A Comparison of 2013 Underemployment Rate Forecasts and Survey Results in Alabama

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Center for Business and Economic Research
Culverhouse College of Commerce
The University of Alabama
Box 870221, Tuscaloosa, AL 35487-0221
Tel: (205) 348-6191   Fax: (205) 348-2951

Acknowledgments

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Executive Summary

- This report presents a comparison of the 2013 underemployment survey results and the first attempt at forecasting those rates for the State of Alabama, its Workforce Investment Advisory Areas (WIAAs), and counties. Underemployment rate forecasts were made for 2013 to 2018, but only 2013 forecasts are tested in this report because the 2014-2018 surveys are yet to be conducted.

- Comparing the underemployment rate forecasts with the survey results is crucial for determining the accuracy and reliability of the forecasting model. Underemployment rates are needed to determine the available labor pool in the state, WIAAs, and counties. Knowing the available labor pool facilitates economic development by demonstrating the availability of workers for existing, expanding, and new industry.

- Alabama's 2013 underemployment rate was 23.1 percent as determined from the survey, down from 23.8 percent in 2012 and indicates an available labor pool of 579,098. The forecast model projected a 23.9 percent rate for the state in 2013, an over-forecast of about 3.5 percent and up from the 2012 rate. Thus the 2013 Alabama underemployment rate forecast missed both in direction and magnitude from the 2012 level compared to the survey result. Though small, the 3.5 percent forecast error translates into there being 16,919 more people in the state's available labor pool.

- At the regional level, survey results had underemployment rates ranging from 19.2 percent in WIAA 10 to 26.8 percent for WIAA 6. The underemployment directional change was against the forecast in five regions—WIAAs 2, 3, 5, 9, and 10. The 2013 underemployment rate forecasts ranged from 21.8 percent for WIAA Region 3 to 26.6 percent for WIAA Region 6, with over-forecasts in half the regions and under-forecasts in the remainder. Forecast deviations were from an under-forecast of 2.7 percent in WIAA 3 to an over-forecast of 3.7 percent in WIAA 10. Absolute percent errors of the regional underemployment rates range from 0.4 percent in WIAA 8 to 19.3 percent in WIAA 10. Forecasts for WIAAs 4, 6, and 8 are of sufficient accuracy, with the WIAA 8 forecast being the most accurate.

- Among counties, underemployment rates are over-forecasted in 32 counties and under-forecasted in 35. Jefferson County has the least forecast deviation at 0.1 percent while Coosa (19.3 percent) has the largest. Absolute percent errors range from 0.4 percent in Jefferson County to 185.4 percent in Cullman County, with just eight counties having the state's 3.5 percent or smaller.

- The comparison of survey and forecast underemployment rates for 2013 indicates that a longer history of underemployment rates is needed to improve the forecasts. The forecast model's performance is mixed at the state and regional levels and quite poor at the county level because of the short history on which it is based. However, the comparison offers hope that when sufficient historical underemployment rate data are developed through the annual surveys, underemployment rate forecasting is possible in Alabama.

A Comparison of 2013 Underemployment Rate Forecasts and Survey Results in Alabama

Overview

This report presents a comparison of underemployment rate forecasts and survey results for the State of Alabama, its workforce investment advisory areas (WIAAs), and counties for year 2013. The objective is to test the 2013 underemployment forecasts by investigating how much the survey results differ from the forecasts. The validation is necessary in determining whether the forecast approach could be used as an alternative to the more expensive (in time and money) survey exercise. Surveys have been the only source of underemployment data, which are crucial to economic development because they help to provide more comprehensive information about the available labor for existing, expanding, and new industry. To lower costs of producing the underemployment rates, a forecasting approach using existing data was developed in 2013. This report seeks to determine if the underemployment forecasts are reliable enough to replace the survey approach.

Underemployed persons are defined as workers who believe that their education and training, skills, or experience (i) are not fully utilized in their current jobs and (ii) qualify them for higher paying or more satisfying jobs for which they could leave their current positions. A detailed description of underemployed persons is presented in the *Underemployment in Alabama WIAAs* reports, *State of the Workforce Report* I through *State of the Workforce Report* VIII, and an article by Bonnal, Lira, and Addy[1] that reviews the dynamics of underemployment.

It is important to note that the lack of sufficient data limits the ability to confidently forecast underemployment rates and test their level of accuracy. Nine observations from seven surveys are used to forecast underemployment and only 2013 survey results are available for testing. These are too few observations to obtain meaningful forecasts and to validate the results. As a result, common measures of accuracy are not applicable in the comparison process.

We find that the forecast model's performance is mixed at the state and regional levels and quite poor at the county level because of the short history on which it is based. As such, a longer history of underemployment rates is needed to improve the forecasts. Where underemployment variability is high, the errors are evidently large. This limitation can only be addressed through improving the number of observations to capture enough history in the series. However, the comparison offers hope that when sufficient historical underemployment rate data are developed through the annual surveys, underemployment rate forecasting is possible in Alabama.

Methodology

The 2013 underemployment rate forecasts for Alabama, the WIAAs, and all the counties in each WIAA are compared with survey results to determine the performance of the forecasting model. The forecasts were generated in mid-2013 while data collection for the underemployment survey was still underway. Historical underemployment rates from seven past underemployment surveys from 2004 to 2012 were used to model and forecast the underemployment rates. A detailed report

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[1] Bonnal, M., Lira, C., and Addy, S.N. 2009. *Underemployment and Local Employment Dynamics: New Evidence.* The Review of Regional Studies Vol. 39, No. 3, pp. 317-335

of the forecasts can be found in *Investigating the Feasibility of Forecasting Underemployment in Alabama.*[2] The surveys were conducted by the Institute for Social Sciences Research of The University of Alabama as part of the State of the Alabama Workforce report series. Although underemployment rates were forecasted from 2013 to 2018, we only test the accuracy of 2013 forecast whose survey results are available.

To determine how the forecasting model performed, forecast errors/deviations are determined using the underemployment survey results and forecasts. The forecast error is the difference between the forecast and the actual survey rate as shown below,

$$d_i = A_i - F_i$$

where A_i are the actual underemployment rates from the 2013 survey for the state, regional, or county, F_i are the 2013 rate forecasts, and d_i are the respective deviations of the forecasts from the actual rates. The magnitude of the error denote the size of the miss by the forecasting model and the sign show whether the model over- or under-forecasts. If $d_i > 0$ the model under-forecasts the respective underemployment rate and where $d_i < 0$ the model over-forecasts. To capture the extent of the forecast errors relative to the real rates, absolute percent error/deviations are calculated as follows:

$$Absolute\ Percent\ Error_i = \frac{|d_i|}{A_i} = \frac{|A_i - F_i|}{A_i}$$

where $|d_i|$ and $|A_i - F_i|$ are absolute errors. The larger the absolute percent error, the bigger the error in the forecast and the more the need for a different approach and most importantly for more data. Since only one forecast point is available, it is not logical to construct a Mean Absolute Percent Error (MAPE) measurement to determine the performance of the model. However, the absolute percent errors can be used to provide some insight on accuracy. Generally, absolute percent errors of less than 10 percent would suggest good to superior accuracy because small errors in the underemployment rate can imply significant over- or under-estimation of the available labor pool. Fair to good accuracy is for absolute percent errors ranging between 10 percent and 20 percent; the 20 percent to 50 percent range is said to have poor to fair accuracy. The forecasting model is inaccurate or has insufficient accuracy if the absolute percent errors are more than 50 percent. To validate the forecast model, maximum absolute percent errors of 2.0 percent at the state level, 3.5 percent at the regional level, and 5.0 percent at the county level are desired. The forecast errors and corresponding absolute percent errors are presented in Tables 1 and 2 along with historical underemployment rates and the forecast for 2013. The comparison is discussed in the next section but must be taken with caution due to the following caveats.

Caveats

Nine observations from seven surveys are used to the forecast underemployment rates. These are too few and critically reduced the degrees of freedom for the forecasting model. The low number of observations also limited the type of model used to forecast underemployment rates. Consequently,

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[2] Addy, S., Nzaku, K., and Ijaz, A. Investigating the Feasibility of Forecasting Underemployment in Alabama, September 2013, http://www2.dir.state.al.us/workforcedev/Underemployment%20Forecasts.pdf

the validity of the estimates could be questioned irrespective of the comparison results. Also, only 2013 forecasts can be tested because survey data for other years are not available, but a single point forecast is insufficient to confidently test model performance. Great model accuracy which can qualify for validation on the single point test might fail a multiple point test. This is more likely the case for the majority of the counties and regions as they exhibit significant variability. Thus, any absolute percent error greater than 10 percent may imply that the forecasts are not reliable. The logic of mean absolute percent errors is used to check the performance of the forecast model although the approach is more suitable when there are more point forecasts to construct averages. Since only one data point is used, the validation is not as trustworthy as in cases with more forecasts. Caution should be used when making inferences based on the comparison presented.

Comparing 2013 Underemployment Forecast Rates with Survey Results

A comparison of the 2013 underemployment rate forecasts and survey results is presented in Tables 1 and 2 along with historical rates for Alabama, WIAAs, and counties. The statewide underemployment rate dropped to 23.1 percent in 2013 from 23.8 percent in 2012. The forecast is 23.9 percent implying the model over-forecasts the rate by 0.8 percentage points. The forecasting model also missed the direction of the change; the statewide underemployment rate was projected to be higher than the previous year but it declined. This suggests that the short underemployment data series used to forecast the rate affects the performance of the forecasting model. The 3.5 percent absolute percent error for the state level forecast is generally acceptable but below the 2.0 percent goal. Though small, the 3.5 percent forecast error translates into there being 16,919 more people in the state's available labor pool (i.e., 596,017 forecast versus 579,098 actual).

Table 1. Alabama WIAAs Underemployment Rate Survey Results and Forecasts (Percent)

Area	Actual										Forecast	Forecast Error		Percent Error
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2013	d	$|d|$	$|d|$
WIAA Region 1	19.4	22.3	22.3	20.1	20.1	20.5	22.1	21.6	22.8	19.3	22.2	-2.9	2.9	15.0
WIAA Region 2	21.7	24.1	24.1	24.6	24.6	22.9	22.5	25.5	23.2	22.6	24.1	-1.5	1.5	6.6
WIAA Region 3	26.2	26.4	26.4	23.0	23.0	23.9	22.9	21.8	24.0	24.5	21.8	2.7	2.7	11.0
WIAA Region 4	25.2	18.5	18.5	20.3	20.3	24.3	25.2	25.7	24.0	25.0	25.3	-0.3	0.3	1.2
WIAA Region 5	23.6	24.8	24.8	27.9	27.9	25.6	24.2	22.6	23.9	22.7	24.3	-1.6	1.6	7.0
WIAA Region 6	28.5	25.1	25.1	27.7	27.7	24.6	28.8	26.5	26.2	26.8	26.6	0.2	0.2	0.7
WIAA Region 7	26.8	25.6	25.6	22.4	22.4	27.5	23.7	23.2	25.5	24.7	23.8	0.9	0.9	3.6
WIAA Region 8	26.6	25.6	25.6	30.2	30.2	28.3	25.4	23.3	25.8	25.6	25.7	-0.1	0.1	0.4
WIAA Region 9	22.8	24.9	24.9	25.1	25.1	23.8	24.7	26.6	22.6	21.9	24.7	-2.8	2.8	12.8
WIAA Region 10	22.2	27.0	27.0	22.8	22.8	21.9	26.6	23.6	22.0	19.2	22.9	-3.7	3.7	19.3
Jefferson County	22.5	28.6	28.6	19.8	19.8	25.2	26.1	28.3	25.8	26.1	26.0	0.1	0.1	0.4
Mobile County	24.6	29.3	29.3	29.7	29.7	27.3	23.9	29.9	23.9	21.0	26.3	-5.3	5.3	25.2
Alabama	**24.0**	**25.2**	**25.2**	**24.2**	**24.2**	**24.3**	**24.4**	**24.0**	**23.8**	**23.1**	**23.9**	**-0.8**	**0.8**	**3.5**
Average												*-0.9*	*1.7*	*7.8*

Note: d is deviation of the forecast from the true (survey) underemployment rate. $|d|$ is the absolute deviation of the forecast from the true underemployment rate. A few WIAA definitions in terms of county groupings changed over the 2004-2012 period. There are too few data observations to allow for reliable and consistent estimates.

At the regional level, forecasting errors range from -3.7 percentage points in WIAA 10 to 2.7 points in WIAA 3. The average WIAAs forecasting error is negative 0.9 implying that in general the model tends to over-forecast most regional rates. Specifically, the model over-forecasts underemployment rates in seven workforce regions (WIAAs 1, 2, 4, 5, 8, 9, and 10) whose forecast errors are negative. Underemployment rates are under-forecasted in three regions—WIAAs 3, 6, and 7. Of the 10

WIAAs, forecasting errors are smallest in WIAA 8 and largest in WIAA 10. Forecast errors are also small in Jefferson County but very high in Mobile; these two counties are usually reported with the regions but Jefferson is part of WIAA 4 and Mobile is part of WIAA 9. The absolute percent errors/deviations range from 0.4 percent in WIAA 8 to 19.3 percent in WIAA 10. WIAAs 10, 1, and 9 have the largest absolute percent errors while WIAAs 8 and 6 had the smallest. Based on the absolute percent errors, the model forecast the underemployment rates with good to superior accuracy in six regions—WIAAs 2, 4, 5, 6, 7, and 8. It is also important to note that the model correctly forecasts the direction of underemployment rates in half of the WIAAs. The underemployment rates are correctly projected to decline in WIAAs 1, 7, and 8 and to rise in WIAA 4, and 6. Jefferson County's underemployment rate is also up as expected.

Among the counties, forecast errors range from -15.2 points in Cullman to 19.3 points in Coosa. Thirty-two counties have negative forecast errors implying that the underemployment rates for these are over-forecasted while the rates in the remaining 35 counties are under-forecasted. The average county forecast error is 4.9 points which means that the model under-forecasts more counties in general. Geneva and Jefferson counties have the least errors and Coosa has the largest. The wide range of the forecast errors at the county level underscore the difficulty of forecasting underemployment rates based on a few observations and as well as volatility of county rates. Clearly, the historical data series is not enough to confidently forecast underemployment at the county level. The forecasting model also misses the direction of the rate change from the previous year in 18 counties. The absolute percent errors range from 0.4 percent in Jefferson County to 185.4 percent in Cullman. Based on the absolute percent errors, accuracy of the forecast model is good to superior in 24 counties, fair to good in 12 counties, and poor to fair for 24 counties. The model is insufficiently accurate in forecasting underemployment in seven counties whose absolute percent errors are more than 50 percent.

Workforce Region 1 comprises of six counties—Colbert, Franklin, Lauderdale, Lawrence, Marion, and Winston. Regional underemployment was projected to decline to 22.2 percent in 2013 from the 22.8 percent observed in 2012. The actual underemployment rate dropped to 19.3 percent, 2.9 points below the forecast. The region's absolute percent error is 15.0 percent. Within the region, county underemployment forecast errors range from -9.9 percent in Franklin County to 8.3 percent in Colbert. The model over-forecasted rates for four counties—Franklin, Lawrence, Marion, and Winston. County absolute percent errors range from 11.3 percent in Winston to 53.8 percent in Franklin. The average county absolute percent error is 32.3 percent implying that the forecasts are of poor to fair accuracy; indeed forecasts in four counties are either fair or insufficiently accurate.

Region 2 comprises of Cullman, DeKalb, Jackson, Limestone, Madison, Marshall, and Morgan counties. Underemployment in the region was projected to rise to 24.1 percent in 2013 from 23.2 percent in 2012. However, the underemployment survey results show that the rate declined to 22.6 percent, 1.5 points below the forecast. The regional rate forecast is of good to superior accuracy as the absolute percent error at 6.6 percent is below 10 percent. The county forecast errors range from -15.2 percentage points in Cullman County to 12.3 points in Marshall. Underemployment rates are over-forecasted in Cullman, DeKalb, Madison, and Morgan counties and under-forecasted in the other three. County absolute percent errors range from 3.3 percent in Morgan to 185.4 percent in Cullman. The forecasting model has good to superior accuracy in three counties, fair to good for one, and fair or insufficient in three counties. Cullman County has the largest absolute percent error in the region and the state as whole.

Table 2. County Underemployment Rate Survey Results and Forecasts, 2013

County	Actual										Forecasts	Forecast Error		Percent Error
	2004	2005	2006	2007	2008	|d|	2010	2011	2012	2013	2013	d	|d|	|d|
Autauga	23.3	32.3	32.3	26.7	26.7	21.1	18.8	24.6	20.3	33.3	19.5	13.8	13.8	41.4
Baldwin	14.7	23.5	23.5	16.7	16.7	21.3	29.1	30.3	18.0	27.0	25.6	1.4	1.4	5.2
Barbour	23.5	25.8	25.8	23.8	23.8	26.8	27.3	34.6	21.4	19.4	27.9	-8.5	8.5	43.8
Bibb	23.5	32.5	32.5	23.0	23.0	22.0	25.5	22.6	19.2	26.7	19.7	7.0	7.0	26.2
Blount	20.3	20.6	20.6	20.3	20.3	22.2	21.8	13.6	16.4	27.3	16.9	10.4	10.4	38.1
Bullock	25.9	27.3	27.3	36.1	36.1	29.4	26.7	15.7	26.9	24.0	24.7	-0.7	0.7	2.9
Butler	32.8	17.0	17.0	25.6	25.6	20.0	20.0	23.1	33.3	20.6	25.6	-5.0	5.0	24.3
Calhoun	27.4	20.3	20.3	27.9	27.9	31.3	27.3	19.7	23.9	21.4	25.2	-3.8	3.8	17.8
Chambers	28.7	24.1	24.1	36.1	36.1	23.2	29.3	23.7	25.0	27.8	26.3	1.5	1.5	5.4
Cherokee	15.5	27.1	27.1	23.0	23.0	28.1	25.9	21.8	28.1	29.9	27.5	2.4	2.4	8.0
Chilton	24.7	15.0	15.0	22.0	22.0	19.6	17.0	27.3	16.1	21.0	20.2	0.8	0.8	3.8
Choctaw	25.0	27.3	27.3	29.8	29.8	21.6	21.2	30.0	25.5	19.1	25.5	-6.4	6.4	33.5
Clarke	22.2	30.5	30.5	25.0	25.0	16.4	27.3	14.6	17.5	23.1	16.4	6.7	6.7	29.0
Clay	24.6	19.0	19.0	23.1	23.1	16.0	31.4	20.4	27.5	20.8	25.4	-4.6	4.6	22.1
Cleburne	21.7	27.1	27.1	29.8	29.8	19.3	18.5	31.3	14.8	23.6	20.8	2.8	2.8	11.9
Coffee	18.2	38.6	38.6	15.3	15.3	25.5	15.5	24.1	16.1	11.8	15.7	-3.9	3.9	33.1
Colbert	12.9	26.9	26.9	25.8	25.8	27.6	17.9	13.0	14.0	25.0	16.7	8.3	8.3	33.2
Conecuh	31.7	21.2	21.2	30.9	30.9	19.6	34.0	13.0	22.6	26.2	21.1	5.1	5.1	19.5
Coosa	28.8	25.5	25.5	31.0	31.0	25.9	17.0	18.0	23.6	39.0	19.7	19.3	19.3	49.5
Covington	20.3	28.6	28.6	14.1	14.1	29.8	36.8	25.5	17.0	15.2	23.8	-8.6	8.6	56.6
Crenshaw	26.1	29.8	29.8	25.8	25.8	21.2	14.3	24.0	20.4	18.6	17.8	0.8	0.8	4.3
Cullman	27.1	19.1	19.1	21.8	21.8	12.1	28.8	29.2	20.6	8.2	23.4	-15.2	15.2	185.4
Dale	23.4	20.7	20.7	20.0	20.0	19.6	32.1	21.1	25.8	28.6	25.3	3.3	3.3	11.5
Dallas	30.8	25.9	25.9	21.3	21.3	25.0	26.2	28.6	29.8	28.3	26.8	1.5	1.5	5.3
DeKalb	18.0	26.7	26.7	23.6	23.6	17.9	27.6	25.0	25.9	24.6	25.7	-1.1	1.1	4.5
Elmore	24.7	18.6	18.6	16.1	16.1	24.1	18.6	15.5	22.8	21.6	18.7	2.9	2.9	13.4
Escambia	22.6	22.8	22.8	16.1	16.1	29.8	27.6	19.6	23.2	24.6	23.7	0.9	0.9	3.7
Etowah	28.9	21.4	21.4	34.2	34.2	27.7	29.3	22.7	31.5	24.6	29.9	-5.3	5.3	21.5
Fayette	6.3	23.3	23.3	24.1	24.1	25.9	26.9	22.6	16.4	20.0	25.4	-5.4	5.4	27.0
Franklin	19.1	14.3	14.3	16.1	16.1	18.2	21.8	21.8	35.1	18.4	28.3	-9.9	9.9	53.8
Geneva	19.4	29.1	29.1	30.8	30.8	25.0	24.0	14.0	17.3	18.5	18.6	-0.1	0.1	0.5
Greene	29.1	31.5	31.5	28.8	28.8	20.7	29.6	19.2	27.5	25.5	22.8	2.7	2.7	10.6
Hale	30.0	19.6	19.6	16.4	16.4	19.6	16.0	19.2	23.1	27.9	17.3	10.6	10.6	38.0
Henry	28.1	24.6	24.6	35.0	35.0	13.7	30.0	21.8	23.6	13.6	23.2	-9.6	9.6	70.6
Houston	19.2	28.6	28.6	15.3	15.3	21.5	29.9	20.8	26.9	25.0	24.2	0.8	0.8	3.2
Jackson	17.5	29.8	29.8	25.4	25.4	23.2	19.0	19.6	21.7	28.3	20.4	7.9	7.9	27.9
Jefferson	22.5	28.6	28.6	19.8	19.8	25.2	26.1	28.3	25.8	26.1	26.0	0.1	0.1	0.4
Lamar	37.7	26.8	26.8	17.9	17.9	25.9	24.0	30.2	28.0	17.7	24.0	-6.3	6.3	35.6
Lauderdale	19.0	23.2	23.2	20.7	20.7	17.9	17.9	14.7	25.8	23.6	19.4	4.2	4.2	17.8
Lawrence	26.6	24.1	24.1	24.6	24.6	19.6	17.9	24.1	20.7	15.2	19.5	-4.3	4.3	28.3
Lee	21.6	23.8	23.8	27.8	27.8	29.0	22.6	20.9	22.6	21.2	23.9	-2.7	2.7	12.7

Note: There are too few data observations to allow for reliable and consistent estimates. The forecasts are likely to be better for the state but poor at the county levels because there is less white noise in the state and regional data series. *d* is deviation of the forecasts from the true (survey) underemployment rate. |*d*| is the absolute deviation of the forecast from the true underemployment rate.

County	Actual*										Forecasts	Forecast Error		Percent Error
	2004	2005	2006	2007	2008	|d|	2010	2011	2012	2013	2013	d	|d|	|d|
Limestone	27.3	24.1	24.1	24.1	24.1	17.9	18.2	21.7	34.5	28.0	24.3	3.7	3.7	13.2
Lowndes	23.2	22.6	22.6	15.4	15.4	30.2	24.1	22.6	25.5	22.4	24.6	-2.2	2.2	9.8
Macon	32.8	26.4	26.4	34.6	34.6	38.0	24.1	29.1	34.6	33.3	32.3	1.0	1.0	3.0
Madison	27.1	29.5	29.5	26.3	26.3	24.8	22.3	25.5	24.2	21.1	22.9	-1.8	1.8	8.5
Marengo	22.6	19.0	19.0	28.8	28.8	28.8	27.1	25.9	26.8	31.9	29.7	2.2	2.2	6.9
Marion	28.1	20.3	20.3	24.2	24.2	21.8	24.6	20.0	27.1	15.7	23.5	-7.8	7.8	49.7
Marshall	18.7	23.6	23.6	21.7	21.7	23.0	20.3	19.6	15.0	30.4	18.1	12.3	12.3	40.5
Mobile	24.6	29.3	29.3	29.7	29.7	27.3	23.9	29.9	23.9	21.0	26.3	-5.3	5.3	25.2
Monroe	20.0	24.5	24.5	20.8	20.8	17.7	22.6	32.1	25.5	14.6	26.3	-11.7	11.7	80.1
Montgomery	28.4	30.4	30.4	22.0	22.0	31.5	28.6	24.5	26.8	26.1	25.6	0.5	0.5	1.9
Morgan	23.8	20.3	20.3	23.5	23.5	30.7	26.7	24.1	19.3	23.9	24.7	-0.8	0.8	3.3
Perry	26.4	35.2	35.2	32.2	32.2	15.4	30.0	16.0	24.1	21.3	19.6	1.7	1.7	8.0
Pickens	23.7	19.2	19.2	26.9	26.9	20.0	20.8	25.0	21.1	23.2	22.8	0.4	0.4	1.7
Pike	25.4	20.3	20.3	30.9	30.9	12.7	17.0	27.3	29.2	18.2	22.5	-4.3	4.3	23.6
Randolph	22.9	35.2	35.2	26.5	26.5	32.2	29.6	22.0	19.2	24.5	22.7	1.8	1.8	7.3
Russell	31.3	15.8	15.8	30.2	30.2	22.5	25.4	27.9	23.7	26.5	26.2	0.3	0.3	1.1
St. Clair	20.0	19.8	19.8	22.1	22.1	19.6	28.1	22.0	19.1	24.5	22.8	1.7	1.7	6.9
Shelby	31.3	15.8	15.8	24.7	24.7	35.5	28.4	29.0	25.9	26.2	30.2	-4.0	4.0	15.3
Sumter	30.9	20.4	20.4	31.6	31.6	30.0	28.0	37.3	22.2	24.4	30.5	-6.1	6.1	25.0
Talladega	15.9	32.8	32.8	22.4	22.4	25.0	16.1	26.7	19.3	8.9	20.7	-11.8	11.8	132.6
Tallapoosa	26.3	17.2	17.2	20.0	20.0	22.4	20.7	18.9	24.6	12.1	21.4	-9.3	9.3	76.9
Tuscaloosa	28.2	28.2	28.2	23.5	23.5	30.3	21.3	16.5	31.3	30.3	23.1	7.2	7.2	23.8
Walker	25.8	23.2	23.2	17.2	17.2	16.4	25.5	24.6	35.1	21.3	26.9	-5.6	5.6	26.3
Washington	30.5	27.3	27.3	24.1	24.1	23.1	13.3	30.8	22.6	17.8	20.6	-2.8	2.8	15.7
Wilcox	34.5	23.2	23.2	24.5	24.5	23.5	33.3	24.5	28.0	29.3	26.4	2.9	2.9	9.9
Winston	18.5	26.9	26.9	12.0	12.0	19.6	27.5	24.0	12.0	16.0	17.8	-1.8	1.8	11.3
Alabama	**24.0**	**25.2**	**25.2**	**24.2**	**24.2**	**24.3**	**24.4**	**24.0**	**23.8**	**23.1**	**23.9**	**-0.8**	**0.8**	**3.5**
Average												*-0.4*	*4.9*	*25.5*

Note: There are too few data observations to allow for reliable and consistent estimates. The forecast is better for the state but poor at the county levels because there is less white noise in the state and regional data series. d is deviation of the forecast from the true (survey) underemployment rate. $|d|$ is the absolute deviation of the forecast from the true underemployment rate.

WIAA Region 3 comprises of Bibb, Fayette, Hale, Greene, Lamar, Pickens, and Tuscaloosa counties. The regional underemployment rate was projected to be 21.8 percent in 2013 and lower than the 24.0 percent observed in 2012, but it went up to 24.5 percent. The regional forecast error is 2.7 percentage points and the absolute percent error is 11.0 percent. This suggests that the rate is under-forecasted but has good accuracy. County forecast errors range from -6.3 percentage points in Lamar County to 10.6 points in Hale, with Pickens having the least error and Hale the largest. The model over-forecasts rates in Fayette and Lamar counties and under-forecasts the rest. County absolute percent errors range from 1.7 percent in Pickens County to 38.0 percent in Hale. The accuracy of most of the county forecasts is fair; only two are of great or good level of accuracy.

Region 4 consists of Blount, Chilton, Jefferson, St. Clair, Shelby, and Walker counties. Regional underemployment was projected to rise to 25.3 percent in 2013 from 24.0 percent in 2012. The actual underemployment rate is 25.0 percent, just 0.3 percentage points below the forecast. The absolute percent error is 1.2 percent implying a superior level of accuracy of the forecasting model. Within the region, county forecasts have good level of accuracy with errors ranging from -5.6 percentage points in Walker County to 7.0 points in Bibb. The absolute percent errors range from 0.4 percent in Jefferson County to 26.3 percent in Walker. The forecast is also correct about the direction of the movement of all the county underemployment rates.

WIAA Region 5 comprises of nine counties—Calhoun, Cherokee, Clay, Cleburne, Coosa, Etowah, Randolph, Talladega, and Tallapoosa. The region's underemployment rate was projected to be 24.3 percent in 2013 up from 23.9 percent in 2012. The actual 2013 underemployment rate is 22.7 percent, 1.6 percentage points below the forecast and the absolute percent error is below 10 percent. This implies that the regional forecast accuracy is good. At the county level forecast deviations range from -11.8 percentage points in Talladega County to 19.3 points in Coosa. By magnitude, the largest forecast error is for Coosa County while the least is for Randolph. Underemployment rates are over-forecasted in five counties given the negative forecast errors and the rest are under-forecasted. Absolute percent errors range from 7.3 percent in Randolph County to 132.6 percent in Talladega. Five counties have poor or insufficient accuracy forecasts, two have fair accuracy, and two have good accuracy. The direction of the underemployment rate is against the forecast in four counties—Calhoun, Cherokee, Coosa, and Talladega.

Workforce Region 6 comprises of Dallas, Marengo, Perry, Sumter, and Wilcox counties. The region's underemployment rate forecast for 2013 is 26.6 percent and the highest in Alabama. The actual rate is 26.8 percent, just 0.2 percentage points above the forecast. The model forecasted the regional underemployment with superior level of accuracy; the absolute percent error is just 0.7 percent. Among the counties, forecasting errors are low and range from -6.1 percentage points in Sumter County to 2.9 points in Wilcox. Only the Sumter County rate is over-forecasted. The county absolute percent errors range from 5.3 percent in Dallas to 25 percent in Sumter. The county underemployment forecasts have good to superior level of accuracy in four of the five counties. The direction of the underemployment rates fit with the forecasts in all the counties except Wilcox.

Region 7 consists of six counties—Autauga, Butler, Crenshaw, Elmore, Lowndes, and Montgomery. Regional underemployment was projected to drop to 23.8 percent in 2013 from 25.8 percent in 2012. The actual rate dropped to 24.7 percent, 0.9 percentage points above the forecast. The regional underemployment rate is forecasted with good to superior level of accuracy; regional

absolute percent error is 3.6 percent. Among the counties, underemployment forecast deviations range from -5.0 percentage points in Butler to 13.8 points in Autauga, with Butler and Lowndes rates being over-forecasted. Montgomery has the least error at 0.5 points while Autauga has the largest. Absolute percent errors range from 1.9 percent in Montgomery County to 41.4 percent in Autauga. Forecasts are of good to superior level of accuracy in half of the six counties and only one had an unexpected directional change.

Region 8's underemployment forecast is the most accurate in the state. Underemployment was projected to slightly drop to 25.7 percent in 2013 from 25.8 percent in the previous year. The 2013 rate is 25.6 percent just 0.1 percentage point below the forecast. The rate is slightly over-forecasted, with an absolute percent error of 0.4 percent, the least across Alabama. The region comprises of Bullock, Chambers, Lee, Macon, and Russell counties. County forecasts are also more accurate in Region 8 than in other WIAAs. Deviations from the forecast range from -2.7 percentage points in Lee County to 1.5 points in Chambers. Lee County has the largest deviation from the true rate and Russell has the least. Underemployment rates are over-forecasted in two counties—Bullock and Lee. The absolute percent errors range from 1.1 percent in Russell County to 12.7 percent in Lee. All the counties have less than 10 percent absolute percent errors, except Lee.

Workforce Region 9 has eight counties—Baldwin, Choctaw, Clarke, Conecuh, Escambia, Mobile, Monroe, and Washington. The 2013 underemployment rate is 21.9 percent, 2.8 percentage points below the projected rate of 24.7 percent. The model over-forecast the region's rate, with an absolute percent error of 12.8 percent. Regional underemployment declined contrary to the projections. Forecast deviations among the counties range from -11.7 percentage points in Monroe to 6.7 points in Clarke. Escambia County has the least error while Monroe has the largest. The model greatly over-forecasts underemployment in half of the counties and greatly under-forecasts in two. Absolute percent errors range from 3.7 percent in Escambia County to 80.1 percent in Monroe. Forecasts in four counties are either of poor or insufficient level accuracy. The forecasting model is also wrong about the direction of the rate change in five counties.

Workforce Region 10 comprises of Barbour, Coffee, Covington, Dale, Geneva, Henry, Houston, and Pike counties. The regional underemployment rate for 2013 is 19.2 percent against the forecasted 22.9 percent. Region 10 has the largest forecast error among all the WIAAs in both magnitude and percentage. The model over-forecast the regional underemployment with an absolute percent error of 19.3 percent. The county underemployment forecast deviations range from -9.6 percentage points in Dale County to 3.3 points in Henry. The model greatly over-forecast underemployment rates in five counties. Geneva County has the least forecast deviations and Henry has the largest. The direction of change of the 2013 rates from the previous year is against the forecasted direction in three counties—Barbour, Covington, and Dale. County absolute percent errors range from 0.5 percent in Geneva to 70.6 percent in Henry. Three of the counties have good or fair accuracy forecasts, but the others have poor or insufficient underemployment rate forecasts.

Underemployment was projected to go up in both Jefferson and Mobile counties. However the rate went up in Jefferson and declined in Mobile. Jefferson County underemployment forecast has the greatest accuracy across the state with a very small deviation of 0.1 percentage point (a slight under-forecast) and an absolute percent error of just 0.4 percent. On the other hand, Mobile County's forecast has a large forecast deviation of -5.3 percentage points. The rate is over-forecasted with an absolute percent error of 25.2 percent.

Conclusions

This report presents a test of the first attempt at forecasting underemployment rates in Alabama, its workforce development regions, and all 67 counties. Underemployment rate forecasts for 2013 are compared with 2013 underemployment survey results to determine the accuracy of the forecasting model. Deviations from the actual underemployment rates and absolute percent errors are used to measure the level of accuracy of the forecasts. The rates have remained generally steady in the state and half of the workforce regions. The model forecasts underemployment with good or fair level of accuracy for the state and six regions and poorer accuracy in the remaining four. The state's underemployment is over-forecasted with an absolute percent error of 3.5 percent. Among the workforce development regions, forecasting errors are lowest in Region 8 and highest in Region 10. The model over-forecast underemployment in five regions and under-forecasts the others. At the county level, underemployment rates are over-forecasted in 32 counties and under-forecasted in the remaining 35. Jefferson County has the most accurate forecast with an absolute percent error of 0.4 percent while Cullman has the most inaccurate forecast (185.4 percent absolute percent error). The forecasting model also has a good level of accuracy in forecasting underemployment in 24 counties out of the 67 counties. Further, the model correctly projected the direction of change in 49 counties and is wrong in 18 counties.

The forecast model's performance is mixed at the state and regional levels and quite poor at the county level because of the short history on which it is based. Only one forecast period is tested, which limits the type of tests that can be conducted to determine the performance of the model. Conventional testing measures such as mean absolute percent errors and root mean square errors could not be applied. In view of the high volatility in county underemployment rates and to some extent regional underemployment rates, the model performance is likely to become more reliable if more history is obtained with future surveys. A richer data history will also enable different forecast model specifications.