

PART III - EXPLORATORY ANALYSIS

6. Assessing the Sensitivity of Current Indicators

Here we conduct an exploratory analysis to examine the sensitivity of different measures of distress. The purpose is to examine the degree of consistency in classifying counties based on changing assumptions about relevant variables that can be included in distress indexes.

Figure 6.1 shows the current distress indicator map for the ARC region, whereas Figure 6.2 reports the pattern for the U.S. as a whole. At the ARC level, distress is concentrated in Central Appalachia in Southwest West Virginia and Southeast Kentucky, as well as in Northeast Mississippi. Under the current formula, there are no distressed counties in New York and Georgia and there is only one distressed county in Pennsylvania. In the rest of the country, distress is most apparent in the Mississippi Delta, along with counties in the Rio Grande, in the Historic Cotton Belt, and in Native American reservations in the West.

Figure 6.3 reports poverty rates for the ARC region, while Figure 6.4 presents the same figures for the U.S. The clear pattern in both cases is that measures of distress closely correspond to the poverty rate. There are two clear causes of this pattern. One, the other indicators (unemployment and PCMI) are both correlated with poverty rates, as shown in Table 6.1. The other is that the poverty rate is more prone to vary across the nation, meaning it drives the variability in the distress indicator. Thus, the current ARC distress indicator is really a “high-poverty” indicator. Likewise, because poverty is so persistent, the current listing of ARC distressed counties would closely correspond to counties that had very high poverty rates in the late 1970s (Partridge, 2007). Conversely, the two candidate indicators for our analysis display a somewhat different pattern. Population change has lower correlations with the other variables, suggesting it provides independent information, but high school attainment is highly correlated with the existing indicators.

Figure 6.5 shows the relative three-year average (2002-2004) unemployment rate in the United States and the ARC region. As noted above, the unemployment rate does not vary greatly across the region, being slightly higher in Central Appalachia and slightly lower in North Alabama and North Georgia. Figure 6.6 reports the relative PCMI in 2003. The pattern is that relative PCMI is lowest in South and especially Central Appalachian counties, and is highest in the Northern counties.

As noted in Section 5, two indicators that appear to be especially worthy of being potential distress indicators are educational attainment and percent change in population change. For the ARC region, Figure 6.7 reports educational attainment as the percent of the adult population over 25 years of age that have achieved at least a high school degree. Likewise, Figure 6.8 illustrates the percent population change over the 2000-2005 period.

The figures repeat the consistent pattern of distress in Central Appalachia—in this case, being depicted by low educational attainment and significant population loss. Yet, there are differences between the two measures. Educational attainment is lower in Central and South Appalachia, but only modestly below the national average in North Appalachia. Population growth is much

weaker in North Appalachia, while actually quite robust in parts of South Appalachia—especially in North Georgia (Lichter et al., 2005). If educational attainment was used as a measure of distress, the range of distressed counties would likely tilt south, with the opposite being the case if population change was used as a distress indicator. Nonetheless, regardless of the choice of distress indicators, there will be most assuredly a cluster of distressed counties in Central Appalachia as well as in Northeast Mississippi, while North Georgia will appear to be relatively prosperous. Other changes would likely occur elsewhere.

Therefore, we briefly examine the sensitivity of the distress measures to include population change and educational attainment. This analysis is **only** for illustrative purposes and does not necessarily represent the best measures of distress, which would require a complete statistical analysis and assessment of the proper weights. Specifically, we will consider two alternatives, one where we replace the unemployment rate with relative education and another where we replace the unemployment rate with the percent change in population over the 2000-2005 period.²⁹ Further analysis would need to assess other possibilities.

	Poverty rate	PCMI	Unemployment	Population change	High school completion rate
Poverty rate	1.00				
PCMI	-0.61*	1.00			
Unemployment	0.46*	-0.41*	1.00		
Population change	-0.26*	0.22*	-0.08*	1.00	
High school completion rate	-0.71*	0.60*	-0.46*	0.13*	1.00

* Significant at the one percent significance level, N=3108 U.S. counties.

Table 6.1: Correlation Matrix of the Economic Indicators

Our methodology is the same as that currently used by the ARC to determine distressed counties. Namely, we calculate each variable *relative* to the U.S. average, sum the scores, and rank them relative to the universe of over 3,100 U.S. counties. If an ARC county falls in the bottom 10% of the national ranking, it is deemed “distressed,” if it falls in the bottom 10 to 25%, it is labeled “at risk,” and so on (ARC, 2007). Of course, it is very unlikely that an optimal distress index would give these variables equal weight—if only because they would have different standard deviations and thus, have more or less impact at the extremes (i.e., a variable with higher standard deviation would be more prone to push a county down into the distressed category or above into the attainment category). Likewise, it is by no means clear that the ARC distress indicator list would exactly include three variables (e.g., Glasmeier et al., (2003) propose using more distress indicators). Moreover, it still needs to be determined which specific indicators should compose a distress indicator list.

²⁹We remove the unemployment rate because of our impression from key informants that it is no longer a good measure of distress. Further research would be needed to confirm this point.

Our alternative variable for educational attainment is the 2000 Census national adult share of the population with at least a high school degree divided by the corresponding county share [(U.S. national value/county value)*100]. This is for illustrative purposes, as further assessment should also consider the college graduate share. For population change, we use an analogous approach, though we cannot exactly use a parallel measure. The problem arises because we would have to divide by negative population change when counties lost population—which would not be desirable for an additive index. Instead, we create a distress measure of population change that is normalized to have the same standard deviation as the relative poverty rate (County Poverty rate/U.S. national poverty rate).³⁰

We present the results for these two alternative indicators. First, Tables 6.2 and 6.3 show changes in economic status in the United States and Appalachian counties respectively, as result of removing unemployment rate from the ARC's national index for the fiscal year 2007 and replacing it with educational attainment and population change. For example, for the United States as a whole, 51 “at-risk” and 20 “transitional” counties now fall in the “distressed” category when including the population change index and 52 “at-risk” counties are now “distressed” when considering the educational attainment index. Fourteen and three counties shift from “distressed” to “transitional” with the population change and education attainment indices, respectively. Counties only shift from “distressed” to “at-risk” and “transitional” status.

In Appalachia, counties also switch from “at-risk” to distressed status. Six at-risk counties switch to distressed with the population change index and 15 with educational index. No counties switch from the transitional, competitive, and attainment categories to the distressed category in Appalachia. Counties mostly switch from distressed to at-risk when using our approach. Compared to the current ARC distress indicator, 19 counties either switch into or out of distress using population change and 22 counties change distress status when using educational attainment. Thus, about one-fourth to one third of the counties classified as distressed would differ from the current ARC distress classification.

³⁰First, we calculate a z-score, or how many standard deviations a county is either *below* the mean U.S. county population growth rate over the 2000-2005 period, or how many standard deviations a county is above the mean U.S. county growth rate. To correspond to the notion that the *bigger* the number, the greater the distress, we then calculate a “normalized” population standard deviation. By normalized, we mean for counties with *below* the national average county population growth, we assign the number of standard deviations a *positive* number, while for counties with above-average population growth, we give the corresponding standard deviation figure a *negative* number (i.e., the negative z-score). We then calculate the standard deviation of the relative poverty rate (County Poverty Rate/U.S. Poverty Rate), which equals 0.527. That is, the relative county poverty rate has a standard deviation of about 53 percentage points around the mean. Thus, the relative population number used in calculating our refined distress index is derived as:

Pop Index Measure = $100 - 52.7 \times (\text{normalized population standard deviations from the national average})$. We use 52.7 since the relative poverty rate is multiplied by 100.

Normalizing the Pop Index Measure to have the same standard deviation as the relative poverty rate gives poverty and net population about equal weight in the distress index. To give an example in constructing this number, Gilmer County, West Virginia's 2000-2005 population growth was 1.18 standard deviations *below* the mean U.S. county average. The resulting Pop Index Measure for Gilmer County then equals $100 - (52.7) \times (-1.18) = 162.2$. Of course, further analysis would need to assess whether the standard deviation of population index should be benchmarked to the poverty rate. See Feser and Sweeney (2003) for a similar discussion of the difficulties of normalizing population-change metrics.

Figures 6.9 and 6.10 portray the new distress status under our approach. For the United States, these two Figures need to be compared with Figure 6.2 to determine the change in economic status on a state-by-state basis. In Michigan for example, three counties appear distressed under the ARC's approach, but at-risk under our alternative using the educational attainment variable. Under the alternative with the population change variable, one of them remains distressed and two become at-risk.

Tables 6.4 and 6.5 present predictions of county economic status in the Appalachian states by both the ARC's index and our two alternatives. In Ohio, for example, the ARC approach produces three distressed counties while our alternatives produce zero and one distressed county, respectively. In such states as Alabama and Mississippi, the number of distressed counties remains the same regardless of approaches. Nonetheless, the specific counties that fall into distress can differ between the two approaches. Likewise, no indicators predict a distressed county in Georgia, Maryland, New York, North Carolina, and South Carolina. While our alternative index with the educational attainment variable predicts more distressed counties in Kentucky, Tennessee, and Virginia; the opposite is observed when using our index with the population change variable. In total, across all five distress designation categories, 91 ARC counties would change their current status if the population growth alternative was used and 61 counties would change their designation if the education alternative was used.

Table 6.6 reports the results for the Appalachian sub-regions. Neither approach predicts a single attainment county in Central Appalachia. Counties are either distressed, at-risk of becoming distressed, or transitional, though one county falls into the competitive category under our added-population approach. While more than 65% of the Central Appalachia counties are classified as distressed under our alternative with the educational attainment variable, about 50% of them are so labeled under the two other indicators. In Northern Appalachia, both approaches put about two-thirds of the counties in the transitional category. Whereas the ARC's approach predicts attainment counties only in the Southern Appalachia, our approach predicts such counties in Northern and Southern Appalachia. It is worth noting that more attainment counties are predicted in Southern Appalachia by our added-population approach, since population growth is stronger in parts of this sub-region as shown in Figure 6.8.

The results above indicate that, in predicting distressed counties, in some cases our approach is consistent with that of ARC, while in other cases, the two approaches disagree. Although we are not endorsing our sensitivity measures (they are only for illustrative purposes), they do clearly show that small subtle changes can produce different counties categorized as in distress, illustrating some sensitivity to the analysis.

For the United States a whole, Figures 6.11 and 6.12 consist of a pair of maps comparing our approach with that of ARC in terms of predicting distressed and non-distressed counties. Red indicates cases where both methods produce the same prediction for a distressed county (scenario 1); blue represents cases where the ARC approach produces a distressed county prediction, but our alternative does not (scenario 2); green represents cases where our method produces a distressed county prediction, but the ARC approach does not (scenario 3); while white represents cases where both methods suggest the county is not distressed (scenario 4).

ARC 's Distress status	Alternative Distressed		Alternative At-risk		Alternative Transitional		Alternative Competitive		Attainment	
	Population	Education	Population	Education	Population	Education	Population	Education	Population	Education
Distressed	-	-	57	49	14	3	0	0	0	0
At-risk	51	52	-	-	149	93	6	0	0	0
Transitional	20	0	144	96	-	-	167	118	56	6
Competitive	0	0	5	0	188	124	-	-	80	59
Attainment	0	0	0	0	36	0	99	65	-	-

The Row indicates current ARC classification and the column is the classification for the alternative indicator.

Education indicates an alternative indicator index where unemployment is replaced with the education index

Population indicates an alternative indicator index where unemployment is replaced with the population index

Table 6.2: Change of County Economic Status in the United States

ARC's Distress status	Alternative Distressed		Alternative At-risk		Alternative Transitional		Alternative Competitive		Attainment	
	Population	Education	Population	Education	Population	Education	Population	Education	Population	Education
Distressed	-	-	13	7	1	0	0	0	0	0
At-risk	6	15	-	-	25	9	0	0	0	0
Transitional	0	0	10	15	-	-	18	4	5	0
Competitive	0	0	0	0	4	8	-	-	8	1
Attainment	0	0	0	0	0	0	1	2	-	-

The Row indicates current ARC classification and the column is the classification for the alternative indicator.

Education indicates an alternative indicator index where unemployment is replaced with the education index

Population indicates an alternative indicator index where unemployment is replaced with the population index

Table 6.3: Change of County Economic Status in Appalachia

The results for Appalachia suggest that for seven out of 13 states, the ARC’s approach agrees with our alternative distress indicator approach in indicating a distressed county (see Tables 6.4 and 6.5). Figure 6.11 shows that our added-education indicator tends to predict more distress in Kentucky, Tennessee, and Virginia and less distress in Ohio and Pennsylvania. Figure 6.12 shows that the added-population approach tends to add more cases in Virginia, while there are fewer distressed counties in Kentucky, Ohio, Tennessee, and West Virginia.

To provide further refinement, we create an additional category for **descriptive** purposes only—“weakly” and “strongly” transitional counties, which is respectively distinguished by a county being below or above the national average. Thus, the “weakly transitional” counties include those ranking between the *worst* 25 and 50% of the U.S. counties and the “strongly transitional” counties are those ranking between the *best* 25 and 50% of the U.S. counties. Figures A-1, A-2, and A-3 in appendix present the refined economic status for both ARC and our approaches.

Summary Evaluation: Even when using *ad hoc* alternative distress indicators that are only modestly different from those used in the current ARC distress index, both the number and types of counties that fall into distress can be somewhat different. It is likely that using other indicators would produce very different results. Moreover, the current ARC distress index implicitly places more weight on the poverty rate due to poverty’s high variability. Changing the variable weights to z-scores would likely further shift the distress index. The point is that for a variety of reasons, measures of distress are somewhat sensitive to the underlying assumptions.

States	Distressed		At-risk		Transitional		Competitive		Attainment		Total
	ARC	Education	ARC	Education	ARC	Education	ARC	Education	ARC	Education	
Alabama	3	3	9	11	23	21	1	1	1	1	37
Georgia	0	0	0	3	26	28	6	3	5	3	37
Kentucky	34	41	11	4	6	6	0	0	0	0	51
Maryland	0	0	0	0	2	2	1	1	0	0	3
Mississippi	9	9	11	11	4	4	0	0	0	0	24
New York	0	0	0	0	14	14	0	0	0	0	14
North Carolina	0	0	7	5	18	20	4	4	0	0	29
Ohio	3	0	10	9	15	19	1	0	0	1	29
Pennsylvania	1	0	1	1	45	42	5	9	0	0	52
South Carolina	0	0	1	0	4	5	1	1	0	0	6
Tennessee	7	11	12	12	27	26	4	1	0	0	50
Virginia	1	3	4	4	15	13	1	1	1	1	22
West Virginia	16	15	16	20	21	18	2	2	0	0	55
Total	74	82	82	80	220	218	26	23	7	6	409*

ARC indicates the ARC's current index composed of three indicators: poverty, income, and unemployment

Education indicates an alternative indicator index where unemployment is replaced with the education index

*There is one missing value for the education attainment variable in Virginia.

**The composition of specific counties differs across the different distress indicator approaches.

Table 6.4: Economic Status Prediction in Appalachian States with the Added-education Approach

States	Distressed		At-risk		Transitional		Competitive		Attainment		Total
	ARC	Population	ARC	Population	ARC	Population	ARC	Population	ARC	Population	
Alabama	3	3	9	9	23	20	1	4	1	1	37
Georgia	0	0	0	0	26	14	6	11	5	12	37
Kentucky	34	32	11	10	6	8	0	1	0	0	51
Maryland	0	0	0	0	2	2	1	1	0	0	3
Mississippi	9	9	11	10	4	5	0	0	0	0	24
New York	0	0	0	0	14	14	0	0	0	0	14
North Carolina	0	0	7	2	18	21	4	5	0	1	29
Ohio	3	1	10	8	15	19	1	0	0	1	29
Pennsylvania	1	0	1	2	45	45	5	3	0	2	52
South Carolina	0	0	1	0	4	5	1	1	0	0	6
Tennessee	7	4	12	9	27	33	4	4	0	0	50
Virginia	1	3	4	5	16	14	1	1	1	0	23
West Virginia	16	14	16	19	21	18	2	2	0	2	55
Total	74	66	82	74	220	218	26	33	7	19	410

ARC indicates the ARC's distress indicator index composed of poverty, income, and unemployment

Population indicates an alternative indicator index where unemployment is replaced with the population index.

*The composition of specific counties differs across the different distress indicator approaches.

Table 6.5: Economic Status Prediction in Appalachian States with the Added-population Approach

Distress status	Indicators^a	Central	Northern	Southern	Total
Distressed	ARC	45	14	15	74
	Population	43	9	14	66
	Education	57	9	16	82
At-risk	ARC	22	26	34	82
	Population	23	26	25	74
	Education	16	27	37	80
Transitional	ARC	20	95	106	221
	Population	20	98	100	218
	Education	14	95	109	218
Competitive	ARC	0	9	17	26
	Population	1	6	26	33
	Education	0	12	11	23
Attainment	ARC	0	0	7	7
	Population	0	5	14	19
	Education	0	1	5	6
Total		87	144	179	410

^aARC indicates the ARC's current index composed of poverty, income, and unemployment
Education indicates our alternative index where unemployment is replaced with the education index
Population indicates our alternative index where unemployment is replaced with the population index
 *The composition of specific counties differs across the different distress indicator approaches.

Table 6.6: Change in Economic Status of the Appalachian Sub-regions

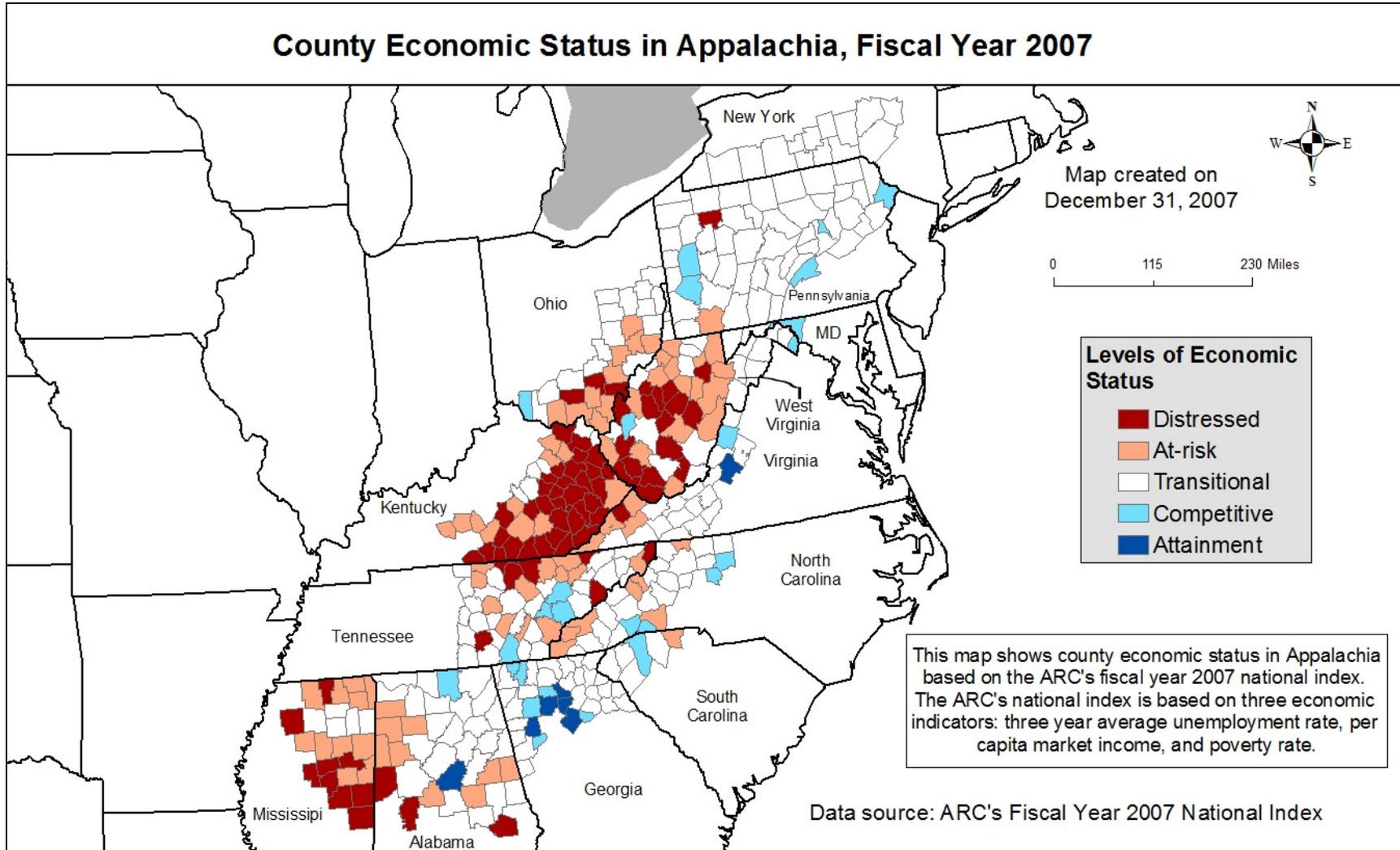
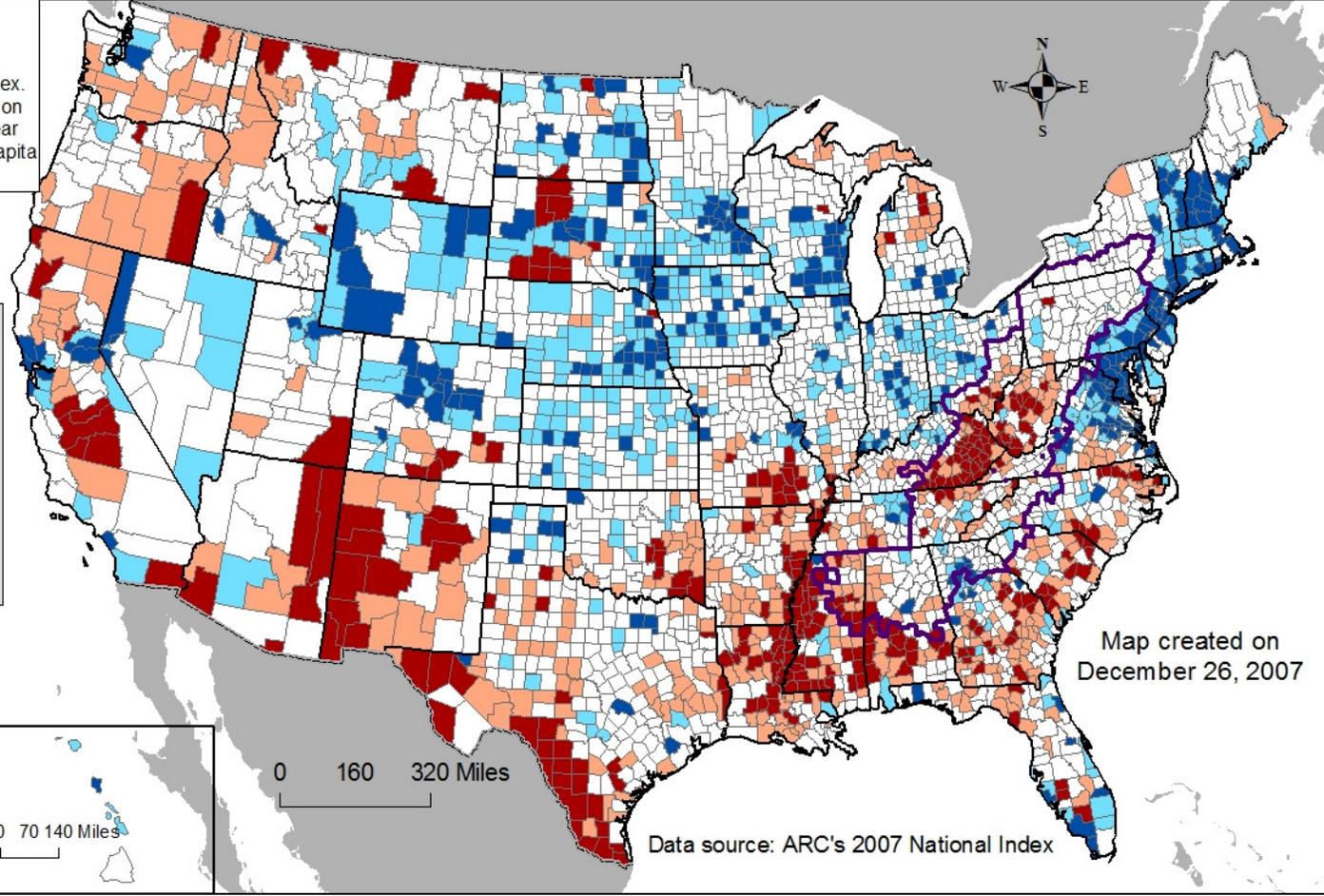


Figure 6.1: Distress Indicator Map for the ARC Region

County Economic Status in the United States and Appalachia, Fiscal Year 2007

This map shows county economic status in the United States and Appalachia based on the ARC's fiscal year 2007 national index. The ARC's national index is based on three economic indicators: three year average unemployment rate, per capita market income, and poverty rate.

- Levels of Economic Status**
- Distressed
 - At-risk
 - Transitional
 - Competitive
 - Attainment
 - Appalachian Region



Map created on
December 26, 2007

Data source: ARC's 2007 National Index

Figure 6.2: Distress Indicator Map for the U.S. as a Whole

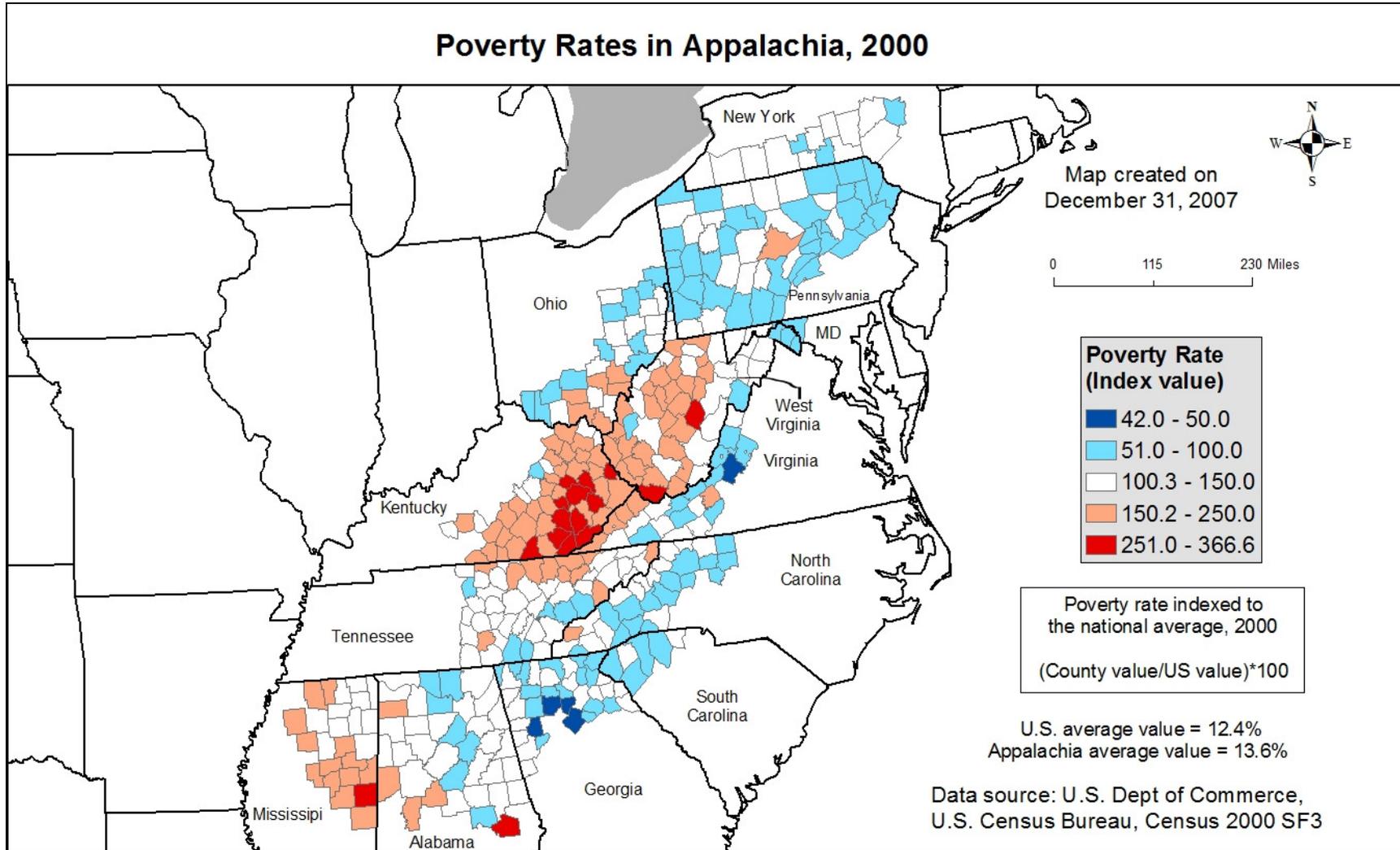


Figure 6.3: Poverty Rate Map in the Appalachian Region

Poverty Rates in the United States and Appalachia, 2000

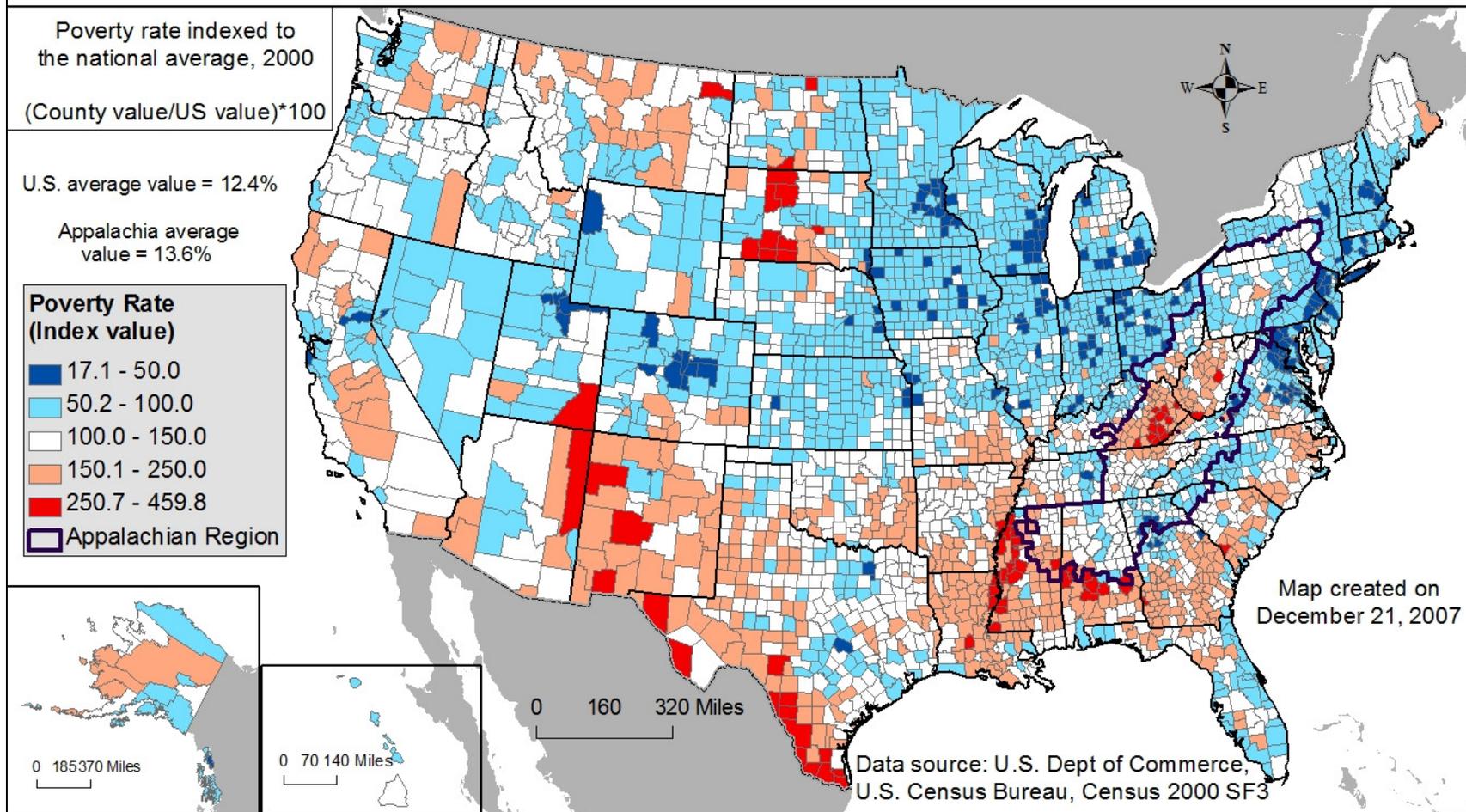


Figure 6.4: Map of Poverty Rates in the United States

Unemployment Rates in the United States and Appalachia, 2002-2004

Three-year average unemployment rate indexed to the national average, 2002-2004

$(\text{County value}/\text{US value}) \times 100$

U.S. value = 100

Appalachia value = 99.6

Unemployment Rate (Index value)

- 175 - 322
- 131 - 174
- 101 - 130
- 61 - 100
- 34 - 60
- Appalachian Region

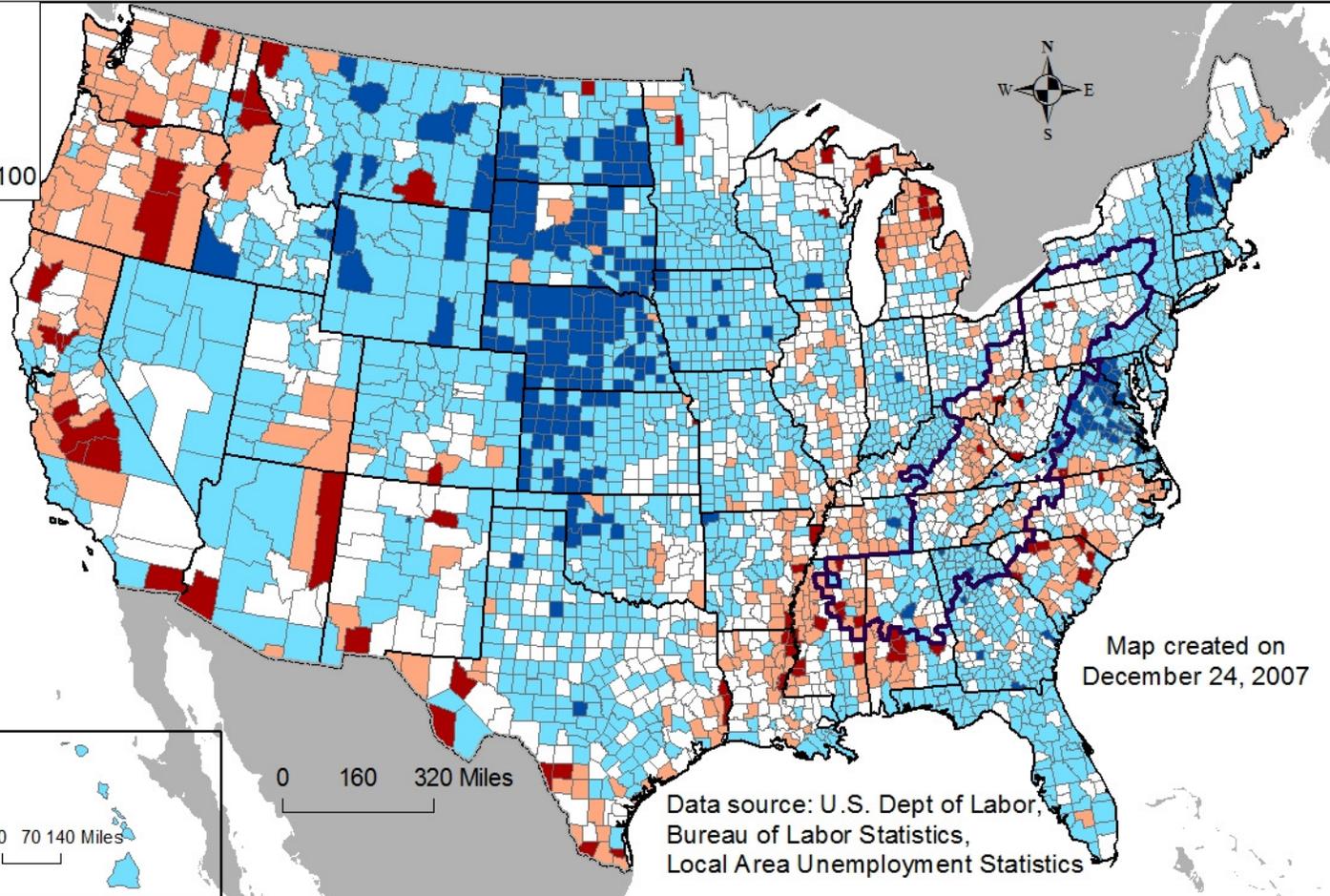


Figure 6.5: Map of Unemployment Rates in the United States and Appalachia

Per Capita Market Income in the United States and Appalachia, 2003

Per capita market income indexed to the national average, 2003
Inverse of (county value/US value)*100

Per capita market income

- 229 - 419
- 177 - 228
- 143 - 176
- 111 - 142
- 36 - 110
- Appalachian Region

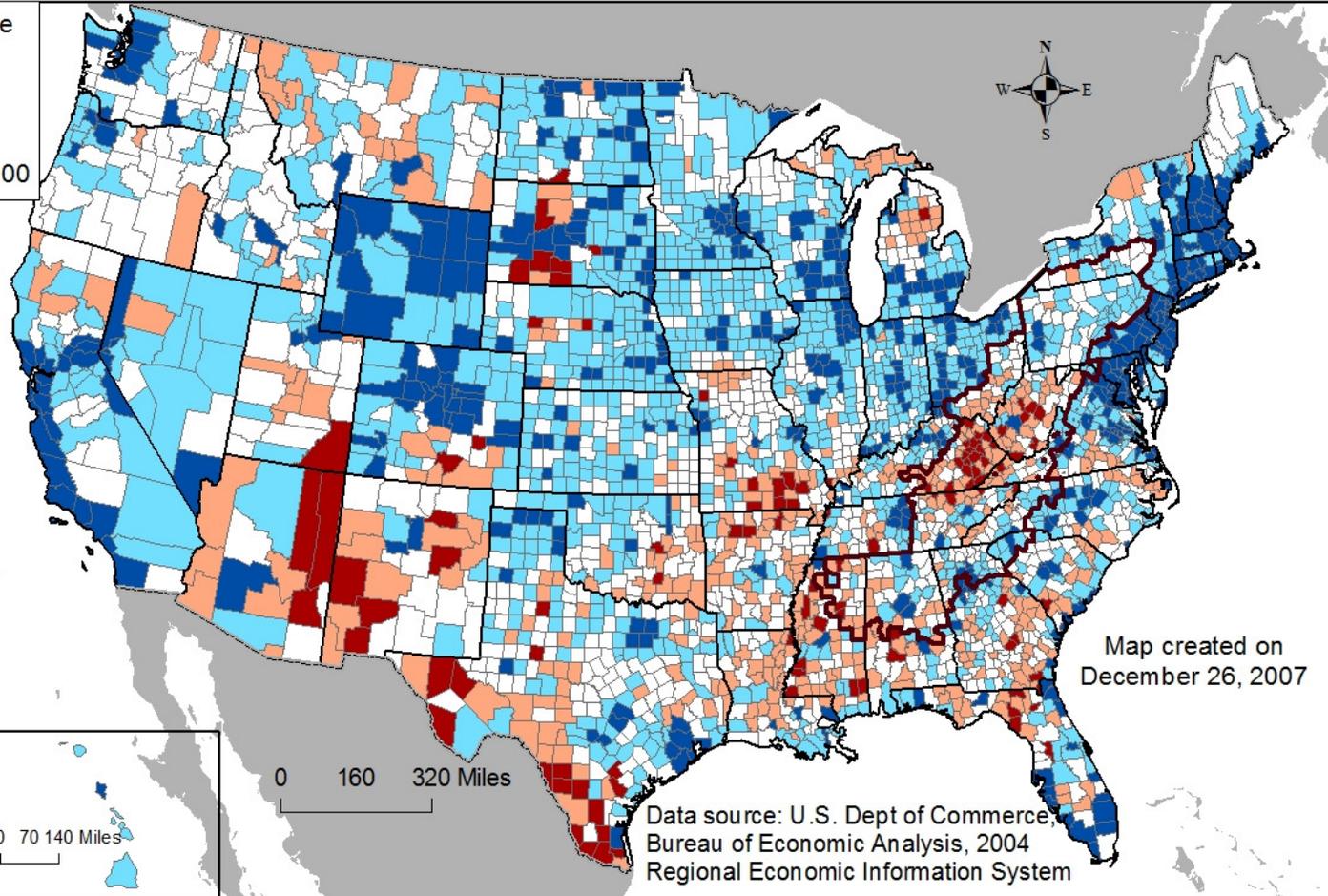


Figure 6.6: Per Capita Market Income in the United States and Appalachia, 2003

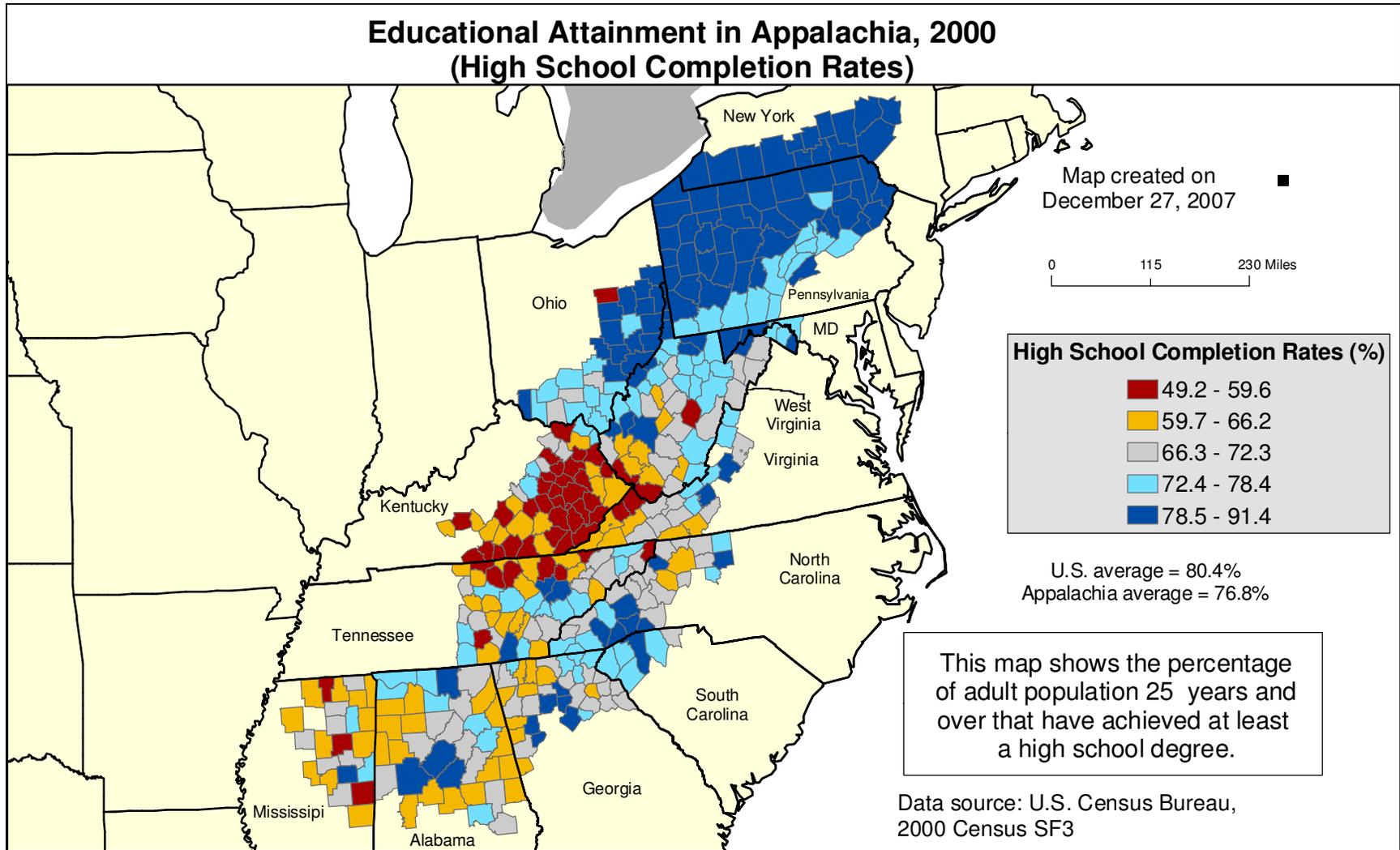


Figure 6.7: Map of Educational Attainment in Appalachia (High School Completion Rates)

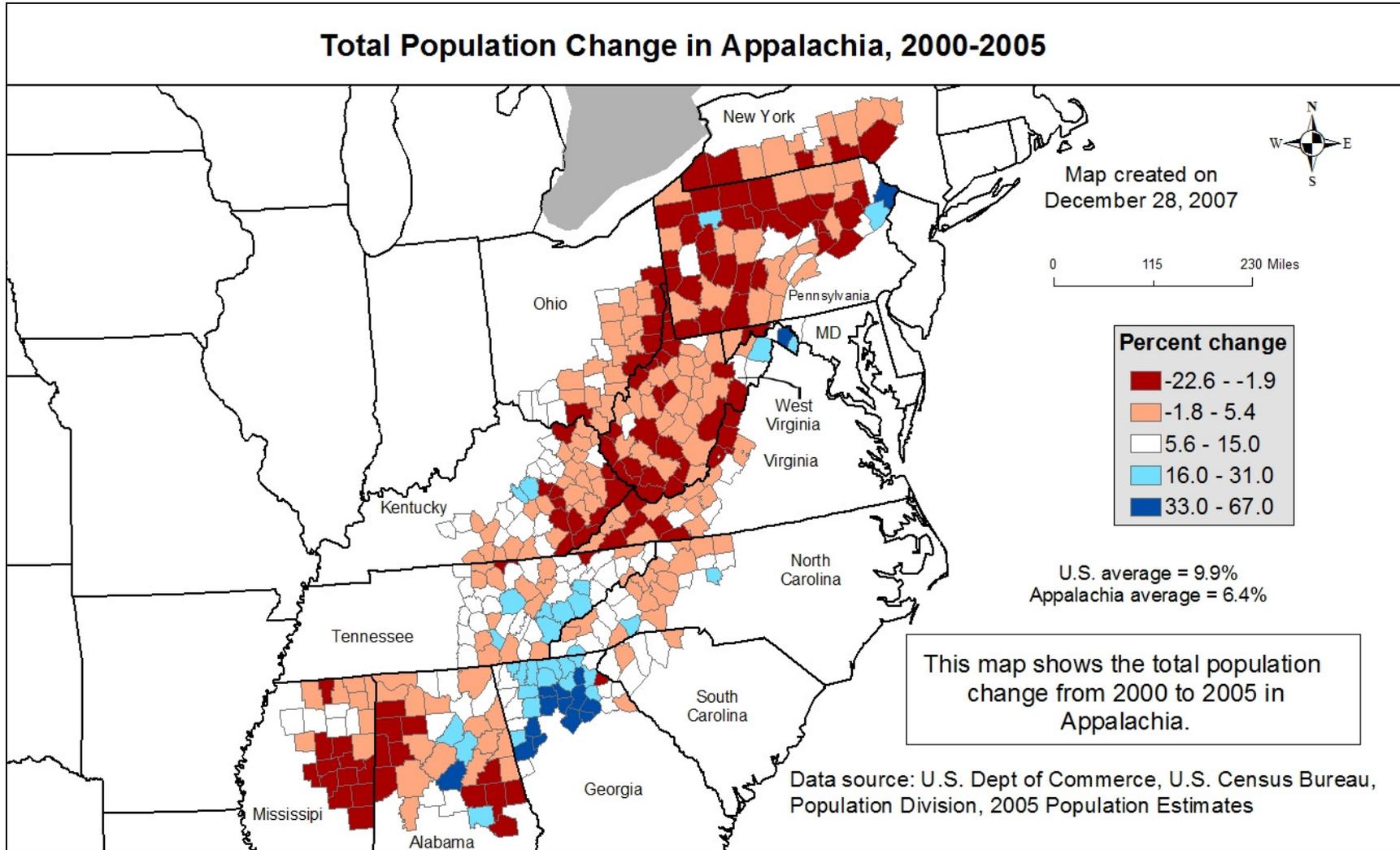


Figure 6.8: Map of Total Population Change in Appalachia, 2000-2005

Prediction of County Economic Status in the United States and Appalachia (With the relative educational attainment index)

This map shows changes in economic status of the United States and the Appalachian counties when replacing the ARC's national index with an alternative national index where the ARC's unemployment indicator is replaced with a relative educational attainment index.

Levels of Economic Status

- Distressed
- At-risk
- Transitional
- Competitive
- Attainment
- Appalachian Region

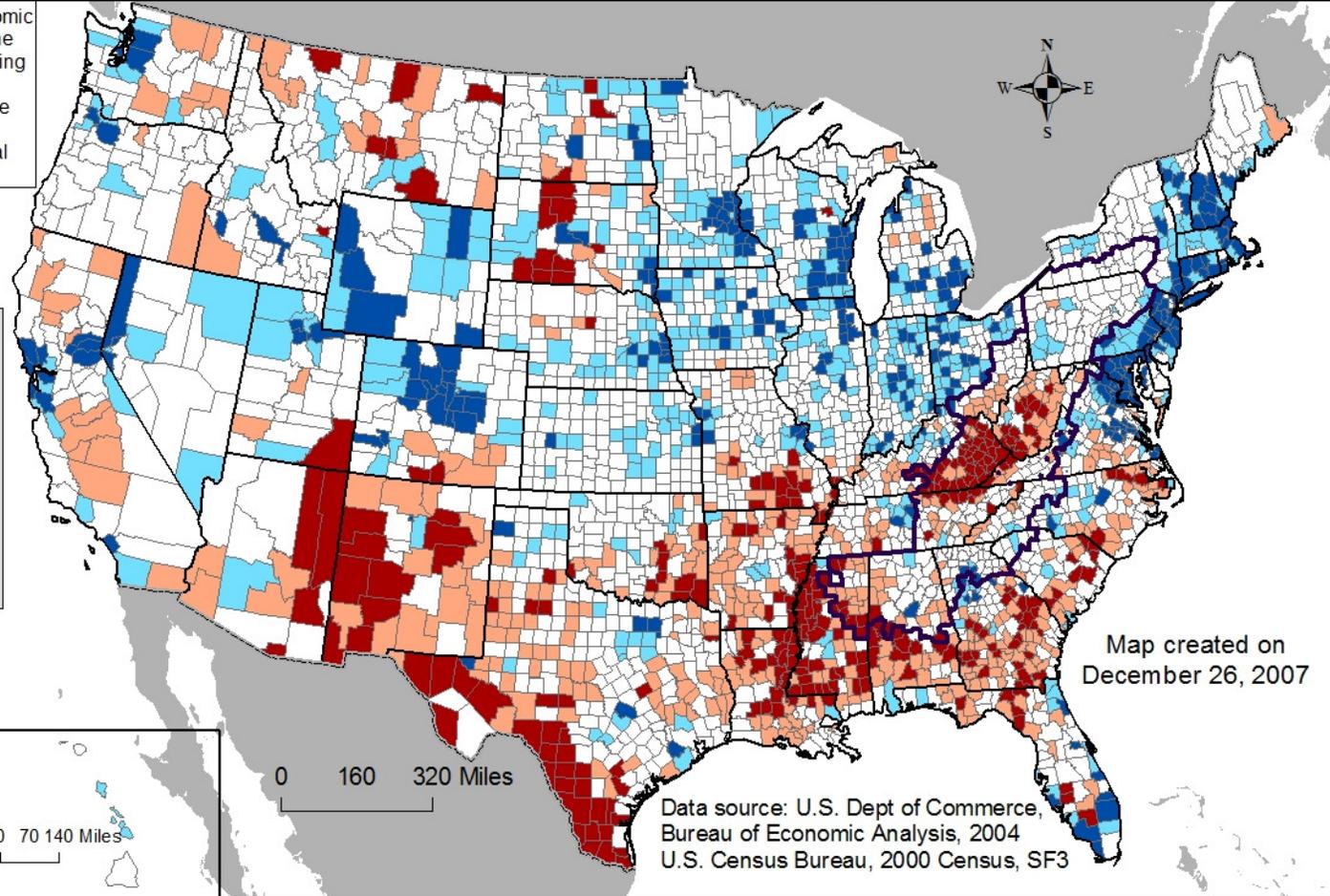
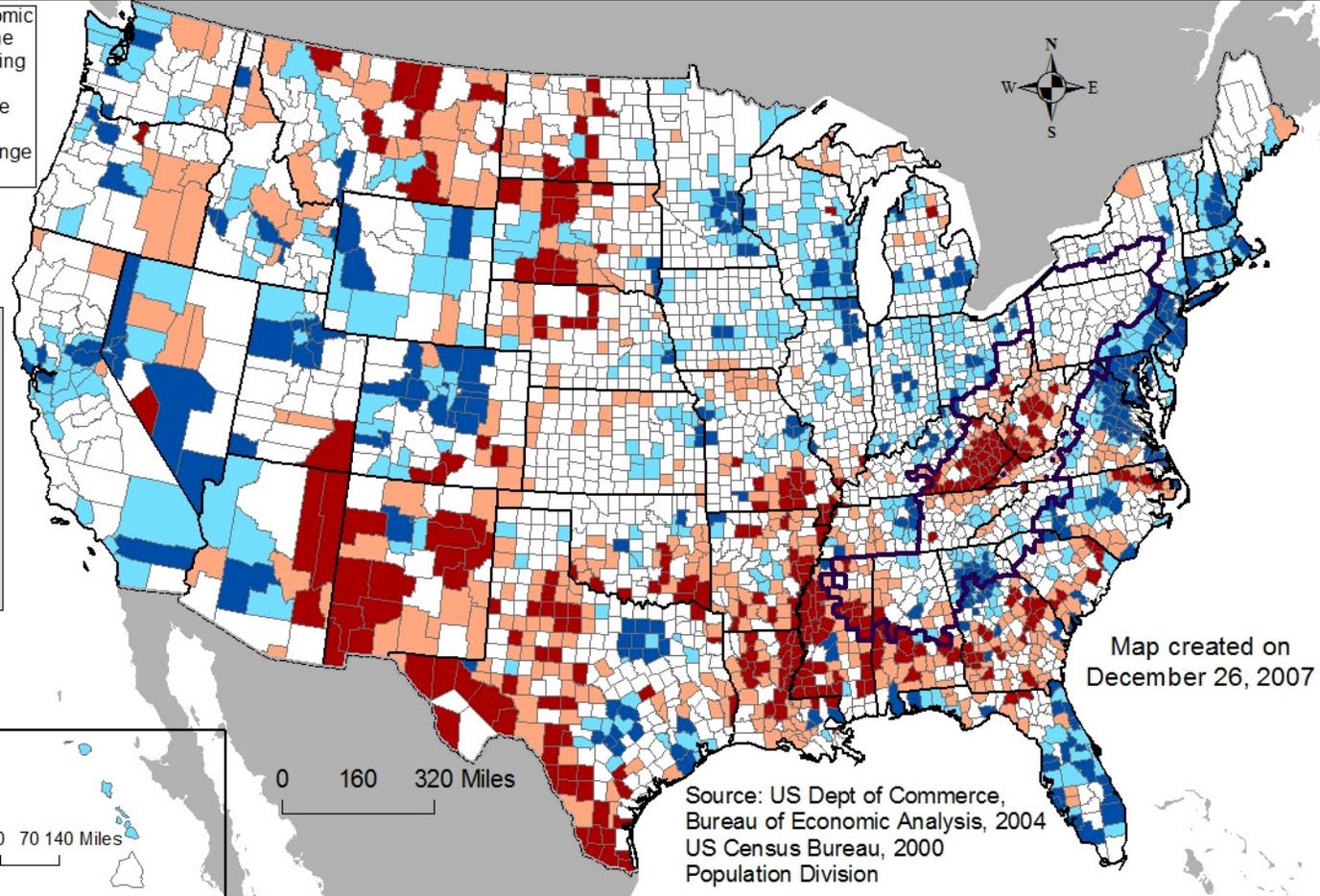


Figure 6.9: Map of Distress Indicator with the Educational Attainment Index

Prediction of County Economic Status in the United States and Appalachia (With the net population change index)

This map shows changes in economic status of the United States and the Appalachian counties when replacing the ARC's national index with an alternative national index where the ARC's unemployment indicator is replaced with a net population change index.

- Levels of Economic Status**
- Distressed
 - At-risk
 - Transitional
 - Competitive
 - Attainment
 - Appalachian Region



Map created on December 26, 2007

Source: US Dept of Commerce, Bureau of Economic Analysis, 2004
US Census Bureau, 2000 Population Division

Figure 6.10: Map of Distress Indicator with the Population Change Index

Distressed and Non-distressed Status Prediction: A Comparison between the ARC's Index and Our Index with Educational Attainment

Scenario 1 = cases where both methods produce a distressed county.

Scenario 2 = cases where ARC method produces a distressed county but our method does not.

Scenario 3 = cases where our method produces a distressed county, but ARC method does not.

Scenario 4 = cases where both methods suggest the county is not distressed.

Scenarios

- Scenario 1
- Scenario 2
- Scenario 3
- Scenario 4
- Appalachian Region

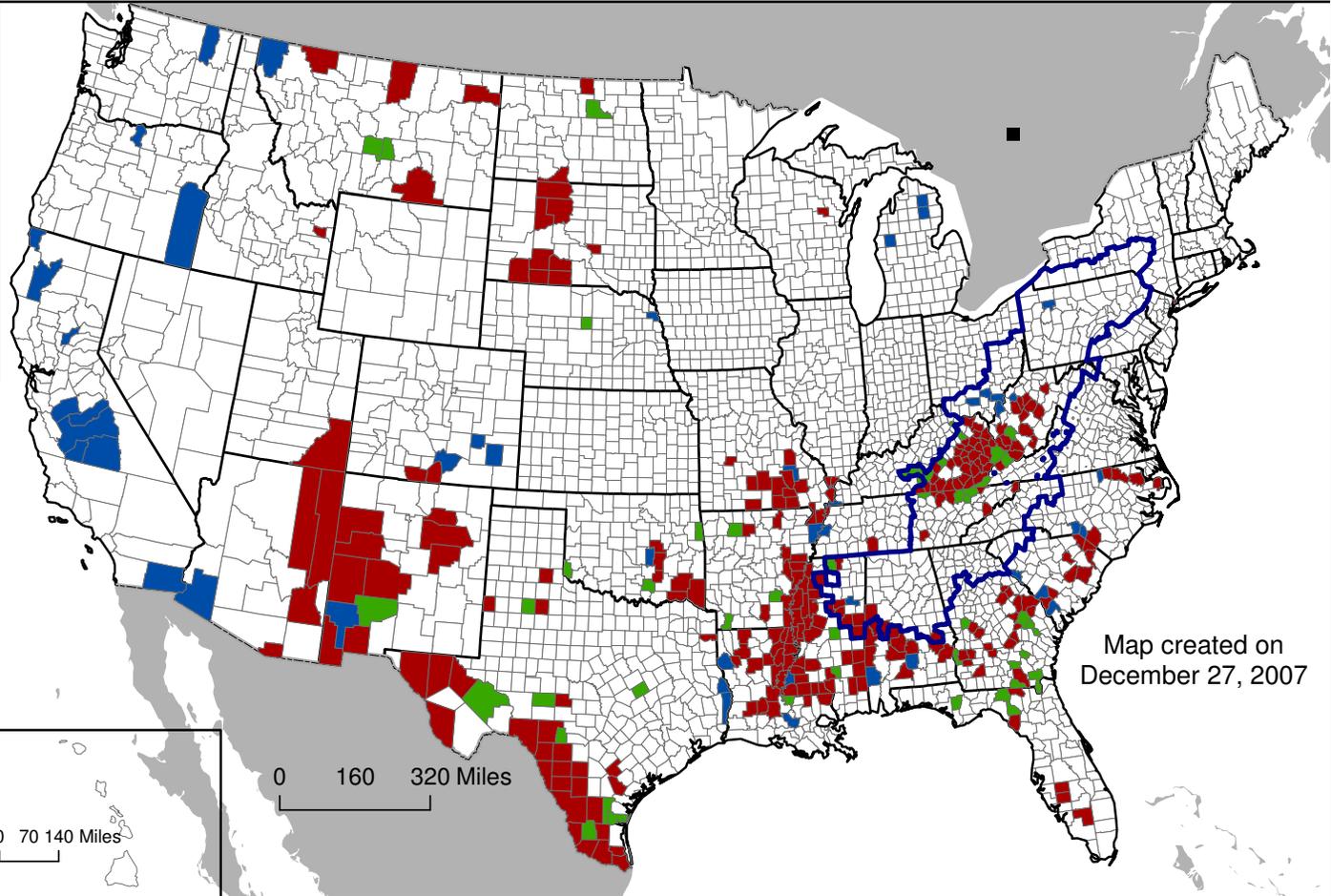


Figure 6.11: Map Comparing the ARC's Index with Our Index with Educational Attainment

Distressed and Non-distressed Status Prediction: A Comparison between the ARC's Index and Our Index with Population Change

Scenario 1 = cases where both methods produce a distressed county.

Scenario 2 = cases where ARC method produces a distressed county but our method does not.

Scenario 3 = cases where our method produces a distressed county, but ARC method does not.

Scenario 4 = cases where both methods suggest the county is not distressed.

Scenarios

- Scenario 1
- Scenario 2
- Scenario 3
- Scenario 4
- Appalachian Region

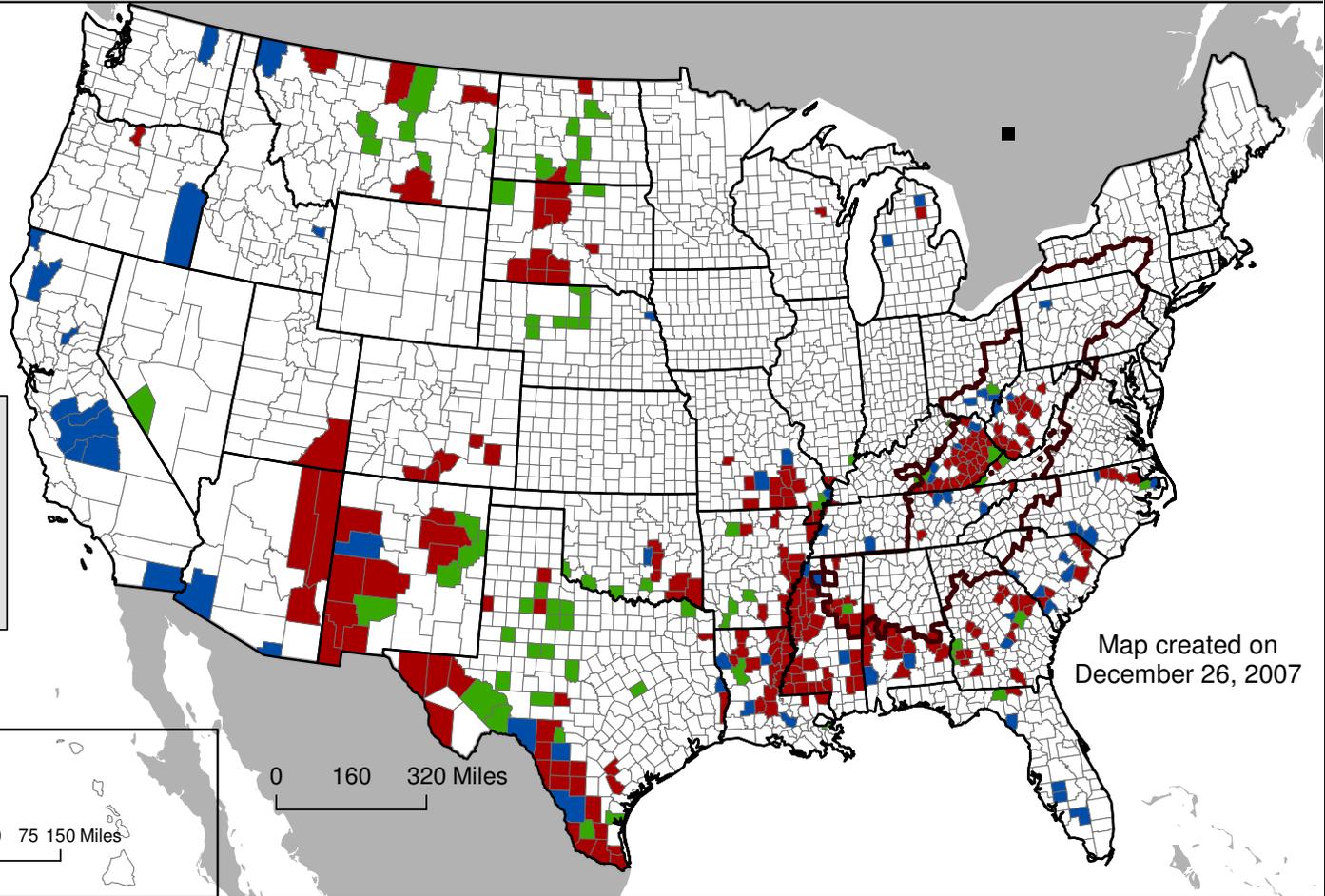


Figure 6.12: Map Comparing the ARC's Index with Our Index with the Population Change

PART IV - CONCLUSIONS AND RECOMMENDATIONS

7. General Principles and Recommendations for Developing Distress Indicators

7.1. An Updated Economic Distress Index for the Appalachian Regional Commission

As set forth in the RFP, the new distress index should satisfy the following general criteria:

- It should be credible, transparent and likely to be acceptable to ARC, Congress and OMB.
- The component indicators selected for the index should be as up-to-date or delivered with as little time lag as possible.
- The index should be accurate in terms of capturing economic distress in the ARC counties, without identifying false positives (a county that is not really distressed but is identified as such by the index) or false negatives (a county that is in reality distressed but does not show up as such on the index).

Evaluation of the Index <i>Index shows county is:</i>	<i>County is in fact:</i>	
	Distressed	Not Distressed
Distressed	Correct	False positive
Not Distressed	False negative	Correct

Table 7.1: Possible Outcomes from a Distress Index Evaluation

Given the fact that economic distress is a multi-dimensional phenomenon, the proper construction of an index requires multiple indicator measures or variables as “inputs.” Thus, each variable needs to have an explicit weight associated with it (whether that weight is 1.0, $1/n$ where n is the number of indicators, or some other number). Not choosing a weight for an indicator (by default) is exactly the same as choosing one, and thus, results in explicit value judgments as to the importance of each factor. In other words, a weight of 1 is just as arbitrary as a weight of 2, 33 or 0.33. For example, as we noted above, the current passive ARC distress index, is, in the end, a *de facto* measure of the poverty rate. And, as we showed in our modest sensitivity analysis using educational attainment and population change, changing variables and/or weights leads to different rankings and to the identification of different counties being labeled as distressed.

Our point is that more empirical work is needed to develop a credible distress index, using actual county-level data going back through time, combined with some ground-truthing with knowledgeable local observers. Thus, a new index can be calibrated against the one current one. Future ARC efforts to adopt a new index should consider adding an additional option that involves “listening” to local experts across the region in order to gauge the range for which indicator variables should be weighted in a distress index—i.e., to ensure that the indicators reflect the reality on ground. For example, should a proper index place considerably more weight on variation in poverty rates (as is currently the case by default rather than by design) relative to other indicator variables? Likewise, as we have noted

repeatedly, the proper indicators would also need to be determined to gauge distress in the 21st Century.

7.1.1. General Principles for Further Analysis

A well-constructed distress index should track how the ARC counties are performing relative to non-ARC counties, and how they are performing relative to one another. Though the current ARC index may be lacking in some dimensions, it does reasonably well in terms of being benchmarked to the U.S. average. However, the following principles should be applied with regard to the possible revision of the index:

1. The ARC should consider reducing the dominating influence that the poverty rate currently has on the overall distress index. This would be accomplished by generating z-scores that standard-normalize each indicator variable by subtracting its mean and dividing by its standard deviation. Of course, each variable would need to be appropriately weighted and empirical verification would be necessary. Such a standard normalization would even the playing field for the variables comprising the index in the sense that each variable is given a more equal relative weight, regardless of how much it varies statistically. This is also relevant for regression analyses discussed in point 7 below. In revising the distress index, future research should assess how much of a difference standard normalizing each indicator variable would make.
2. An explicit weighting of each variable—perhaps equal to one—will create greater transparency regarding how each variable affects a given county’s distress ranking. For example, using z-scores, a variable could be transparently given a weight of 2 by multiplying the variable’s z-score by 2. Conversely, under the current ARC distress measure, it is not transparent how much more weight the poverty rate receives as compared to the other two indicators. Yet, as Partridge (2007) notes, the current ARC distress index corresponds quite closely to a poverty mapping from the late 1970s.
3. The current ARC indicators—poverty, unemployment and PCMI—may not describe the current or future situation in a county because they reflect the cumulative effects of previous economic forces. Instead, they describe the situation as it existed two (or more) years earlier. We strongly recommend that the ARC consider adopting better indicators that help predict future distress for directing government expenditures (Appendix A.2 presents materials on lagging, coincident and leading indicators.)
4. In the past, ARC has had to measure distress using indicators that were at least two or even more years out of date. This should be less of a problem in the future with the American Community Survey.
5. As a supplementary measure, ARC could consider using a leading economic indicator – in the form of building permits issued or other relevant variables (see Appendix A.2). Building permit numbers are released with only a relatively short delay of 12 months or less, and they help describe local economic conditions (subject to caveats discussed elsewhere). The Conference Board uses building permits as a leading measure of U.S. national economic activity.³¹

³¹The Conference Board’s methodology for constructing their indexes of economic activity can be found at:

6. The ARC should weigh whether economic conditions in nearby counties are components of a given county's level of distress. If neighboring counties are distressed, then economic spillovers across county-lines may increase the distress burden of the county in question. This phenomenon could be assessed using geographical weighting procedures described in Section 5.3.1.
7. To validate potential distress indicators, we strongly recommend using econometric modeling to determine how well the contemporaneous measures of distress presage future economic conditions. For example, using models developed from regression analysis, one can simulate over time how well a particular variable predicts structural economic (distress) conditions in a future period. A general approach for accomplishing this as a validity check could be to regress outcomes over the period 2000-2007 on initial conditions in 2000.
8. Another 'reform' that the ARC should consider is a finer delineation of distress to better address the absolute threshold issue of either being "in" or "out" of distress or the related issue of greater severity of distress. The advantage of a finer delineation is that it would target more funding to the most severely distressed cases, while at the same time, including counties that fall just below the "distressed threshold." Clearly, the group of "most at risk" counties faces structural issues much like their distressed cousins and including them for funding would partially mitigate the concerns of counties that fall just below the "distressed" threshold.

7.1.2. Related Questions for Further Analysis

1. High poverty rates have persisted for decades in certain ARC counties. Other counties in the region have had low rates since ARC was first formed. Are there other key correlates (additional information) that account for these differences? A conceptual framework would provide guidelines for selecting the indicators that best represent distress, assessing the causes of distress, and designing policies that are intended to alleviate it.
2. Counties in the northern reaches of the ARC have low poverty and unemployment rates, as well as high educational attainments compared to other ARC counties. Thus, these counties tend not to show up as distressed. To what extent then, are there sub-regional variations in distress? If a range of different indicators were evaluated, would the northern ARC counties still tend to have lower distress rankings?
3. Even though individuals who are left behind in the northernmost counties may not live in poverty or experience high rates of officially-recorded unemployment. However, they do suffer from the (unmeasured) externalities or spillovers associated with the departure of long-time residents (Kilkenny and Johnson, 2007). To what extent should these spillovers be considered in the funding formula?
4. Increasing urbanization in the southern areas of the ARC has resulted in general reductions in distress. Many remote areas of southern and central Appalachia have not experienced this relative prosperity. Issues of race and class still plague many communities. What additional social issues and problems continue to influence patterns of distress in Appalachia?

7.2. Recommendations for Selecting Variables and Developing a Distress Index

7.2.1. Review of Current Indicators

Section 4, 5 and 6 discussed various shortcomings of the current ARC distress index consisting of poverty rates, unemployment rates, per-capita market income (PCMI). The key concern is that the current index is a *de facto* poverty rate measure. Moreover, because the poverty rate is so persistent, the current list of distressed counties is almost synonymous with lagged poverty rates from decades ago. Our point is not that poverty is a weak measure of distress, but rather that it may be receiving too much weight in the process of determining the distress status of counties.

Another shortcoming with the current indicators is that the poverty rate varies significantly across the ARC region, as well as the country. By contrast, PCMI and the unemployment rates vary less across the region and country. Because the poverty rate is more variable, it drives whether a county appears to be distressed or falls into the attainment category. This could be corrected by weighting each variable differently in the construction of the overall distress index. A final problem is that the unemployment rate and PCMI are increasingly flawed measures of distress due to socioeconomic shifts. For example, differences in unemployment rates no longer clear reflections of economic conditions due to migration patterns—i.e., at the local level, job growth and changes in unemployment are very low.

For these reasons, we encourage the ARC to reexamine its current distress index to better reflect socioeconomic shifts since the 1980s. Likewise, indicators could better capture future distress in order to guide funding to areas that are designed to mitigate future problems rather than providing band-aids for past characteristics of distress. Finally, future efforts need to rigorously examine the weights that should be placed on each variable so that the distress indicator fully reflects the intended structural weaknesses.

7.2.2. Next Steps

In a quest to assess persistent distress, a rigorous appraisal of the underlying structural factors that predict future distress would be in order. Such a conceptual framework would inform the ensuing statistical investigation.

From this conceptual framework, we envision a new distress index that consists of three to five major components (each of which may have a number of sub-components), that are to be standard-normalized to facilitate a transparent weighting process. Weights would be determined based on consultation with key informants and on the basis of the outcomes (that is, how well they predict or correlate with actual conditions of local distress).

The ARC would be presented with several different distress indexes. Key information that would be considered would include the counties that changed status—i.e., enter the distress category or exit the distress category. Our basic sensitivity analysis in Section 6 provides a good example of how such an analysis could present such findings. We envision the ARC being presented with maps and tables showing the results of an extensive sensitivity analysis.

We believe that the following variables deserve further close examination:

After evaluating over 50 indicator variables, we believe the following form the core indicators of future analysis for a distress indicator. They are transparent, valid, reliable, easy for stakeholders to understand, and available at a relatively low cost. We also offer a set of secondary indicators that would be of value for stakeholders for tracking progress. A data dictionary for the key core and secondary variables we recommend for consideration is provided in Table 7.2.

1. **Population Change:** Population change -- including its key component such as out-migration -- forms an important mechanism for dealing with economic decline. As such, it should be considered for use in any future distress index. Population loss is a real measure of economic deterioration, and counties should not be penalized in the distressed counties formula for tackling their economic problems through out-migration. Over longer periods, population change also closely proxies for employment change, capturing a key economic component as well. Further assessment of the composition of population change would be warranted. For instance, is distress more related to migration of young workers, or is distress linked more to changes in the numbers of retirees?

Adjustment assistance to counties experiencing significant population loss can be motivated with two arguments: (1) Those staying behind have to deal with real negative consequences of a smaller population base; and (2) Assistance could stem or even reverse the outmigration (See section 5.1 for further discussion).

2. **Educational Attainment:** Education is the prime measure of human capital, is an underlying determinant of an individual's *current* and *future* earnings capacity, and is highly correlated with other factors such as poverty. It is also associated with an individual's ability to adjust to economic change and succeed in the knowledge economy. For these reasons it is connected to current distress and is a forward-looking measure of future distress. Indeed, adding high school educational attainment was more important than adding population change in terms of affecting county exit/entry into/from distress, as shown by the sensitivity analysis in Section 6. A full set of measures should be considered, including the proportion with an associate degree, four-year college degrees, and net changes in educational attainment as a way of determining whether there is an ongoing problem with brain drain.
3. **Income:** Per capita market income is another possible measure of economic well-being or distress, and it should be considered as a potential candidate in a new index (see section 5.2 for further discussion). Yet, as noted above, lower per-capita income can reflect amenities, lower cost of living, and other factors that are not related to distress. For these reasons, other measures of income and earnings should be weighed as well, including recent trends in changes in income.
4. **Housing or Housing Change:** Some measure of building permits, coupled with changes in property values, would reflect the forward-looking economic outlook of each individual county. Property values denote local on-the-ground assessments of the future direction of the community by private entrepreneurs (the market). Changes in new home construction are also good forecasts of changes in future population.

5. **Entrepreneurship and Self-Employment:** A forward-looking measure of the local community's ability to compete is having a strong entrepreneurial capacity. Though "entrepreneurial capacity" cannot be directly measured from any federal data source, a good proxy is self employment as owners of small businesses. Because small business formation is motivated by a host of favorable and unfavorable reasons, the ARC should consider investing resources to sort out "reactive" from "radical" entrepreneurship in the region. As section 5.2.5 described, one clue regarding the extent to which self-employment growth in an Appalachian county is *radical* (response to opportunity) as opposed to *reactive* (response to necessity) may be found in the returns to self-employment. This distinction could be an important measure of a county's ability to adjust to new employment realities.

6. **Labor Market Strength:** Several measures of labor market conditions should be considered in a refined distress index. As noted above, the unemployment rate fails to adequately capture labor market conditions. As described in Section 5.1.4, the *employment rate* (employment rate/population that is sixteen years old and over), in conjunction with annual employment growth, are better indicators of overall labor market strength. The employment rate directly captures labor force participation, unemployment and discouraged worker effects. It also proves more informative than the conventional unemployment rate measure.

7. **Poverty Rate:** The poverty rate should remain one of the core variables that indicate distress. Yet, future assessment should consider the proper weight to place on the poverty rate. Moreover, this investigation should consider the overlap of poverty with the other indicators included in the complete distress index.

8. **Other Alternative Measures:** Our final recommendation is for the ARC to report a more complete listing of indicators for the region beyond those narrowly interpreted as distress. These would include a large number of the alternative indicators discussed in various sections of this report, such as the more innovative measures of social capacity. Though many of these measures are not suited to be among the four or five core selected indicators of distress, they would offer the ARC counties and interested parties a more comprehensive/holistic gauge of their progress towards meeting regional goals aside from "distress." By providing a more complete list of measures, individual counties can customize their benchmarks to monitor progress. Such measures could be reported at a relatively low cost on the ARC web-site for access by interested users.

Some candidates for inclusion in a secondary list of indicators include:

- Social capital proxies such as voter participation rates, home ownership, and residential stability to help assess various forms of social development and capacity-building;
- Local government capacity to provide services; because of limitations in Census of Government data, a full delineation of fiscal capacity will require data collection from taxation and revenue departments at the state level, which may be more costly;
- Foreclosures and vacancy rates for local housing;
- Amenities and quality of life indicators;
- Demographic change including changes in immigrants;
- An index of leading economic indicators for each county;
- Knowledge-economy occupational changes;
- Share of local employment in industries that are vulnerable to international competition.

Indicators	Overall assessment, strengths, and weaknesses	Geography	Cost	Source	Frequency	Timeliness
<i>Current</i>						
Poverty rate	Good measure of structural problems of a location, but households just above poverty not included	County, Census tract	No cost	U.S. Census Bureau, ACS ¹	Decennial but will become annual with ACS	9 month lag
Unemployment rate	Easy to obtain, use, and interpret; but may not reflect labor market conditions	County, Census tract	No cost	U.S. Census Bureau, Bureau of Labor Statistics, and ACS	Annual	Two-year lag
Employment rate	Better than unemployment rate, but cannot adjust for the size of the local working age population	County and census tract	No cost	Local Area Unemployment Statistics, Bureau of Labor Statistics, and ACS	Annual	Almost no delay
Employment growth	Can give clues about local economic conditions, but does not reflect place of residence prosperity	County	No cost	U.S. Bureau of Economic Analysis (BEA)	Annual	Eighteen-month delay
Per capita income	A good measure of well-being, but does not account for differences in the cost of living over space, does not reflect average wages, and does not measure income inequality	County and Census tract	No cost	Regional Economic Information System, U.S. Dept of Commerce, and BEA	Annual	Two-year lag
Population or net migration rate	Reflects many elements missing in the existing ARC indicators.	County, Census tract	No cost	U.S. Census Bureau, IRS	Annual	9-month lag

¹: See Section 5 for more details. American Community Survey (ACS) will be available in 2010.

Table 7.2: Data Dictionary

Indicators	Overall assessment, strengths, and weaknesses	Geography	Cost	Source	Frequency	Timeliness
Housing conditions	Can predict future conditions in a county, but quality of data for nonmetro areas could be of concern	County	No cost	ACS, U.S. Census Bureau	Updated Quarterly	
Population change/In- and out-migration	Useful to track down origin and destination of migrants, but not entirely complete	County	\$500 per year for the entire U.S.	IRS income tax database, ACS	Annual	Two-year lag
<i>Forward-looking</i>						
Building permits	Do not reflect construction activity outside areas subject to local permit requirements, not all local governments regularly report their data	County	No cost	U.S. Census Bureau	Monthly, Annual	Minimal lag
Foreclosure (F) and vacancy rates (VC)	Important measure of local economic well-being, but need to be examined in the context of population change	County	No cost	F: RealtyTrac.com VC: ACS	F: Daily, VC: annually with ACS	F: No lag VC: many lags
Self-employment/ entrepreneurship	A good indicator for future well-being, but research is needed to separate radical from reactive self-employment	County	No cost	U.S. Census Bureau, Dept. of Commerce, BEA, ACS	Annual	Two-year lag
Educational attainment	Very good predictor of future economic growth, but does not reflect quality of education and has an arbitrary nature	County and census tract	No cost	ACS	Annual	Two-year lag
Natural amenities/ natural capital	Good indicator of natural capital base, but not a good indicator of distress.	County	No cost	Economic Research Service (USDA)	Every several years	NA

Table 7.2: Data Dictionary, Cont.

Indicators	Overall assessment, strengths, and weaknesses	Geography	Cost	Source	Frequency	Timeliness
<i>Social Capabilities</i>						
Local government capacity	Reflects fiscal health and resources, data available for small counties, but data quality not uniform across all counties	County	No cost	Census of Governments	Every five years	
Social capital	See Table 5.3 for a list social capital variables and their sources. These variables can be obtained at zero or a nominal fee.					

Table 7.2: Data Dictionary, Cont.

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Appendices

Appendix A.1 Maps of Distress Indicators with the Refined Categories

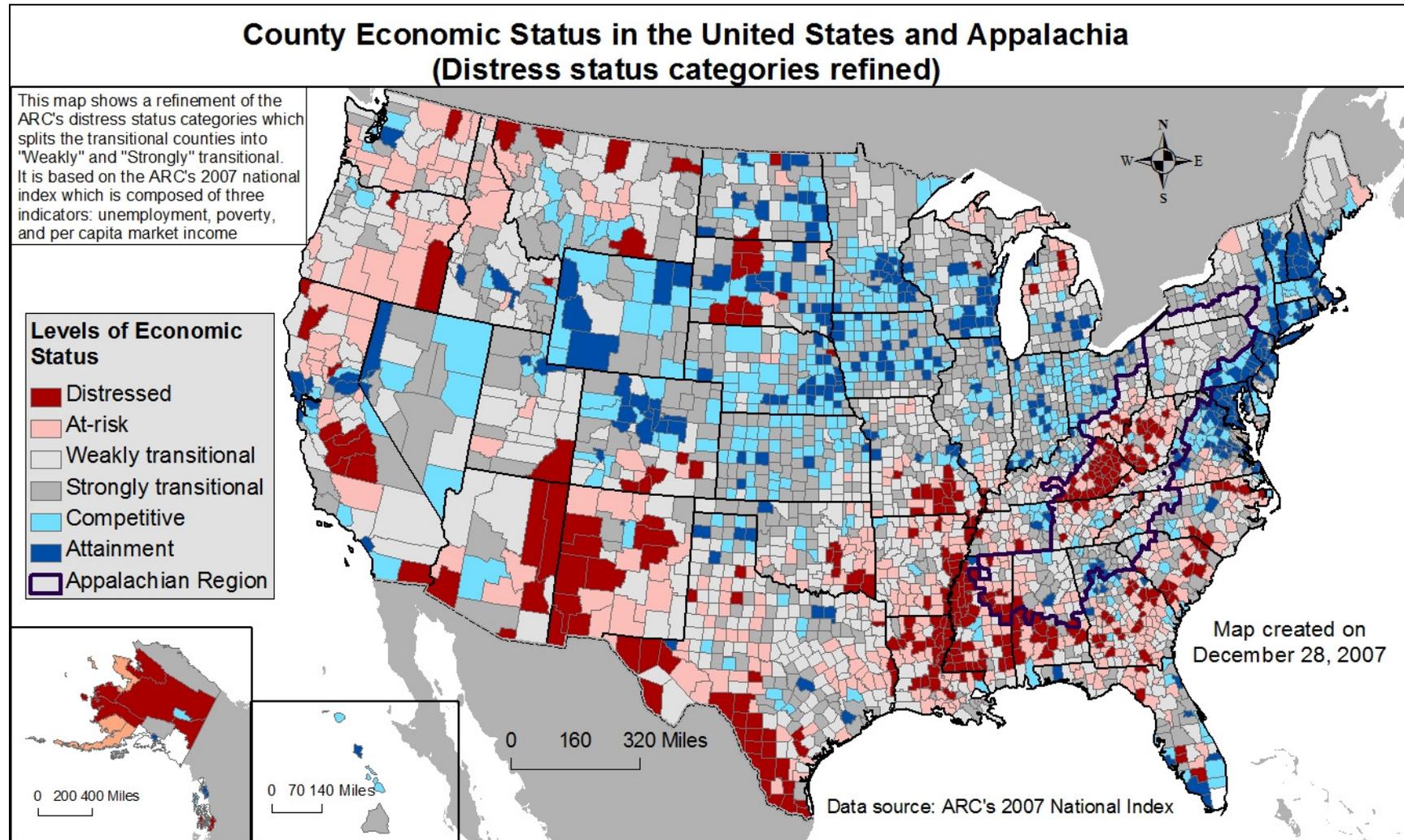


Figure A.1: Map of ARC's Distress Indicator with the Refined Economic Status

Prediction of Refined County Economic Status in the United States and Appalachia (With the relative educational attainment index)

This map shows a refinement of the ARC's distress status categories which splits the transitional counties into "Weakly" and "Strongly" transitional. It is based on our alternative national index which includes the relative educational attainment index.

Levels of Economic Status

- Distressed
- At-risk
- Weakly transitional
- Strongly transitional
- Competitive
- Attainment
- Appalachian Region

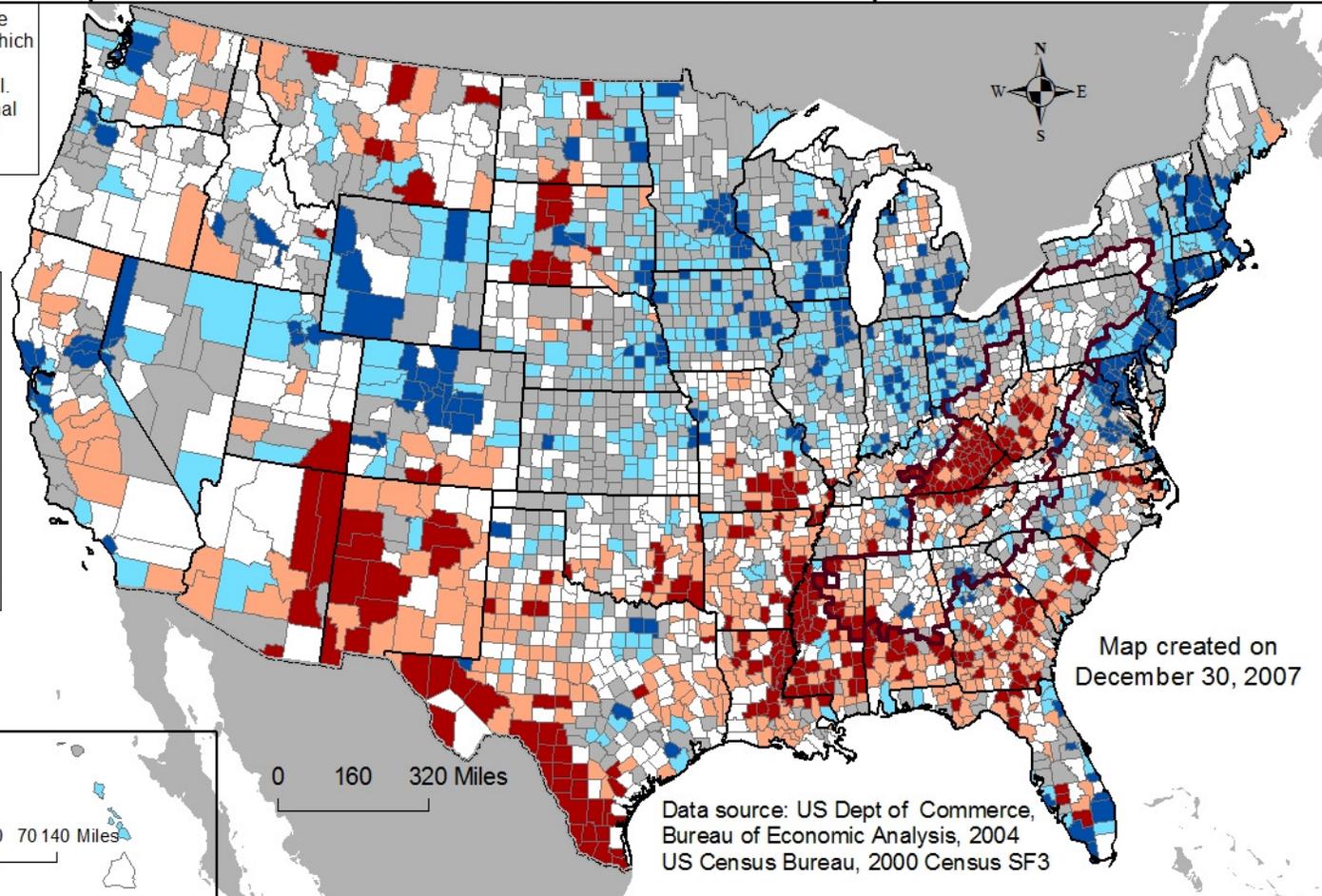


Figure A.2: Map of Prediction of Refined Economic Status Using Our Index with Educational Attainment

Prediction of Refined County Economic Status in the United States and Appalachia (With the net population change index)

This map shows a refinement of the ARC's distress status categories which splits the transitional counties into "Weakly" and "Strongly" transitional. It is based on our alternative national index which includes the net population change index.

Levels of Economic Status

- Distressed
- At-risk
- Weakly transitional
- Strongly transitional
- Competitive
- Attainment
- Appalachian Region

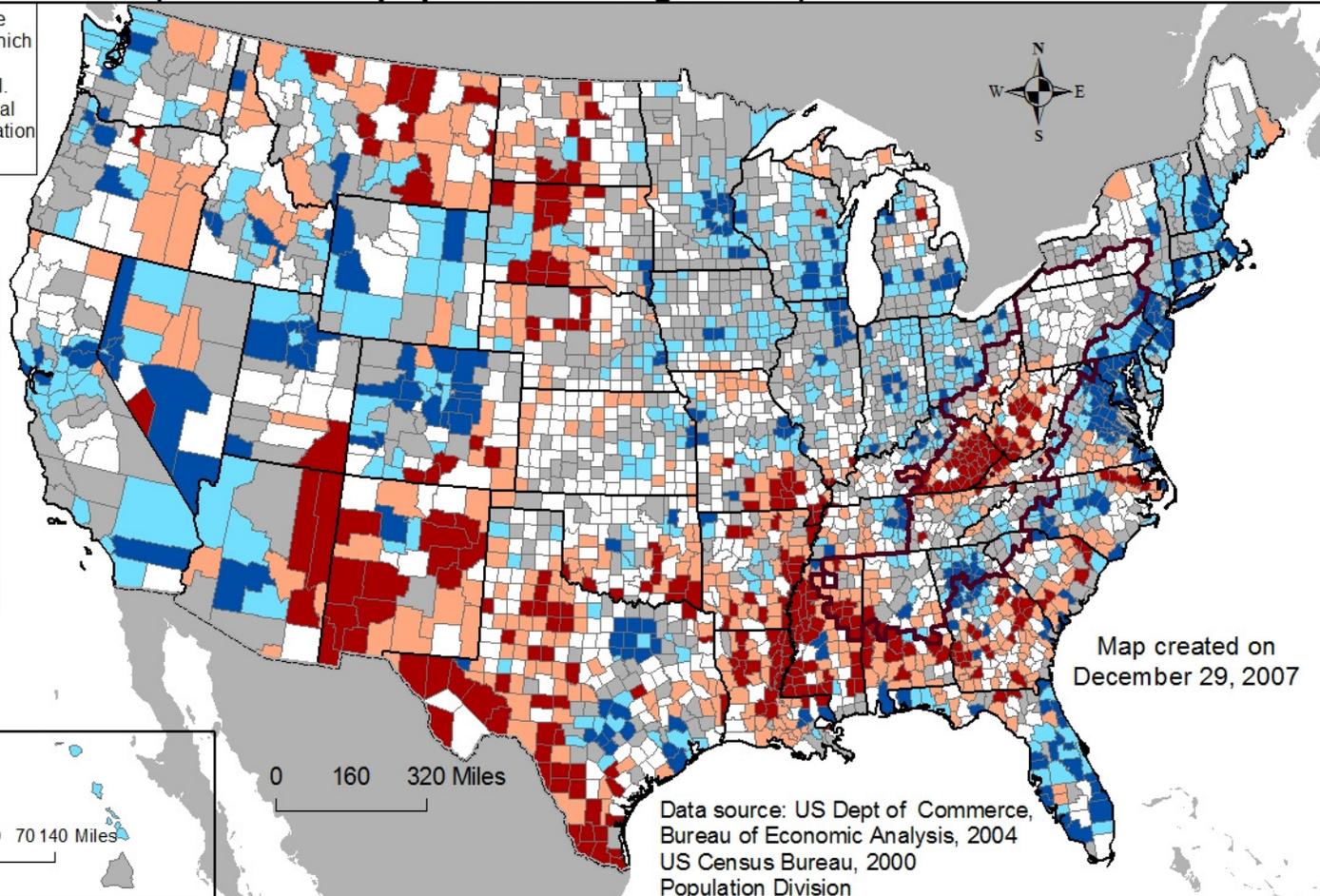
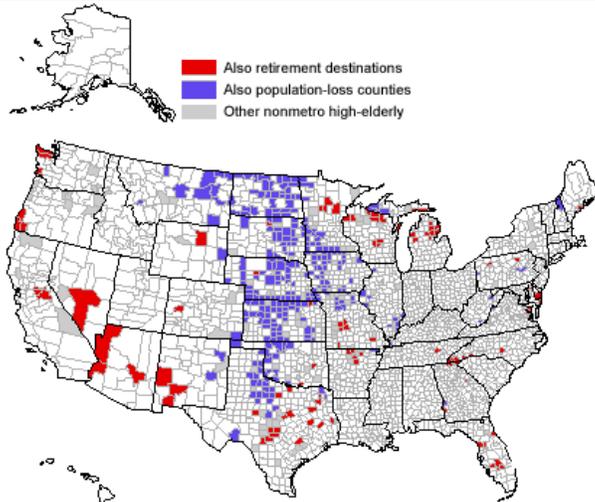


Figure A.3: Map of Prediction of Refined Economic Status Using Our Index with Population Change

Appendix A.2 Supplementary Information: Maps Showing Information of Potential Interest

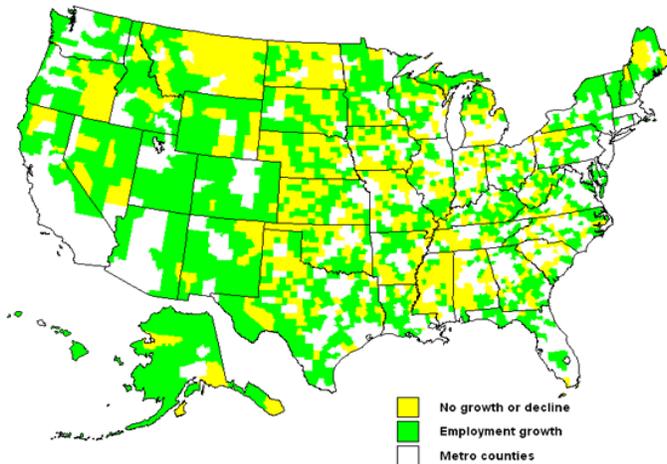
Nonmetro counties with above-average (18 percent or higher) population 65 and older, 2000



Source: USDA, ERS using data from the U.S. Census Bureau and ERS County Typologies.

Figure A.4: Nonmetro Counties with Above-average (18 percent or higher) Population 65 and above, 2000

Nonmetro employment change, 2000-2006

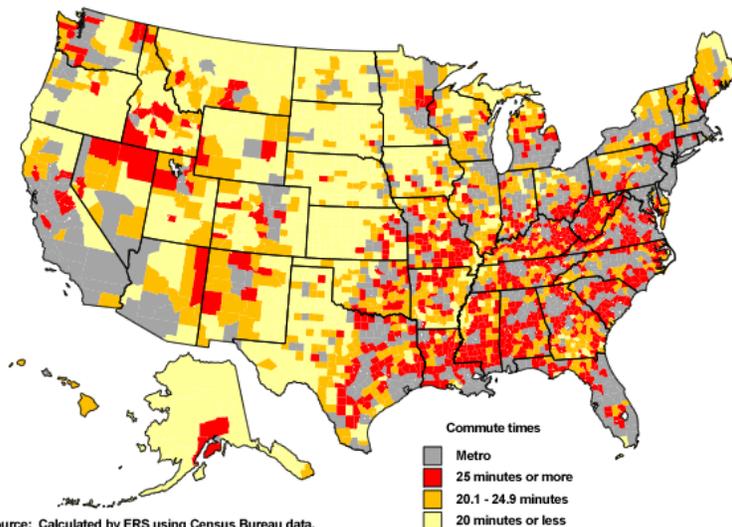


Source: Calculated by ERS using data from the Bureau of Labor Statistics.

Figure A.5: Nonmetro Employment Change, 2000-2006

Average commute times in nonmetro counties, 2000

Longest commutes are in mountainous areas and in counties near metro areas



Source: Calculated by ERS using Census Bureau data.

Figure A.6: Average Commute Times in Nonmetro Counties, 2000

Appendix A.3 Materials on Leading, Coincident, and Lagging Indicators

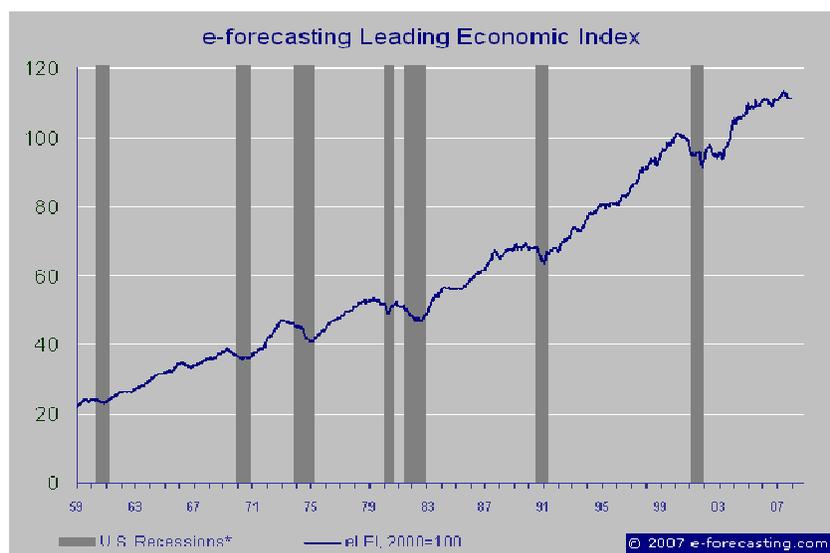


Figure A.7: E-forecasting Leading Economic Index

The following describes leading, coincident, and lagging economic indicators used to construct the national index of leading, lagging, and coincident economic indicators.

Ten Components of the U.S. National Leading Economic Indicator: Vendor performance, average weekly manufacturing hours, manufacturers' new orders for nondefense capital goods, stock prices, average weekly initial claims for unemployment insurance (inverted), index of consumer expectations, real money supply, building permits, interest rate spread, and manufacturers' new orders for consumer goods and materials

Four Components of the Coincident Economic Indicator: Personal income less transfer payments, industrial production, employees on nonagricultural payrolls, and manufacturing and trade sales.

Seven Components of the Lagging Economic Indicator: Change in CPI for services, commercial and industrial loans outstanding, change in labor cost per unit of output, ratio of consumer installment credit to personal income, average prime rate charged by banks, average duration of unemployment (inverted) and the ratio of manufacturing and trade inventories to sales.

Source: Conference Board

<http://www.e-forecasting.com/U.S. Leading Economic Indicator.htm>