RESEARCH RAP Special Report

State Unemployment Rate Nowcasts*

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For the month of August, the unemployment rates for Pennsylvania, New Jersey, and Delaware were 9.2 percent, 9.6 percent, and 8.4 percent, respectively, and the national unemployment rate was 9.6 percent. Using national unemployment and other regional data, we predict the September unemployment rates for the three states in our District to be 9.2 percent for Pennsylvania, 9.6 percent for New Jersey, and 8.4 percent for Delaware with 90 percent confidence intervals of [9.1,9.4], [9.5,9.7], and [8.3,8.5], respectively[1].

Although the national unemployment rate for a given month is usually reported on the first Monday of the following month, state unemployment rates are not released until roughly three weeks later. For example, the data on the national unemployment rate for September 2010 were reported on Friday, October 8, 2010, but the state unemployment rate data for the same month will not be reported until Friday, October 22, 2010. Because of this lag in the release of state-level data for a given month, it would be desirable to produce a nowcast — which is what economists call a "forecast" or estimate of economic activity that has already occurred — of the state unemployment rates in advance of the actual report.

Our goal is to nowcast the unemployment rates for the current month for the three states in our District — Pennsylvania, New Jersey, and Delaware — based on weekly state unemployment insurance claims (number of continued claims to receive unemployment benefits and the number of employed workers covered by state insurance programs, which are used to

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[1] Due to rounding of the forecasts and interval bounds to match the traditional format of unemployment rates, the nowcasts may not be presented as the midpoint of their respective confidence intervals.

calculate an insured unemployment rate), historical state unemployment rates, and the national unemployment rate. We also include as an indicator of overall state employment the employment index from the Federal Reserve Bank of Philadelphia's Business Outlook Survey, which reflects the difference in the percentage of local manufacturing firms that have increased workers and the percentage of firms that have decreased workers.

The availability of these data varies by data series. As noted above, national employment data for a given month are released on the first Friday of the following month. Claims data are reported weekly (on Thursdays) on a two- to three-week delay, and the BOS for a given month is released on the third Thursday of the same month. State employment data for a given month are released roughly around the third week of the following month, so by the time state unemployment data are released, the insured unemployment rate (which we calculate using claims data), the current employment index from the BOS, and the national unemployment rate for the same month are already available. Figure 1 shows the timing of all relevant data releases for this month's nowcasts. Because of the delay in data releases for state claims, the insured unemployment rate used in the model represents a partial month (the average of two-three weeks of data); for this month's nowcasts, the insured unemployment rate covers three weeks.

In order to predict the new unemployment rate for each state, we run a linear regression of the one-month change in the state unemployment rate ($\Delta state\_ur_t = state\_ur_t - state\_ur_{t-1}$) dependent on the following variables:

- $\Delta state\_ur_{t-1}$, the lagged one-month change in the state unemployment rate
- $\Delta state\_iur_t$, the one-month change in the state insured unemployment rate, defined as average weekly continued claims of unemployment insurance divided by average weekly covered employment
- nec_t, the current BOS employment index

as shown below:

$$\Delta state\_ur_t = \beta_0 + \beta_1(\Delta state\_ur_{t-1}) + \beta_2(\Delta state\_iur_t) + \beta_3(nec_t),$$

where $state\_ur_t$ is unknown and what we are estimating at time t.

Additionally, because national unemployment data for the month for which we are nowcasting the state unemployment rates are available at the time of nowcasting, we can also run a set of regressions by state using the above model with the addition of the one-month change in the national unemployment rate (Δus_ur_t):

$$\Delta state\_ur_t = \beta_0 + \beta_1(\Delta state\_ur_{t-1}) + \beta_2(\Delta state\_iur_t) + \beta_3(nec_t) + \beta_4(\Delta us\_ur_t).$$

The data we use are monthly and run from January 1990 for Pennsylvania and New Jersey and from January 1991 for Delaware[2] through the most recent date available, covering more than 240 months. Table 1 lists the coefficients and standard errors we obtain from each model (excluding and including the U.S. rate) for each state when nowcasting state unemployment rates using data through September 2010 (for a September nowcast). For all three states, the inclusion of the change in the national unemployment rate improves the model, and the coefficient on the national rate change variable is significantly different from zero at the 5 percent level.

In order to get a sense of the consistency of the data and our model, we compare the root mean squared errors (RMSEs) obtained from two separate methods: rolling regressions and in-sample and out-of-sample forecasting. Table 2 lists the RMSEs from each method for each state.

Rolling regressions, which are linear regressions on moving subsamples of the data, were run for each state. These rolling regressions use the same linear models described above (with and without the national unemployment rate) but on a moving window of a specified size, which in this case is 10 years (120 months). Starting in January 2000, we run the models described above on a sample of the past 10 years, calculate a "forecasted" rate for the end month (January 2000), then shift ahead one month and repeat the process through the most recent month of data. We end up with at least 120 individual regression results per state. For the end month of each window, we calculate a residual from the actual state unemployment rate and the "forecasted" unemployment rate. We are then able to construct an RMSE for the entire set of rolling regressions by taking the square root of the sum of the squared end-month residuals and dividing by the number of months. So for each state *i* and end-month *j*:

$$RMSE_{rolling,i} = \sqrt{\frac{\sum(actual_{i,j} - forecast_{i,j})^2}{N_i}}$$

For all three states, the rolling RMSEs are comparable to the RMSEs from the model and are lower when the national rate is included.

[2] In September 1990, the Delaware unemployment rate jumped to 5.8 percent from an average rate of 3.2 percent for the year leading up to that month and remained around that level for the rest of the year. This jump produced a very large, isolated residual so we start the Delaware sample in January 1991.

We also look at the RMSEs for an in-sample and out-of-sample of the data, with the hope that the two are similar, implying consistent data over time. The in-sample consists of the first 10 years of data for each state. The model is used to estimate an equation for the in-sample data, which is then used to produce “forecasts” for the out-of-sample data. RMSEs are then calculated for each sample. If the data are consistent over time, the RMSEs will be similar. While for Pennsylvania the RMSEs are very similar when the national rate is included, New Jersey and Delaware show more disparity. However, if we compare the actual unemployment rates observed since January 2008 through August 2010 with the 90 percent confidence intervals created from the out-of-sample forecasts over the same period, we see that the forecasts for Pennsylvania and New Jersey have been mostly accurate (see Figure 2).

In general, the RMSEs from the overall model fall between the RMSEs calculated from the in-sample and out-of-sample testing and are similar to the rolling regressions in most. With the exception of the in-sample RMSEs, including the U.S. unemployment rate lowers the RMSEs and improves the predictive power of our model, so we want to continue to use national data to help inform the state nowcasts. Table 3 lists the nowcasted (excluding and including U.S. rate) and actual state unemployment rates from our models since January 2010 when we began nowcasting state unemployment rates. Figure 3 shows the residuals for the model that includes the national rate from this month’s nowcast for each state. Over the entire time span, the nowcasts are fairly stable, although Delaware has experienced wider dispersion in recent months.

Because of the relative consistency of the nowcasts and the lag in data availability for unemployment data at the state level and the other data we use in our model, these nowcasts help provide a better sense of the current state of the regional economy before actual data are released. The model only produces a one-step forecast for each state, but it provides an accurate idea of what the unemployment rate is in the absence of actual data.

Table 1. Change in State Unemployment OLS Regression Results and Standard Errors, September 2010						
	Pennsylvania		New Jersey		Delaware	
ΔState UR_{t-1}	0.151** (0.063)	0.107* (0.064)	0.485*** (0.053)	0.444*** (0.055)	0.506*** (0.058)	0.431*** (0.056)
ΔState IUR_t	0.245*** (0.047)	0.211*** (0.048)	0.199*** (0.063)	0.160** (0.063)	0.039 (0.038)	0.038 (0.035)
NEC_t	-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.001*** (0.001)	-0.000 (0.001)
ΔUS UR_t		0.113*** (0.041)		0.114*** (0.041)		0.219*** (0.038)
Constant	0.009 (0.005)	0.008 (0.005)	0.005 (0.005)	0.004 (0.005)	0.005 (0.006)	0.003 (0.005)
Adjusted R^2	0.377	0.394	0.613	0.623	0.358	0.438

Table 2. Root Mean Squared Errors, September 2010			
	Pennsylvania	New Jersey	Delaware
Without US UR			
OLS – overall	0.0845	0.0851	0.0840
OLS – in sample	0.0775	0.0941	0.0446
OLS – out sample	0.1042	0.0795	0.1759
Rolling	0.0802	0.0704	0.1003
With US UR			
OLS - overall	0.0833	0.0840	0.0787
OLS – in sample	0.0815	0.0955	0.0627
OLS – out sample	0.0825	0.0685	0.0899
Rolling	0.0803	0.0688	0.0897

Table 3. Forecasted and Actual Unemployment Rates, January to August 2010									
	Pennsylvania			New Jersey			Delaware		
	Forecasted		Actual	Forecasted		Actual	Forecasted		Actual
	W/out US Rate	With US Rate		W/out US Rate	With US Rate		W/out US Rate	With US Rate	
January	8.9	8.8	8.8	10.2	10.2	9.9	9.0	8.9	8.9
February	8.7	8.7	8.9	9.8	9.8	9.8	8.9	8.9	9.2
March	8.8	8.9	9.0	9.7	9.7	9.8	9.2	9.2	9.2
April	8.9	9.0	9.0	9.8	9.8	9.8	9.2	9.2	9.2
May	9.0	9.1	9.1	9.8	9.8	9.7	8.9	9.0	8.8
June	9.1	9.1	9.2	9.7	9.7	9.6	8.7	8.8	8.5
July	9.2	9.2	9.3	9.6	9.6	9.7	8.3	8.4	8.4
August	9.3	9.3	9.2	9.8	9.8	9.6	8.4	8.4	8.4

Figure 1. Schedule of Data Releases for September Nowcasts

12 **September**	13	14	15	16 Sep. BOS; State claims for week ending 8/28	17	18
19	20	21 Aug. state urates	22	23 State claims for week ending 9/4	24	25
26	27	28	29	30 State claims for week ending 9/11	1 **October**	2
3	4	5	6	7 State claims for week ending 9/18	8 Sep. US urate; **State nowcasts run**	9
10	11	12	13	14	15	16
17	18	19	20	21	22 **Sep. state urates**	

Figure 2. Unemployment Rates and 90% Confidence Intervals for Out-of-Sample Forecasts by State, January 2008 to August 2010

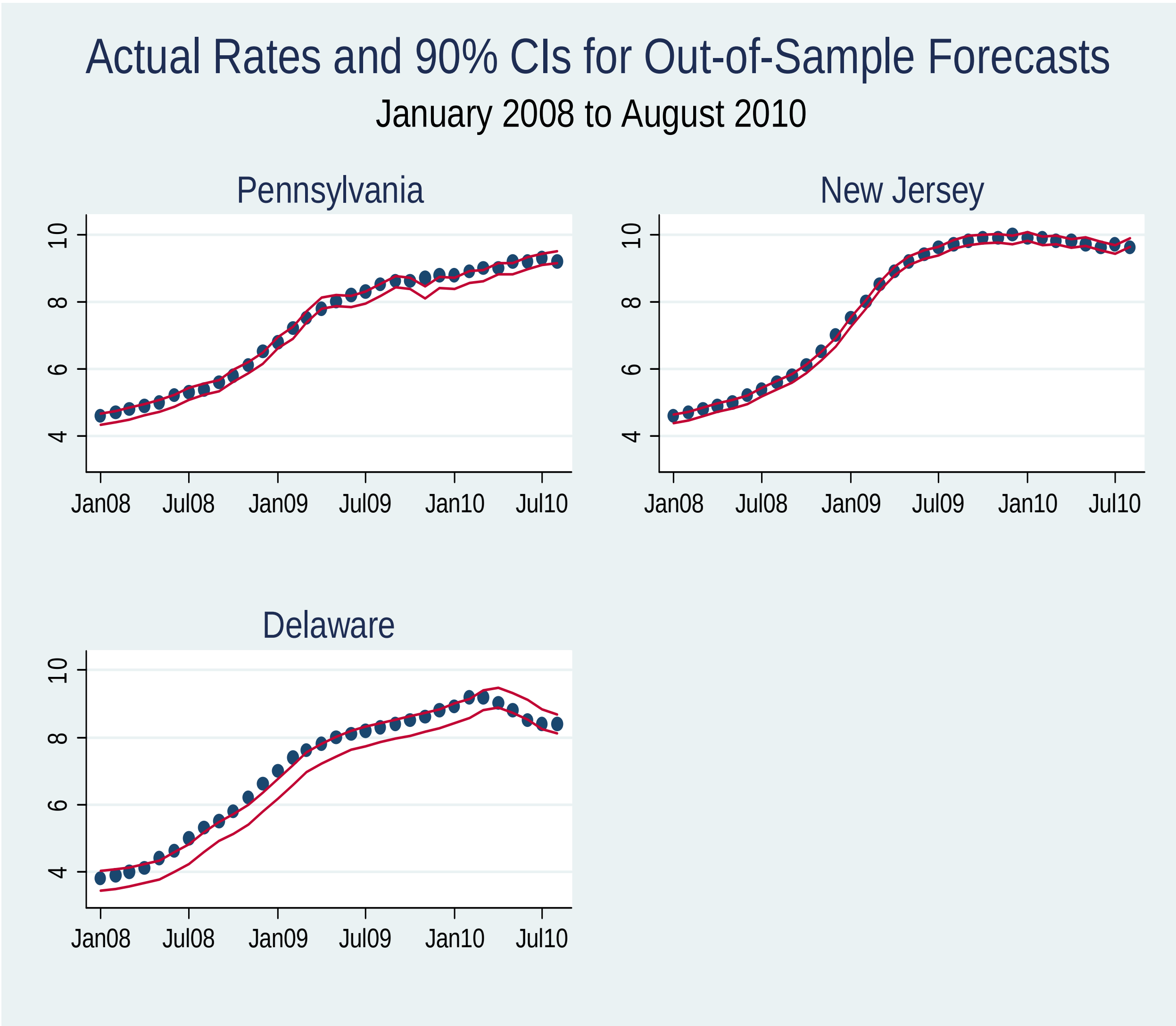

Figure 3. OLS Residuals by State When U.S. Unemployment Rate Is Included, September 2010