real incomes for the southern counties were higher than mean indexes of per capita real incomes for the eastern panhandle counties. However, this trend was reversed starting in the 1980s. Two possible explanations might help put this finding in perspective. First, during the first half of the 1980s, employment in the coal industry, which was the backbone of the economies of the southern counties, collapsed. As a result, thousands of jobs were lost in the coal mining industry; and the few jobs that were left paid lower wages. Consequently, the once booming southern economy witnessed its per capita real incomes fall below those of the eastern panhandle region. Second, the eastern panhandle region benefited from urban sprawl because of its proximity to metropolitan Washington, DC and Baltimore, MD, through improved access to employment opportunities in these agglomerations and the influx of well-educated suburban residents.

Correlation Analysis

The computation of simple correlation coefficients within different sub-periods of a total sample period can be employed to test the concept of converging correlation over time between variables separated by space. However, since correlation analysis is static rather than dynamic, it is also important to examine cross-correlations with a lag structure between the variables of interest. Several studies have examined the geographical relationship between prices looking at correlation coefficients [e.g., Lele (1967), Southworth, Jones, and Pearson (1979), Timmer, Falcon, and Pearson (1983), and Stigler and Sherwin (1985), Bukenya and Labys (2000)]. In this paper simple correlation coefficients r_i^2 within different sub-periods of the total sample are calculated. The estimated correlation coefficients are then used to estimate the convergence indexes, b_{ij} and b_{iT} for the three per capita income indexes, where *i* represents a county, *j* a region, and *T* represents sub-periods in each case:

$$b_{ij} = \frac{r_{12}^2 + r_{13}^2 + r_{14}^2 + \ldots + r_{2021}^2}{n_{c_2}} \qquad (1)$$

where i = 1,…, 21 and j = 1, 2.

$$b_{iT} = \frac{\dfrac{r_{12}^2 + r_{13}^2 + r_{14}^2 + \ldots + r_{2021}^2}{n_{c_2}}}{\dfrac{r_{12}^2 + r_{13}^2 + r_{14}^2 + \ldots + r_{2021}^2}{n_{c_2}}} = \frac{b_{ij}}{C_1} \qquad (2)$$

where T = 1, 2, …, 6 and $c_1 = b_{ij}$ for the first sub-period. In equations (1) and (2) a coefficient of *b* equal to one, 1, would represent a perfect transmission of income shock, while a coefficient of zero would represent a short-run invariance to changes in incomes elsewhere. Since the short-run effect is in principle unrestricted, a value of b_{iT} greater than unity, for example, would suggest an over-reaction to changes in income in the current period.

The estimated results are presented in Tables 2, 3 and 4. The results in these tables not only show evidence of income instability within the sub-periods, but also across regions. The possible explanation for the observed trends, especially during the 1980s, is factors such as exogenous shocks (such as the oil price shocks) and national and international business cycle conditions (such as recession/depression). Income instabilities have been largely intertwined with swings in international business cycles.

The crucial phase occurred when OPEC sharply increased crude oil prices from \$3 per barrel in 1973, then to \$12 in 1974, and finally to \$40 in 1978. By 1980, however, higher oil prices had induced greater oil supplies and hence lower oil prices. Other commodity prices followed downwards and in 1980-1982, the world economy slipped into a recession that was its worse since the 1930's. Such strong business cycle interactions could well have caused the observed income instabilities. In general, correlation results do not support the convergence hypothesis, but rather a pattern of flactuating coherence.

F-test for Convergence

The F-test is used to test the null hypothesis, $H_0 : \sigma_{69}^2 \leq \sigma_{98}^2$ (ie., the standard deviation of per capita income in the intial year is less or equal to the standard deviation in the later year) against the alternative hypothesis, $H_A : \sigma_{69}^2 > \sigma_{98}^2$ (ie., the standard deviation of per capita income in the initial year is greater than the standard deviation in the later year) at the five percent level of significance. The statistic of this one-sided test is calculated by dividing the variance of one sample by the variance of a second sample: F-test = S_{69}^2 / S_{98}^2, where S_{69}^2 is the standard deviation squared for 1969 of observations n = 21, and S_{98}^2 is the standard deviation squared for 1998 of observations n = 21. The null hypothesis is rejected if $F > F(n-1, \alpha)$.

The results indicate that the null hypothesis, $H_0 : \sigma_{69}^2 \leq \sigma_{98}^2$, can be rejected in each of the three index series (Table 5). These results provide statistically significant evidence that convergence occurred during the study period for the three income indexes. Similar patterns to these observed here are reported in other US states (Barro and Sala-i-Martin, 1992a) and among Swedish counties in the 1920s (Persson, 1994). To explain the patterns observed, for instance, among the Swedish counties, Persson (1994) mentions trade union behavior, central government policies and migration. In this paper, the observed pattern can further be explained by government income transfer programs such as welfare benefits.

Time Series Analysis

The most intricate problem in analyzing the evolution of income disparities using time series data, is related to structural breaks that may be present in time series. Perron (1989) has shown that the presence of a unit root in time series indicates that the series are trend-stationary and contains a small number of structural breaks, or that the true data generating process is characterized by a random walk. A graphical representation of the data of this study revealed the presence of breaks and permanent shocks. It is for this reason that in this analysis, the deterministic time-trend hypothesis put forward by Helliwell (1994) is jointly tested with the hypothesis of unit roots and drift, by using augmented Dickey-Fuller tests (ADF) and Phillips-Perron unit root tests (PP).

The ADF and PP tests are carried out by estimating an equation with Y_{t-1} subtracted from both sides of the equations:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \varepsilon_t\,, \qquad (3)$$

where μ and γ are parameters and ε_t is assumed to be white noise. *Y* is a stationary series if $-1<\gamma<1$. If $\gamma=1$, Y is a nonstationary series (a random walk with drift); if the process is started at some point, the variance of Y increases steadily with time and goes to infinity. If the absolute value of γ is greater than one, the series is explosive. Therefore, the hypothesis of a stationary series is evaluated by testing whether the absolute value of γ is strictly less than one. Both the ADF and the PP tests[2] take the unit root as the null hypothesis $\gamma=1$. Since explosive series do not make economic sense, the null hypothesis is tested against the one-sided alternative: $\gamma<1$.

The results of the ADF and PP tests are presented in Tables 6 and 7. Looking at the 1969-1984 period (Table 6), the ADF tests indicate that the series are nonstationary; and the joint tests suggest that the null hypothesis of a unit root, zero drift and no trend cannot be rejected at the 5 percent critical value. For the same period, the PP test results are slightly ambiguous. First, the null hypothesis that a random walk process generates the levels of each of the three-index series of PI, PDI and PIT cannot be rejected. However, the joint hypothesis of a unit root is rejected at the 5 percent level for the *first differences* in each of the three indexes, when a time trend is not included in the regression. Overall, the time series results suggest that the null hypothesis of no convergence cannot be rejected for the 1969-1984 period.

Turning to the 1984-98 period (Table 7), the ADF tests results for the *levels* series are similar to the 1969-1984 results. They indicate that the null hypothesis that a random walk process generates the *level* series cannot be rejected for all series. However, for the *first deffernces* series the joint unit root, zero drift and no trend null hypothesis is rejected for the PDI and PI series, while it cannot be rejected for the PIT series. Thus, transfers appear to play a significant role in determining the presence of convergence in the 1984-

[2] It is worth noting that the ADF and PP tests use different methods to control for higher-order serial correlation in the series. The ADF test makes a parametric correction for higher-order correlation by assuming that the y series follows an AR(γ) process and adjusting the test methodology. The PP test is a nonparametric method of controlling for higher-order serial correlation in a series. While the ADF test corrects for higher order serial correlation by adding lagged difference terms on the right-hand side, the PP test makes a correction to the t-statistic of the γ-coefficient from the AR(1) regression to account for the serial correlation in ε.

1998 period. For the same period, the PP test results for the *level* series slightly ambiguous, but suggest that the joint unit root, zero drift and no trend null hypothesis can be rejected. The *first differences* series also suggest that the joint unit root, zero drift and no trend null hypothesis can be rejected at the 5 percent critical level for all the series.

Parametric Testing for β-Convergence

For parametric testing, the speed of convergence, β, is estimated. β-convergence would be observed if, in a cross-section data set, economic units that are initially poor tend to grow faster than rich units. To test the convergence hypothesis the methodology suggested by Sala-i-Martin (1996) is followed.

$$\frac{1}{T}\log\left(\frac{y_{i,t}}{y_{i,t-T}}\right) = \alpha_1 - \left(\frac{1-e^{-\beta_1 T}}{T}\right) * \log(y_{i,t-T}) + u_i \tag{4}$$

$$\frac{1}{T}\log\left(\frac{y_{i,t}}{y_{i,t-T}}\right) = \alpha_2 - \left(\frac{1-e^{-\beta_2 T}}{T}\right) * \log(y_{i,t-T}) + \delta_1 AGR_{i,t} + \delta_2 IND_{i,t} + \delta_3 MIG_{i,t} + u_i \tag{5}$$

where $y_{i,t}$ is real per capita income in region *i* at time t, *T* is the length of the interval, α_i is the intercept, β_i (i = 1, 2) is the rate of convergence parameter, δ_i are linear parameters and u_i is the disturbance term. In equations (4) and (5), if regions with initially lower per capita real income, $y_{i,t-T}$, grow faster than regions with higher per capita real income, then $\beta > 0$, and there is convergence.

The results as dipicted in Tables 8, 9 and 10 indicate that the models explain the process of convergence relatively well (Adjusted R-squares range between 83 to 94 percent). These results suggest that the southern and eastern panhandle counties observed β-convergence between 1969-1985 and between 1985-1998. Based on these results the null hypothesis of no convergence can be rejected at the one- percent critical level.

Specifically, the results imply that the poor counties were catching up to the rich ones at a rate between 1.8 and 2.4 percent annually, based on PI and PIT indexes; and at a rate between 1.9 and 2.1 percent based on the PDI index. The results show that the estimated speed of convergence is much slower for PDI than for PI and PIT after 1985. In testing the stability of the β-coefficients between the period 1969-1985 and 1985-1998, the results reveal that there is no change in the process of convergence between the two periods.

The effect of several control variables on the process of convergence is also tested. Looking at the 1969-1985 period, model 1A, the inclusion of the control variable affects the adjusted R-squares marginally. That is to say, convergence among counties before 1985 is mostly a function of the counties' initial per capita real incomes. For the period after 1985, model 1B, the inclusion of the control variables is more important as the adjusted R-squares increase from 0.84 to 0.92 for PI, 0.83 to 0.90 for PDI and 0.83 to 0.92 for PIT. This suggests that the rate of migration and the employment structure of the regions largely influence the speed of convergence in per capita real income in the period after 1985. Thus, the parametric test results support the convergence hypothesis.

Conclusions

A cross-section and time series data are used to examine whether the patterns of per capita real income across the southern and eastern panhandle regions of West Virginia are consistent with the convergence hypothesis. Inflation-adjusted per capita household income as reported by the US Census of Population is used because the data are available for both regions and because the statistics provide a measure of changes in living standards for typical American households over time.

First, the estimated results concur with the conclusions reached by previous studies that divergence in the 1980s replaced the convergence that was observed in earlier decades. Second, cross-section results supported the convergence hypothesis, while time series (stationarity test) results are ambivalent. The observed weak relationship between cross-section and time series results is not unexpected. For time series analysis, it has been documented in the literature (Baffes and Ajwad, 1998; Hamilton, 1994; Bukenya and Labys, 2000) that conventional stationarity tests exhibit low power and may give misleading results regarding the true degree of cointegration.

Third, the results showed that the gap in per capita real income between the southern and eastern panhandle counties had narrowed after the 1960s, though at a slow rate of about 2 percent per year. Fourth, the results suggest that the rate of migration and the employment structure of the regions influenced the speed of convergence. Fifth, the data revealed that before the 1980s average per capita real incomes in the southern counties were higher than average per capita real incomes in the eastern panhandle counties. However, this trend was reversed during the 1980s following the collapse of the mining industry. From a policy perspective, the results suggest that reductions in personal direct taxes, and increases in government transfers and, possibly, other government assistance programs are the alternative tools for use by policy makers to further close the income gap between the regions.

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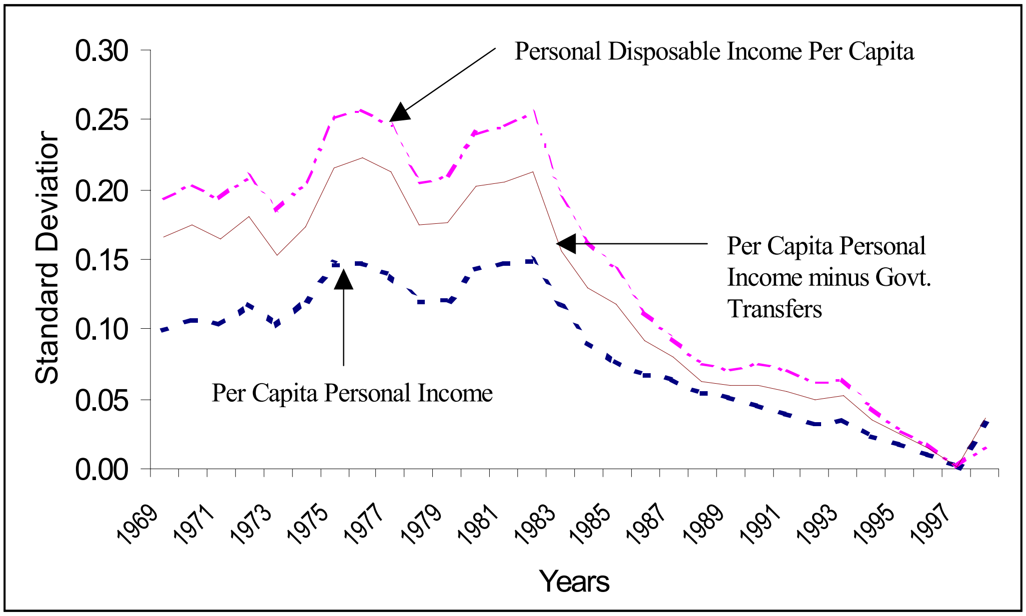

Figure* 1: *Sigma* Convergence for Per Capita Income 1969-1998.
*Dispersion of logarithm of real per capita incomes in 1997 prices

Table 1: Test of Equality of Means among Income Series and Estimates of *Sigma* Convergence for the Study Areas.

	Southern WV Counties			***Eastern Panhandle Counties***			***Southern & Eastern Panhandle Counties***		
	Index Numbers (1997=100)								
	Mean Indexes⊗						**σ- Convergence Indexes***		
Year	PI	PDI	PIT	PI	PDI	PIT	PI	PDI	PIT
1969	14.47	20.59	18.33	13.77	16.94	15.47	0.100	0.194	0.166
1979	42.55	52.41	47.69	36.38	40.76	38.53	0.121	0.210	0.176
1989	69.08	72.70	74.31	73.25	75.14	76.26	0.051	0.071	0.060
1998	96.69	103.66	108.51	97.15	102.89	112.27	0.030	0.016	0.036
	Sub-Periods								
1969 – 1979	27.05	34.14	30.72	23.04	26.42	24.70	0.333	0.335	0.345
1979 – 1989	57.20	63.17	61.82	54.14	55.76	56.05	0.210	0.224	0.221
1989 – 1998	86.28	89.49	90.07	87.22	89.61	90.83	0.126	0.115	0.115
1969 – 1998	54.09	61.34	59.89	51.92	56.14	56.05	0.609	0.538	0.569

⊗ Equality test based on the mean indexes for all per capita real income series in the region.
* Standard deviation of log of per capita real income series.

Table 2: Estimated Correlation Convergence Index for PI

Years	Index	Southern Region	Eastern Panhandle Region	Southern and Eastern Panhandle Regions
1969 – 1973	b_{ij}	0.985	0.987	0.979
	b_T	1.000	1.000	1.000
1974 – 1978	b_{ij}	0.975	0.992	0.969
	b_T	0.990	1.005	0.989
1979 – 1983	b_{ij}	0.963	0.962	0.938
	b_T	0.978	0.975	0.958
1984 – 1988	b_{ij}	0.784	0.981	0.853
	b_T	0.796	0.994	0.871
1989 – 1993	b_{ij}	0.983	0.965	0.967
	b_T	0.998	0.978	0.988
1994 – 1998	b_{ij}	0.982	0.989	0.975
	b_T	0.997	1.002	0.996
1969 – 1998	b_{ij}	0.995	0.993	0.988
	b_T	1.010	1.006	1.009
Number of Counties		13	8	21

Table 3: Estimated Correlation Convergence Index for PIT

Years	Index	Southern Region	Eastern Panhandle Region	Southern and Eastern Panhandle Regions
1969 – 1973	b_{ij}	0.961	0.981	0.960
	b_T	1.000	1.000	1.000
1974 – 1978	b_{ij}	0.954	0.986	0.944
	b_T	0.993	1.005	0.983
1979 – 1983	b_{ij}	0.874	0.902	0.809
	b_T	0.909	0.919	0.843
1984 – 1988	b_{ij}	0.626	0.972	0.744
	b_T	0.651	0.991	0.775
1989 – 1993	b_{ij}	0.929	0.897	0.892
	b_T	0.967	0.914	0.929
1994 – 1998	b_{ij}	0.963	0.986	0.964
	b_T	1.002	1.005	1.004
1969 – 1998	b_{ij}	0.983	0.988	0.976
	b_T	1.023	1.007	1.017
Number of Counties		13	8	21

Table 4: Estimated Correlation Convergence Index for PDI

Years	Index	Southern Region	Eastern Panhandle Region	Southern and Eastern Panhandle Regions
1969 – 1973	b_{ij}	0.955	0.977	0.954
	b_T	1.000	1.000	1.000
1974 – 1978	b_{ij}	0.733	0.564	0.546
	b_T	0.768	0.577	0.572
1979 – 1983	b_{ij}	0.493	0.953	0.646
	b_T	0.516	0.975	0.677
1984 – 1988	b_{ij}	0.917	0.877	0.874
	b_T	0.960	0.898	0.916
1989 – 1993	b_{ij}	0.843	0.815	0.823
	b_T	0.883	0.834	0.863
1994 – 1998	b_{ij}	0.964	0.983	0.959
	b_T	1.009	1.006	1.005
1969 – 1998	b_{ij}	0.955	0.977	0.954
	b_T	1.000	1.000	1.000
Number of Counties		13	8	21

Table 5: F-test Results

Hypothesis	F-test Statistics
Southern Region and Eastern Panhandle Counties	
Null Hypothesis: $H_0 : \sigma^2_{69} \le \sigma^2_{98}$ Against Alternative Hypothesis: $H_A : \sigma^2_{69} > \sigma^2_{98}$	PI 11.11* PDI 147* PIT 21.26*
N=21	

* Denotes rejection of the null hypothesis at 5% significance level.

Table 6: Unit Root Tests (1969-84)

Null Hypothesis		ADF Test Statistics		PP Test Statistics		⊕ Critical Value: 5%
		Levels	1st Differences	Levels	1st Differences	
Constant no Trend	PI	-1.306	-1.909	-0.815	-2.544	-3.08
$H_0 : \gamma = 0$	PDI	-1.853	-2.393	-1.273	-2.797	
T-Test	PIT	-1.539	-2.180	-1.062	-2.807	
F-Test	PI	1.298	2.902	0.125	6.517*	4.03
	PDI	1.969	4.004	0.929	7.981*	
	PIT	1.419	3.688	0.500	7.979*	
Constant with Trend	PI	-0.639	-2.826	-0.176	-3.214	-3.76
$H_0 : \gamma = 0$	PDI	-1.385	-2.900	-0.874	-3.147	
T-Test	PIT	-1.137	-2.763	-0.741	-3.188	
F-Test	PI	1.434	4.064	1.414	5.336	5.34
	PDI	1.422	3.882	1.463	5.093	
	PIT	1.224	3.840	1.370	5.210	

*Denotes rejection of the hypothesis

⊕ Denotes MacKinnon (1991) critical values for unit root tests

Table 7: Unit Root Tests (1984-98)

Null Hypothesis		ADF Test Statistics		PP Test Statistics		⊕ Critical Value: 5%
		Levels	1st Differences	Levels	1st Differences	
Constant no Trend	PI	-1.747	-1.463	-2.240	-3.647*	-3.08
$H_0 : \gamma = 0$	PDI	-1.621	-3.081	-2.064	-6.216*	
T-Test	PIT	-1.579	-1.744	-2.061	-3.378*	
F-Test	PI	2.751	7.227*	5.699*	12.911*	4.03
	PDI	2.357	21.012*	5.003*	36.339*	
	PIT	2.366	4.026	4.846*	11.521*	
Constant with Trend	PI	-0.893	-1.871	-1.127	-3.940*	-3.76
$H_0 : \gamma = 0$	PDI	-1.896	-2.831	-2.097	-5.826*	
T-Test	PIT	-0.306	-2.241	-0.928	-3.813*	
F-Test	PI	1.813	5.382*	2.686	8.331*	5.34
	PDI	2.713	13.748*	4.428	20.135*	
	PIT	1.453	4.963	2.246	7.574*	

* Denotes rejection of the hypothesis.
⊕ Denotes MacKinnon (1991) critical values for unit root tests

Table 8: Regression Models for Per Capita Real Personal Income (PI)

MODEL	1A		1B		2
Period	1969-85		1985-98		1969-98
Equation	(i)	(ii)	(i)	(ii)	(ii)
Constant	0.1876 (2.042)	0.260 (2.681)	0.185 (4.193)	0.254 (3.810)	0.244 (2.556)
β	0.018* (4.95)	0.022* (3.72)	0.019* (4.88)	0.024* (3.50)	0.018* (3.82)
AGRICULTURE	----	-0.004 (-0.681)	----	-0.004 (-0.104)	-0.004 (-0.064)
INDUSTRY	-----	-0.003** (-2.55)	----	-8.77E-02* (-2.58)	-0.003* (-3.55)
MIGRATION	-----	0.32*** (1.56)	----	0.27** (2.11)	0.039** (1.91)
Observation	21	21	21	21	21
R^2 (R^2_{adj})	0.90(0.88)	0.92(0.90)	0.86(0.84)	0.93(0.92)	0.88(0.85)
Test of β-stability	χ^2 =1.51	χ^2 =0.66			

Note: t-statistics in parentheses.
*, **, and *** indicate significance at 1, 5 and 10 %, respectively using a two-tailed test.
The regressions use non-linear regression to estimate the models. For models 1a and 1b the estimation method is SUR. The test of β-stability tests (using a Wald-test) the hypothesis that the β in model 1a equals the β in model 1b.

Table 9: Regression Models for Per Capita Real Disposable Income (PDI)

MODEL	1A		1B		2
Period	1969—85		1985—98		1969—98
Equation	(i)	(ii)	(i)	(ii)	(ii)
Constant	0.344 (4.802)	0.382 (6.832)	0.857 (3.162)	0.220 (5.813)	0.711 (3.226)
β	0.019* (4.94)	0.021* (3.71)	0.020* (4.88)	0.021* (3.50)	0.018* (3.82)
AGRICULTURE	----	-0.009 (-1.02)	----	-0.003 (-0.55)	-0.001 (-0.17)
INDUSTRY	-----	-0.0003* (-3.77)	----	-0.0003* (-3.15)	-0.0003* (-2.88)
MIGRATION	-----	0.191** (1.755)	----	0.23** (1.75)	0.133** (2.17)
Observation	21	21	21	21	21
R^2 (R^2_{adj})	0.89(0.87)	0.91(0.90)	0.85(0.83)	0.92(0.90)	0.89(0.86)
Test of β-stability	χ^2 =1.54	χ^2 =0.76			

Note: t-statistics in parentheses.
*, **, and *** indicate significance at 1, 5 and 10 %, respectively using a two-tailed test.
The regressions use non-linear regression to estimate the models. For models 1a and 1b the estimation method is SUR. The test of β-stability tests (using a Wald-test) the hypothesis that the β in model 1a equals the β in model 1b.

Table 10: Regression Models for Per Capita Real Personal Incomes Minus Transfers (PIT)

MODEL	1A		1B		2
Period	1969—85		1985—98		1969—98
Equation	(i)	(ii)	(i)	(ii)	(ii)
Constant	0.200 (2.89)	0.575 (2.93)	0.191 (3.53)	0.499 (2.43)	0.251 (2.87)
β	0.018* (11.31)	0.022* (8.32)	0.021* (14.04)	0.024* (6.94)	0.016* (12.06)
AGRICULTURE	----	-0.0002 (-0.40)	----	-0.0002 (-0.35)	-0.003*** (-1.75)
INDUSTRY	-----	-0.00018* (-6.22)	----	-0.00016* (-5.60)	-0.0003* (-2.93)
MIGRATION	-----	0.134*** (1.49)	----	0.201** (1.70)	0.233** (1.83)
Observation	21	21	21	21	21
R^2 (R^2_{adj})	0.90(0.89)	0.91(0.90)	0.85(0.83)	0.94(0.92)	0.88(0.85)
Test of β-stability	χ^2 =1.53	χ^2 =0.79			

Note: t-statistics in parentheses.
*, **, and *** indicate significance at 1, 5 and 10 %, respectively using a two-tailed test.
The regressions use non-linear regression to estimate the models. For models 1a and 1b the estimation method is SUR. The test of β-stability tests (using a Wald-test) the hypothesis that the β in model 1a equals the β in model 1b.