Is It Jobs or the Unemployment Rate?

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August 5, 2015

1 Introduction

Which should we be measuring, Wisconsin's job growth or its unemployment rate?

This question arises because while the state's job growth has been mediocre, its unemployment rate is quite good. Over the last 4 years, Wisconsin's unemployment rate has come down from around 9% in early 2011 to around 5% in early 2015.[1] 5% unemployment is generally interpreted as approximately full employment, so this suggests that Wisconsin has made a full (or nearly full) economic recovery. And despite being at roughly the national unemployment rate in 2011, Wisconsin's unemployment rate is now consistently below the national level, by as much as 0.7% (in April 2015).

However, over that same time frame, Wisconsin's job growth has been mediocre at best. By May 2015 the US had reached an employment level of over 149.3 million jobs, a 1.38% increase over its pre-recession peak. In contrast, by May 2015 Wisconsin had only 2.93 million people employed, still almost 2% below where it stood in July 2008.

The question itself has political implications. When Scott Walker became Governor, he guaranteed that he would add 250,000 jobs in his first term. In fact however, Wisconsin only added 127,518 jobs, barely more than half of his target.[2] So now, rather than trumpet the job growth numbers, his office has been focusing on the far more attractive unemployment

[1]Wisconsin's unemployment rate is always higher in the first three months of the year than in the rest of the year. In 2011, the rate ranged from 10.4% in February to 8.5% in May. In 2015, it ranged from 5.6% in February to 4.4% in April. I used 9% and 5% is reasonable approximations.

[2]The 127,518 jobs comes from the Bureau of Labor Statistics' Local Area Unemployment (LAU) statistics, Dec. 2014 jobs minus Dec. 2010 jobs. The Quarterly Census on Employment and Wages (QCEW) consistently reports fewer jobs than the LAU, in part because the latter includes the self-employed. By the QCEW, Wisconsin added 119,324 jobs, not quite 48% of the target.

data. Which raises the question, is that switch legitimate?[3]

This paper seeks to explore that question, by looking into the far more fundamental issue: how could these two measures be so divergent? Shouldn't more jobs mean a lower unemployment rate, and vice versa? Apparently, the answer seems to be no, one doesn't imply the other, but how can that be the case?

I'll begin by discussing how the two measures are related, and how that relationship naturally divides into several other measures. We'll then look at each of those measures, to see how well or how poorly Wisconsin has performed under each one. Finally, we'll pull the pieces back together, to determine what if anything has been right about Wisconsin's economic performance over the last 4 years, and what if anything has been wrong.

Before turning to that issue, let me note an interesting irony. During the 2012 recall campaign, there was a debate about how Wisconsin's performance should be measured. Democrats pointed to the job numbers reported in the Current Employment Statistics (CES), which showed very week job growth in the 6 months prior to the recall election. Republicans responded by pointing out that the CES numbers were based on a survey, and were far less accurate than the QCEW, which is based on an actual monthly census of all employers.

The irony is that the QCEW, based on that census, continues to show weak job growth. So the Governor's office prefers to talk about the state unemployment rate. But that measure comes from the Bureau of Labor Statistics' Local Area Unemployment (LAU) statistics. Those numbers are themselves estimated from the Current Population Survey (CPS), the CES, and the state's unemployment insurance data. Both the CPS and the CES are in fact surveys, not censuses, and are based upon a relatively small fractions of the population. The CES that Walker's supporters dismissed as inaccurate in 2012 is based on a survey of about 143,000 businesses nationwide. The CPS is an even smaller survey, of 60,000 households nationwide.

So the state unemployment rate, that the Governor's office prefers, is based merely on surveys, while the QCEW jobs numbers, which the Governor's office discounts, are based on a complete census. Ironic, yes?

[3] All of the state data is based on the LAU, which can be found at http://www.bls.gov/lau/ststdnsadata.txt. The national numbers come from the BLS's Current Population Survey (CPS).

2 The jobs/unemployment rate relationship

To see how our two measures of economic success – the unemployment rate and total job growth – could diverge, we need to first see how they are related. We'll begin with the unemployment rate, and the standard textbook discussion of how the unemployment rate is calculated.

To measure the unemployment rate, the Bureau of Labor Statistics begins by measuring the size of the labor force. They include in the labor force everyone who is employed, plus anyone who is currently unemployed but is actively seeking employment. The unemployment rate is then the fraction of those in the labor force who are currently unemployed:

$$\text{U rate} = \frac{\text{Unemployed}}{\text{Labor Force}} = \frac{\text{Unemployed}}{\text{Employed + Unemployed}} \quad .$$

Only around two thirds of the adult population is included in the labor force. Retirees, full time students, stay-at-home parents, and people with disabilities are typical examples of adults who are not counted in the labor force, so they don't appear in either the numerator or the denominator of the above equation when the unemployment rate is calculated. Discouraged workers – eligible workers who have become discouraged because their job search had been consistently unsuccessful, and have quit seeking employment – are also excluded from the calculation .

This latter group is the source of one criticism of the unemployment rate as a measure of economic performance. If economic growth is so poor that many workers become disillusioned, and they quit looking for work, they will no longer be counted as unemployed. That will cause the unemployment rate to severely undermeasure the amount of economic hardship. On the other hand, during times of economic recovery, if the economy is widely perceived as getting better, many of these discouraged workers may restart their job search efforts, and will again be counted as unemployed. For this reason, the unemployment rate may not accurately measure the underlying improvement in the economy.

Because of these shortcomings with the unemployment rate, economists also routinely measure the *Labor Force Participation Rate* (LFPR). The LFPR measures the fraction of the population 16 years or older who are in the labor force. The equation is:[4]

[4]The formula excludes those serving in the military, as well as anyone who has been institutionalized, such as those in prison. Hereafter, by population I mean the Civilian Noninstitutional Population, as measured by the Census Department.

$$\text{LFPR} = \frac{\text{Civilian Labor Force}}{\text{Civilian Pop'n, 16+}} \ .$$

The LFPR will reflect among other things the behavior of discouraged workers. As they quit looking for work, the unemployment rate will fall (as noted above), but so will the LFPR. A drop in the latter signals that the drop in the unemployment rate may not be a good sign.

The two measures can be combined into a single measure, by first converting the unemployment rate into the employment rate. The relationship between these two measures is simple:

$$\text{Employment rate} = \frac{\text{Employed}}{\text{Labor Force}} = 1 - \text{Unemployment rate} \ .$$

Thus, a 6% unemployment rate implies a 94% employment rate. Multiplying the employment rate by the LFPR gives the *Percent of the Population Employed* (%Empl):

$$\begin{aligned} \%\text{Empl} = \frac{\text{Employed}}{\text{Pop'n}} &= \frac{\text{Employed}}{\text{Labor Force}} \cdot \frac{\text{Labor Force}}{\text{Pop'n}} \\ &= \text{Employment rate} \cdot \text{LFPR} \ . \end{aligned}$$

Finally, multiplying the employment rate by the population gives the total number of jobs:

$$\begin{aligned} \text{Total Employed} &= \frac{\text{Empl}}{\text{Labor Force}} \cdot \frac{\text{Labor Force}}{\text{Pop'n}} \cdot \text{Pop'n} \\ &= \text{Empl rate} \cdot \text{LFPR} \cdot \text{Pop'n} \ . \qquad (1) \end{aligned}$$

Equation (1) describes how a state could increase, or fail to increase, its total number of jobs. An increase in the population, in the LFPR, or in the Employment rate (*i.e.* a decrease in the unemployment rate) all lead to an increase in the total number of jobs. But if the employment rate were rising and the other two measures were falling, the total number of jobs could actually fall. That is, a decrease in the unemployment rate will not necessarily lead to more total jobs, because it can be cancelled out by declines in either of the other two measures.

Since Wisconsin's reduced unemployment rate has been accompanied by relatively anemic job growth, the problem must be in one or both of those other two measures. To explore that, we'll look at all of these measures, one at a time, in the order that we've encountered them thus far. So first, how good is our drop in the unemployment rate?

3 The Drop in the Unemployment rate

As noted in the Introduction, Wisconsin's unemployment rate is now down in the 5% range, better than the US average. However, we should be careful about such simple comparisons. The US average includes states like West Virginia and Mississippi, that have chronic unemployment. It also includes states like North Dakota, that are booming. So how good is 5%?

To explore that, I'll use a strategy that I employed in my paper, *Measuring Wisconsin's Job Gap*.[5] I'll begin by estimating the relationship between Wisconsin's unemployment rate, and the unemployment rates of our neighboring states and of the US as a whole. The idea is that if there are special characteristics that have affected unemployment in Wisconsin – say, a weakening of manufacturing exports or strong agricultural prices – these characteristics will likely have also affected our neighboring states in similar ways.

Table 1: Unemployment rates

month	WI	US	IL	IN	IA	MI	MN	OH
May 1990	3.80	5.20	5.74	5.15	4.02	7.08	4.18	5.42
May 1995	3.66	5.45	5.12	4.79	3.24	5.33	3.37	4.43
May 2000	3.32	3.84	4.12	3.22	2.29	3.37	2.79	3.74
May 2005	4.52	4.89	5.61	5.19	3.95	6.66	3.71	5.66
May 2010	8.50	9.34	10.06	10.27	5.61	12.59	7.02	9.91
May 2015	4.70	5.31	5.64	4.80	3.40	5.88	3.61	4.88

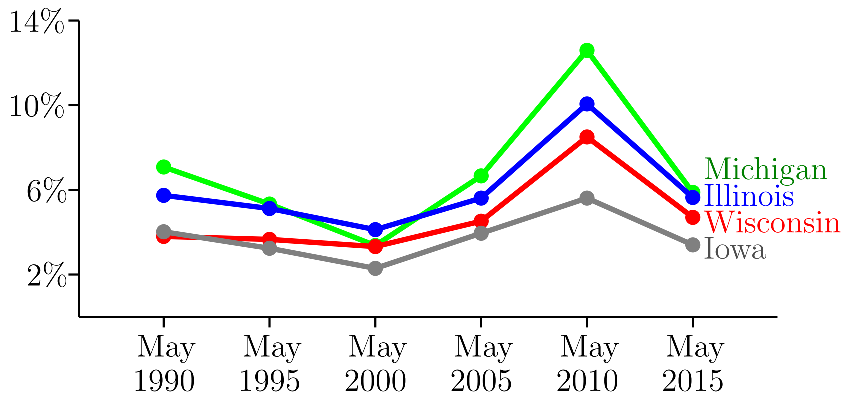
Regression analysis should capture these similarities, by measuring how the pattern of changes in our unemployment rate is related to the changes in their unemployment rates. That analysis will then allow me to estimate where Wisconsin's unemployment rate should

[5] McGee, *Measuring Wisconsin's Job Gap*, www.uwosh.edu/faculty_staff/mcgee/Measuring_WIs_Job_Gap_Revised.pdf.

be, given the corresponding rates in our neighbors and in the country as a whole.[6]

Table 1 lists some of these unemployment rates, for the month of May in selected years. Figure 1 plots these for four states. As both the table and figure suggest, Wisconsin typically has a lower unemployment rate than our neighbors to the south and east, and a higher rate than Iowa and Minnesota. So the fact that we're current below four of our neighbors and above the other two is in itself pretty much the norm.

Figure 1: Unemployment Rates over Time



To be more precise about the comparison, I estimated the relationship between Wisconsin's employment rate and the employment rates of the US and our 6 neighbors, using monthly data from Jan. 1990 to Dec. 2010.[7] The estimated coefficients are reported in the Appendix, in Table 8.

The fitted pattern (the black line), as well as the actual observed unemployment rates (the red dots), also appear in the Appendix, in Figure 13. The R^2 value reported in Table 8 shows that the model explained over 99.5% of the variation in Wisconsin's changes in the employment rate. The type of time series data used in this study will almost always provide a high R^2, but as the figure shows, this R^2 represents an extremely good fit to the actual unemployment numbers.

So how well has Wisconsin done over the last 4 and a half years? Figure 2 presents the fitted pattern and observed unemployment rates from Jan. 2011 to May 2015. As the figure shows, Wisconsin's unemployment rate has been consistently below the projected value for the last year and a half. The difference has been fairly significant – since Jan.

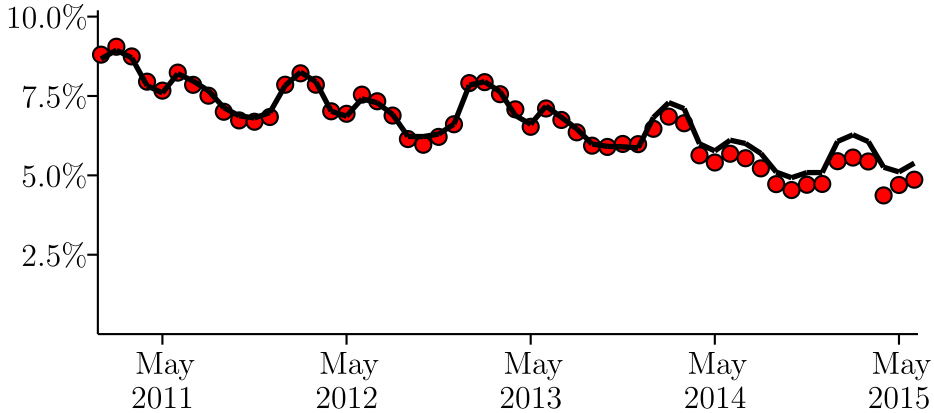
[6] This technique, of using observable variables (the other states' rates) to indirectly capture the impacts of unobservable variables (changes in demand for various state products), is called Instrumental Variables.

[7] Details of the econometric procedures are in the Appendix. Because the employment rate and unemployment rate must necessarily sum to 1, a regression using unemployment rates would have generated exactly the same results.

2014 it has averaged about a half percentage point lower than projected – and it has been growing, averaging almost two thirds of a percent in the first 6 months of 2015.[8]

This suggests that Wisconsin is doing a bit better than its neighbors in returning its workforce to work, even after taking into account all the long term differences in the states' employment patterns.[9] So the Governor's boasts about Wisconsin's low unemployment rate seem at this point to be entirely justified.

Figure 2: WI Unemployment Rates Compared to the Projection



It should also be clear from Figure 2 that Wisconsin's unemployment rate follows a regular seasonal pattern, peaking in the first quarter (Jan. to March) and reaching its low in the fourth quarter (Oct. to Dec.). We should therefore be very careful in interpreting month-to-month changes in the unemployment rate, since these could easily be just normal seasonal fluctuations, or normal sampling error. Comparisons to the corresponding month of the prior year will almost always be more valid.

So, does our low unemployment rate suggests a strong state economy? Before drawing any conclusions on that score, let us look at the state's labor force participation rate.

[8]The margin of error for the June 2015 projected value is 0.63%; prior months have similar but slightly smaller margins of error. The difference between the reported unemployment rate and the projected value was statistically significant for three of the six months in 2015. This margin of error does not take into account that the reported unemployment rates are themselves estimates, with unknown standard errors.

[9]Recall that the state unemployment rate numbers are based on survey data. As a result, the reported rate may differ from the actual rate due to "sampling error" – the normal likelihood that a sample may randomly differ from the population. However, sampling error alone would not explain 17 negative differences in a row.

4 The Labor Force Participation Rate

Our next measure of state economic performance is the Labor Force Participation Rate (LFPR). As discussed in Section 2, the LFPR calculates the fraction of the population 16 years or older who are counted as in the labor force, *i.e.*, the fraction of the population that is either employed, or currently unemployed but actively seeking employment.

A low LFPR can be a sign that unemployed workers have become discouraged, and are no longer seeking employment. But it can also reflect population demographics. As the Baby Boom reaches retirement age, and the share of the population over age 65 grows, we would naturally expect the LFPR to decline.

Table 2: Labor Force Participation Rates

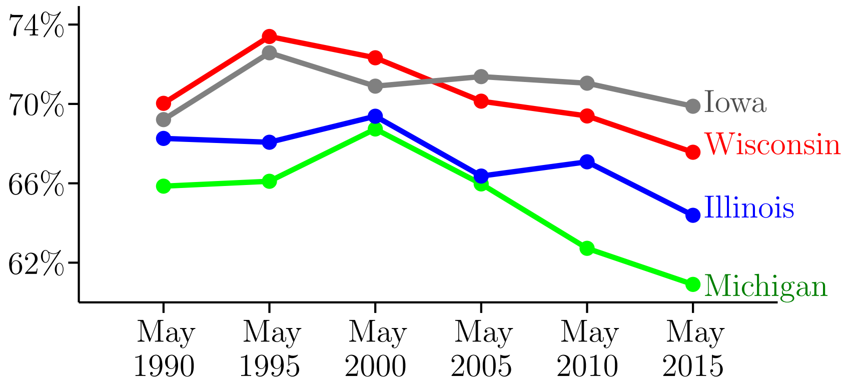
month	WI	US	IL	IN	IA	MI	MN	OH
May 1990	70.03	66.53	68.26	67.81	69.21	65.86	73.18	66.08
May 1995	73.40	66.44	68.07	71.16	72.58	66.10	74.57	65.70
May 2000	72.33	66.97	69.38	68.36	70.90	68.74	75.32	67.02
May 2005	70.14	65.97	66.37	67.54	71.38	65.97	73.38	66.76
May 2010	69.39	64.79	67.08	64.37	71.05	62.72	71.47	65.41
May 2015	67.57	62.97	64.39	63.64	69.88	60.91	70.66	63.09

Table 2 lists some of the LFPRs for the month of May in selected years. Figure 3 plots these for four states. As both the table and figure suggest, the LFPR has been falling all across the country over the last 15 years. There has been some concern that the high unemployment levels experienced in the Great Recession may have exacerbated this trend, but the table and figure both suggest that the patterns in 2010-15 are mostly just continuations of the trends established in 1995-2005.

Both the table and the figure also suggest that Wisconsin typically has a higher LFPR than our neighbors to the south and east, and a lower rate than Iowa and Minnesota. But they also make clear that our nearly 6 percentage points drop since 1995 exceeds all but Indiana and Michigan. For some reason, our labor force as a percent of the population seems to be shrinking faster than most of our neighbors.

Once again, to more precisely determine how we are doing, I have estimated the relationship between our LFPR and those of our neighbors from 1990 through 2010. Table 9 in the Appendix presents the regression results. Figure 14, also in the Appendix, shows the observed and fitted values over the data range, from Jan. 1990 to Dec. 2010. Once again,

Figure 3: Labor Force Participation Rates over Time

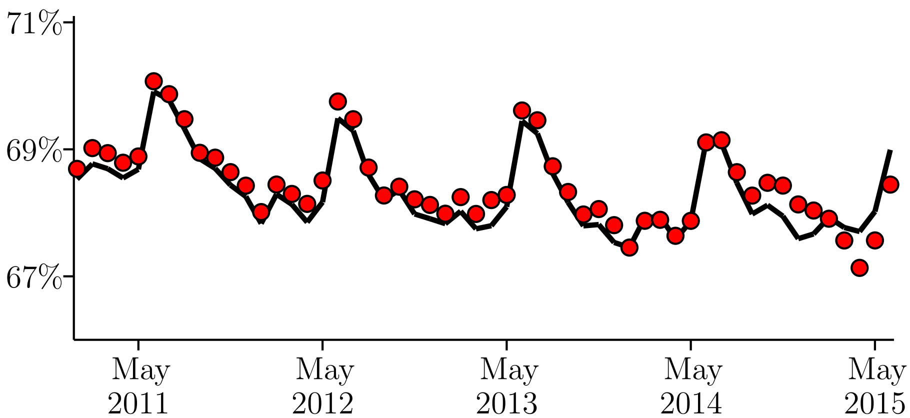


as the figure shows, the regression provides an extremely good fit to the data, with an R^2 of 0.977.

To again see how Wisconsin has done in the last 4 plus years, the fitted equation was projected forward, and compared to our actual LFPRs since Jan. 2011. The results are presented in Figure 4.

As Figure 4 shows, over the last several years Wisconsin has generally been above the projection, but in the last four months has drifted below the projected line. These most recent results are consistent with the simpler picture shown in Figure 3, which also suggested that Wisconsin's LFPR has been dropping more rapidly than its neighbors.

Figure 4: WI LFPRs Compared to the Projection



However, Figure 4 provides a substantially less alarming picture than Figure 3, since it suggests that most of the decline in labor force participation is captured by the projection, which estimates where Wisconsin's LFPR should be based on the LFPRs of our neighbors. It is hard to say whether the recent dip below the projection is at all meaningful, especially since it was preceded by a string of observations above the projection.[10] The safest conclusion to draw at this point is that our LFPR is roughly on par with what our neighbors' LFPRs suggest ours should be.

5 The Percent Employed

Recall from Section 2 that the percent of the population employed is equal to (1- Unempl. rate) times the LFPR:

$$\%\text{Empl} = \frac{\text{Empl}}{\text{Lab Fce}} \cdot \frac{\text{Lab Fce}}{\text{Pop'n}} = \text{Empl rate} \cdot \text{LFPR} \ .$$

In the last two sections, we saw that Wisconsin's unemployment rate was consistently below the projection, which would imply that its employment rate is consistently above projection. However, we also saw that its LFPR was tending a bit below projection. Since these are opposite movements, it is not clear ahead of time how the combined measure will fare relative to its projection.

Table 3: Percent of the Pop'n Employed

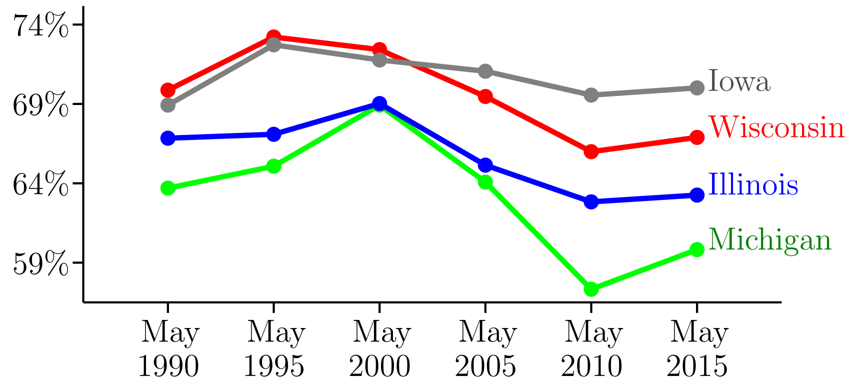
month	WI	US	IL	IN	IA	MI	MN	OH
May 1990	67.37	63.07	64.34	64.32	66.43	61.20	70.12	62.50
May 1995	70.72	62.82	64.59	67.75	70.22	62.58	72.06	62.80
May 2000	69.92	64.40	66.52	66.16	69.27	66.43	73.22	64.51
May 2005	66.97	62.74	62.64	64.03	68.56	61.58	70.65	62.98
May 2010	63.49	58.74	60.33	57.76	67.06	54.83	66.46	58.93
May 2015	64.39	59.63	60.76	60.59	67.51	57.32	68.11	60.01

Again, I begin with a table (Table 3) and figure (Table 5) reporting observed values every 5 years. Figure 5 suggests that again, Wisconsin is slipping a bit relative to its neighbors, doing better than Michigan but worse than Iowa in its changes over time.

In the Appendix, Figure 15 shows the fitted model compared to observed values, Jan. 1990 to Dec. 2010. The estimated coefficients are in Table 10. As before, the regression model provides an extremely good fit, with an R^2 again exceeding 98%.

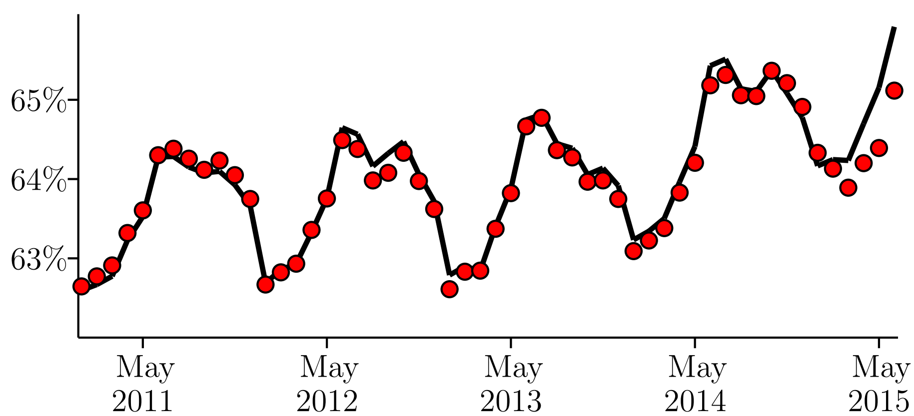
[10] In particular, none of the differences exceed the 2.38% margin of error, so none can be considered statistically significant.

Figure 5: Percent of the Pop'n Employed over Time



To again evaluate Wisconsin's recent economic performance, I show in Figure 6 how our actual percent employed since Jan. 2011 has compared to the projection. As the figure shows, Wisconsin is recovering from the dip in the percent employed that occurred during the Great Recession. However, consistent with what we've seen already, the values over the last five months are a bit below projection. The differences are small, but have successively grown to 0.8%, and 0.8% of the civilian population age 16 or older would imply about 37,000 people not employed.

Figure 6: WI Pct Employed Compared to the Projection



Once again however, it is not obvious at this point that five low values have any particular significance.[11] So the safest conclusion to draw thus far is that we appear to be recovering, at roughly the rate that our neighbors' recoveries suggest we should be at.

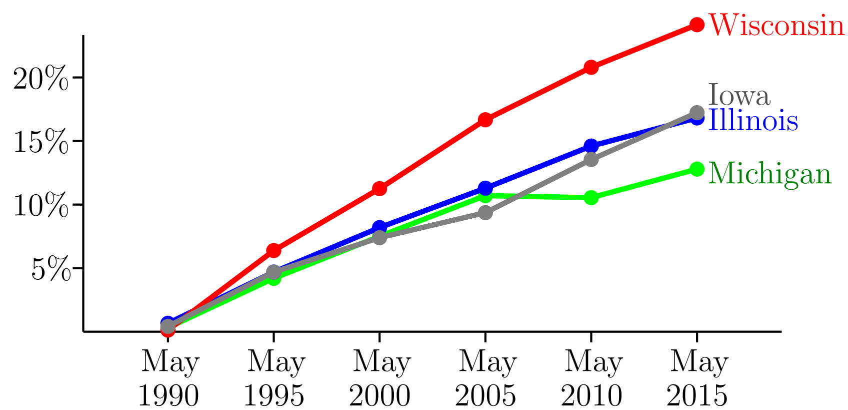
[11] As in the previous section, none of the differences are statistically significant. The June 2015 margin of error is 2.42%.

6 Population Growth

We have thus far been looking at rates: the unemployment rate, the LFPR, the percent employed. To translate what we've learned about these rates into conclusions about total job growth, we need to look at population and its rate of growth. In this section we will do just that.

I begin as usual with a simple picture using 5 year intervals. As Table 4 and Figure 7 show, Wisconsin has had reasonably strong population growth since 1990, growing faster than most of its neighbors, but not as fast as Minnesota or as the US as a whole. However, that population growth rate has been consistently falling, and in the last year has been at 0.51%, virtually tied with Michigan and Ohio and ahead of only Illinois. So perhaps the problem with job creation is a problem with population growth.

Figure 7: State Pop'ns over time, Relative to Jan. 1990



To again assess Wisconsin's most recent performance, I've fitted its population numbers to those of its neighbor, Jan. 1990 to Dec. 2010. The model again has a very high R^2, despite the fact that the state coefficients all had to be constrained to equal each other (see the Appendix for details). The Appendix presents the estimated coefficients in Table 11, and the observed values in Figure 16. Not surprisingly, the observed dots create such a smooth pattern that they merge into a line. The fitted line fits smoothly into that river of red dots.

As before, that fitted modeI lets me compare Wisconsin's actual population growth to the projection of what our growth rate should be, based on the growth rates of our neighbors. Figure 8 presents that comparison.

As Figure 8 clearly shows, Wisconsin has been consistently below the projected line over the last 4 plus years, and is steadily falling further behind. Had our population growth

Table 4: Civilian Pop'n, 16+, in 1000s

month	WI	US	IL	IN	IA	MI	MN	OH
May 1990	3,672	188,913	8,683	4,175	2,087	7,005	3,266	8,222
May 1995	3,902	198,286	9,031	4,424	2,175	7,276	3,482	8,473
May 2000	4,080	212,242	9,333	4,595	2,232	7,507	3,723	8,615
May 2005	4,279	225,670	9,600	4,746	2,273	7,731	3,922	8,812
May 2010	4,430	237,499	9,886	4,966	2,359	7,720	4,111	8,962
May 2015	4,553	250,455	10,077	5,127	2,436	7,876	4,287	9,130
Pop'n Average Annual Growth Rates								
1990-1995	1.22%	0.97%	0.79%	1.17%	0.84%	0.76%	1.28%	0.61%
1995-2000	0.90%	1.37%	0.66%	0.76%	0.51%	0.63%	1.35%	0.33%
2000-2005	0.96%	1.23%	0.57%	0.65%	0.36%	0.59%	1.05%	0.45%
2005-2010	0.70%	1.03%	0.59%	0.91%	0.75%	-0.03%	0.95%	0.34%
2010-2015	0.55%	1.07%	0.38%	0.64%	0.64%	0.40%	0.84%	0.37%
2014-2015	0.51%	1.14%	0.29%	0.69%	0.76%	0.46%	0.77%	0.50%

stayed at the level consistent with our neighbor's growth rates, we would have had an additional 46,000 state residents 16 and over – so roughly 1% of our projected population is missing.[12]

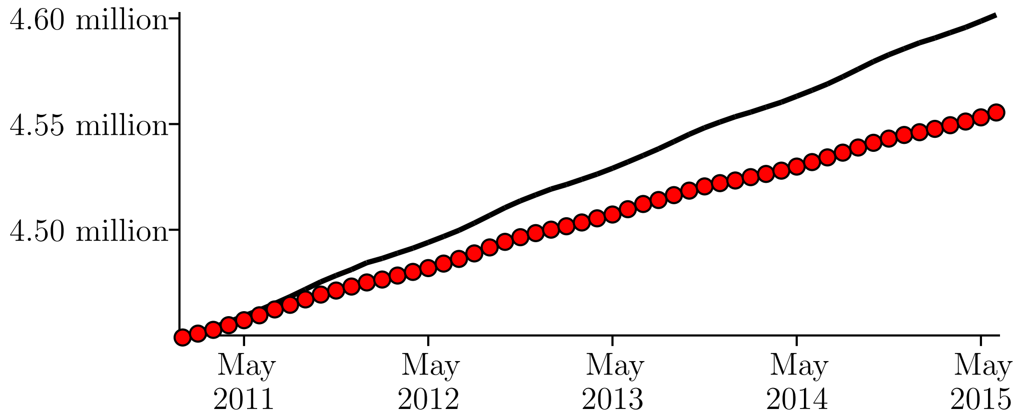
To investigate this lack of population growth further, I accessed the Census department's estimates of Wisconsin's population, broken down by ages.[13] I compared the estimated number of residents at each age in 2015 with the number at the corresponding age in 2011. For example, I compared the number of 20 year olds in 2015 with the number of 16 year olds in 2011, since the 2011 16-year-olds would all be 20, 4 years later. That allowed me to see what the net changes were for each age. The changes fairly naturally grouped themselves into 9-year age groups. For comparison purposes, I did the exact same analysis for 2001-2005.

Table 5 presents the results. An interesting pattern, observable in both 4 year changes, is that Wisconsin tends to lose 18-26 year olds, who either go away to college or move away after completing their schooling, but the state tends to gain 27-35 year olds, as well as their

[12]The differences are statistically significant, having consistently exceeded the margin of error over the last 8 months. The June 2015 margin of error was 38,060 people.

[13]The data is available at www.census.gov/population/projections/data/state/st_yr11to15.html for 2011-15, and at . . . /state/st_yr01to05.html for 2001-05.

Figure 8: WI Pop'n Compared to the Projection



children (note the increases in 0-8 year olds). However, the state then loses 36-44 year olds. For ages beyond 50, the changes are probably due mostly to mortality, and of course the gain in 0-3 year olds represents births during the 4 years.

Table 5: Population changes by age group, 2001-05 and 2011-15

Ages		2001	2005	%chg	2011	2015	%chg	Difference
	0-3		276,335			286,219		
0-8	4-12	628,681	652,305	3.76%	640,744	658,656	2.80%	-0.96%
9-17	13-21	711,023	717,001	0.84%	667,392	667,120	-0.04%	-0.88%
18-26	22-30	672,832	652,099	-3.08%	680,880	658,345	-3.31%	-0.23%
27-35	31-39	639,239	647,894	1.35%	661,417	663,588	0.33%	-1.03%
36-44	40-48	774,866	764,456	-1.34%	639,423	626,610	-2.00%	-0.66%
45-53	49-57	682,671	677,095	-0.82%	734,073	725,997	-1.10%	-0.28%
54-62	58-66	460,297	443,493	-3.65%	664,123	639,448	-3.72%	-0.07%
63-71	67-75	338,185	309,606	-8.45%	438,726	404,997	-7.69%	0.76%
72-80	76-84	271,619	227,097	-16.39%	270,607	228,901	-15.41%	0.98%
81+	85+	181,848	111,459	-38.71%	213,082	133,218	-37.48%	1.23%
Total		5,361,261	5,478,840	2.19%	5,610,467	5,693,099	1.47%	-0.72%

Notice however the difference between 2001-05 and 2011-15, in the last column of the table. Up to the age of 62, in every age group the change was negative: we either gained fewer people (ages 0-8 and 27-35) or switched from gaining to losing (ages 9-17), or lost more (ages 18-26 and 36-62). Throughout the primary working years, from 27 to 62, we are doing a substantially worse job of attracting or retaining wooers, compared to what we did a decade ago.

This sharp decline in population growth could be the reason why our job growth has been so anemic. Yes, we have done a pretty good job of putting our existing labor force back to work. And yes, we have done an acceptable job of putting our existing population back to work.

But no, we are no longer attracting workers to come to Wisconsin, and are indeed losing workers at nearly every age level over the prime working years. If this continues for long, it would not bode well in the long term for the state.

Before jumping to any such conclusions, however, let us look at how our slowing population growth rate is affecting the growth in the state's labor force, and the growth in its total number of jobs.

7 Labor Force Growth

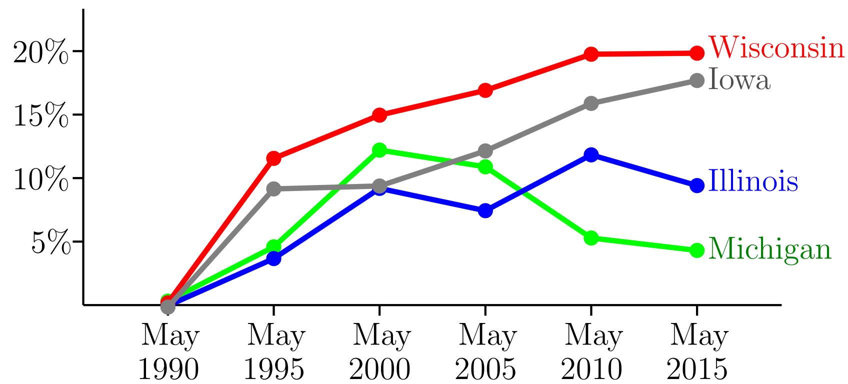
The size of the labor force is by definition the size of the civilian 16+ population times the LFPR. We have observed that Wisconsin's LFPR has been slightly below projection over the last half year, and that Wisconsin's population growth has been significantly below projection for the last 4 plus years. We would expect therefore that our recent labor force growth would also be below projection.

Table 6: Labor Force Size, in 1000s

month	WI	US	IL	IN	IA	MI	MN	OH
May 1990	2,572	125,682	5,927	2,831	1,444	4,614	2,390	5,433
May 1995	2,864	131,739	6,147	3,148	1,579	4,810	2,596	5,567
May 2000	2,951	142,144	6,475	3,141	1,582	5,160	2,804	5,774
May 2005	3,001	148,878	6,371	3,205	1,622	5,100	2,878	5,883
May 2010	3,074	153,866	6,632	3,196	1,676	4,842	2,938	5,862
May 2015	3,076	157,719	6,488	3,263	1,702	4,797	3,029	5,760
Labor Force Average Annual Growth Rates								
1990-1995	2.17%	0.95%	0.73%	2.15%	1.80%	0.84%	1.67%	0.49%
1995-2000	0.60%	1.53%	1.04%	-0.04%	0.04%	1.42%	1.55%	0.73%
2000-2005	0.34%	0.93%	-0.32%	0.41%	0.50%	-0.24%	0.52%	0.38%
2005-2010	0.48%	0.66%	0.81%	-0.05%	0.66%	-1.03%	0.42%	-0.07%
2010-2015	0.01%	0.50%	-0.44%	0.41%	0.31%	-0.19%	0.61%	-0.35%
2014-2015	0.06%	1.21%	-0.27%	0.70%	0.22%	0.54%	1.97%	0.84%

That is the picture painted by the now familiar table (Table 6) and figure (Figure 9). Over the last 5 years, our declining labor force participation rate has almost exactly offset our weak population growth, resulting in an anemic labor force growth rate of 0.01% over the 5 year period 2010-15, and 0.06% in the last year. That is better than Illinois, which continues to lose workers, but we have now slipped behind Michigan and Ohio, both of which had been continually losing workers over the last 10 years.

Figure 9: Labor Force Sizes over time, Relative to Jan. 1990



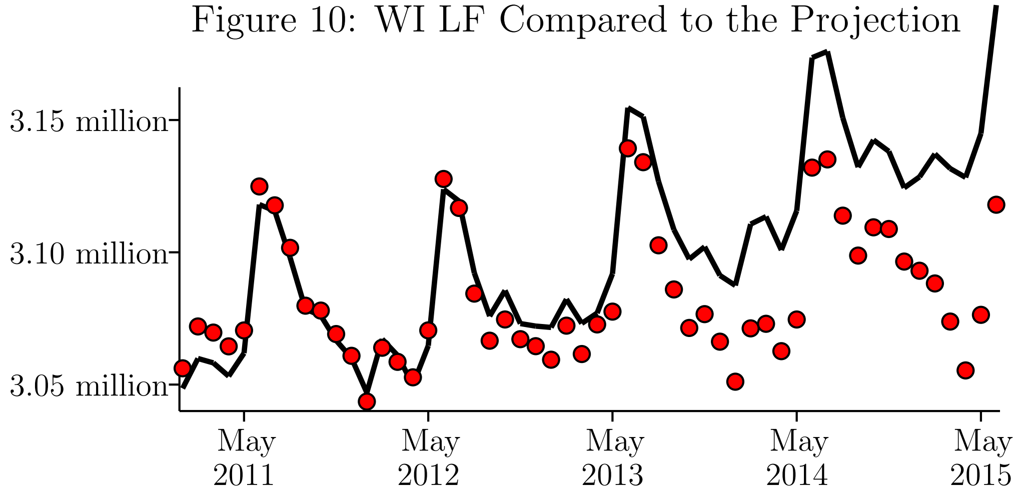
Once again, I estimated the relationship between our labor force numbers and those of our neighbors. The estimated coefficients are in the Appendix in Table 12; the fitted line and observed points for the estimation period (Jan. 1990 to Dec. 2010) are in the Appendix in Figure 17. As has been the case consistently, the line fits the data extremely well, with an R^2 above 97%.

Wisconsin's recent performance can again be assessed by comparing actual labor force numbers with the model's projected values, in Figure 10. What we see is exactly what our population results suggested we would see: an increasingly large difference between the observed and projected values. While the projection suggests that our labor force should be growing, and should have averaged 3.13 million workers over the last five months, we are in fact stuck at around 3.08 million workers, barely more that what we had 4 years ago.

These results just reinforce what was found earlier: that Wisconsin is doing fine at getting its active workforce employed, but clearly has a problem with growing its workforce. And the problem is substantial, on average a difference of about 60,000 workers over the last 6 months, and surpassing 75,000 workers in June 2015.[14]

[14] However, these differences cannot be considered statistically significant, since this projection has a rather large margin of error, of just over 105,000 workers in June 2015.

Figure 10: WI LF Compared to the Projection



8 Total Job Growth

A state's total employment is just the employment rate (*i.e.*, 1- unemployment rate) times the size of the labor force. We saw in the previous section that Wisconsin's labor force has been essentially flat over the last 4 plus years. We also saw in Section 3 that Wisconsin's unemployment rate – and therefore its employment rate – was consistently doing better than the projection. What does that imply about overall job creation?

Table 7: Total Employment, in 1000s

month	WI	US	IL	IN	IA	MI	MN	OH
May 1990	2,474	119,148	5,587	2,685	1,386	4,287	2,290	5,139
May 1995	2,759	124,554	5,833	2,997	1,528	4,553	2,509	5,321
May 2000	2,853	136,685	6,208	3,040	1,546	4,987	2,726	5,557
May 2005	2,866	141,591	6,014	3,039	1,558	4,760	2,771	5,550
May 2010	2,813	139,497	5,964	2,868	1,582	4,232	2,732	5,281
May 2015	2,932	149,349	6,122	3,106	1,644	4,515	2,920	5,479

Employment Average Annual Growth Rates

1990-1995	2.21%	0.89%	0.87%	2.22%	1.96%	1.21%	1.84%	0.70%
1995-2000	0.67%	1.88%	1.26%	0.28%	0.24%	1.83%	1.68%	0.87%
2000-2005	0.09%	0.71%	-0.64%	-0.01%	0.16%	-0.93%	0.33%	-0.03%
2005-2010	-0.37%	-0.30%	-0.16%	-1.15%	0.31%	-2.32%	-0.28%	-0.99%
2010-2015	0.83%	1.37%	0.52%	1.61%	0.78%	1.30%	1.34%	0.74%
2014-2015	0.81%	2.02%	1.03%	1.92%	0.91%	2.32%	2.19%	1.41%

As Table 7 and Figure 11 show, Wisconsin experienced very strong job growth in the first half of the 1990s, but slipped to somewhere in the middle of the pack during the decade between 1995 and 2005. We were not hit terribly badly by the Great Recession, averaging only a 0.37% annual job loss between 2005 and 2010, only slightly behind Minnesota (a 0.28% annual job loss) and the US as a whole (a 0.30% annual job loss). Only Iowa did substantially better, the only neighboring state with positive average job growth over those 5 years.

In the last 5 years however, our job growth has barely edged out Iowa and Ohio, falling well behind Indiana, Minnesota, Michigan, and the US overall; only hapless Illinois did significantly worse. And in the last year, we were dead last among our neighbors. Between May 2014 and May 2015, even Illinois was creating jobs at a faster rate than Wisconsin.

Again however I wish to be more precise about our performance than what can be determined from 5-year averages. So again I have fitted our Jan. 1990 to Dec. 2010 numbers to those of our neighbors, using the resulting pattern to project where our job numbers would have been, had we kept up with those neighbors.

Figure 11: Total Employment over Time

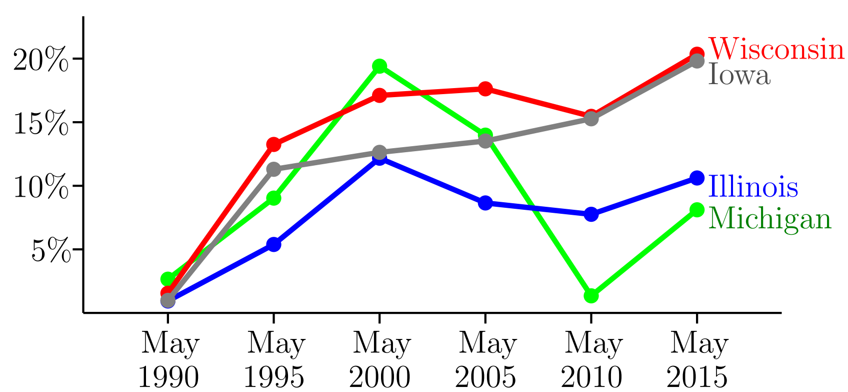
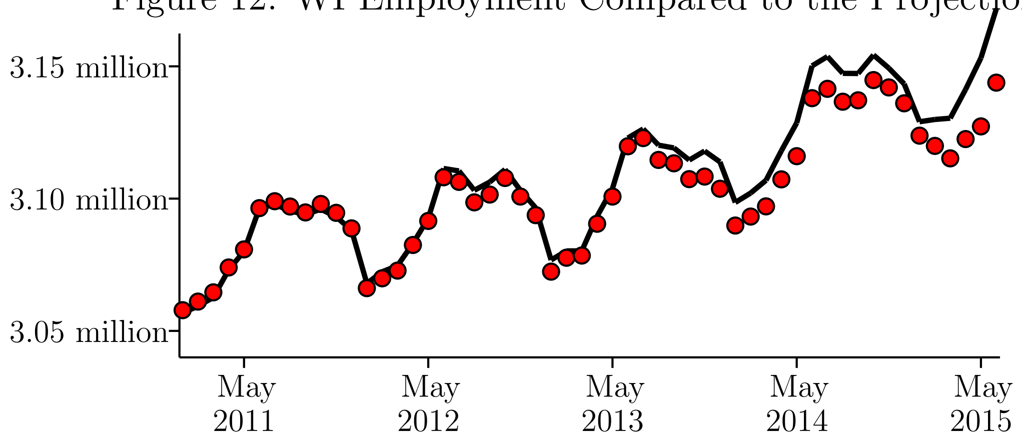


Table 13 in the Appendix shows the estimated regression coefficients; Figure 18 plots the fit against the LAU employment numbers. As usual, the model provides an excellent fit, with an R^2 of over 98%.

As in the preceding sections, I then compare the projection of that model for the months since 2010 to Wisconsin's actual LAU job estimates, in Figure 12. The results should at this point not surprise you. As we've seen in the previous sections, Wisconsin has been doing just fine in putting its existing workforce to work. But that workforce is barely growing. So as Figure 12 shows, over the last 4 plus years, Wisconsin has been adding jobs, but at a much lower rate than the projection suggests we should have added jobs.

Figure 12: WI Employment Compared to the Projection



Indeed, as the figure suggests, we have been continually falling further and further behind. In 2012, this job gap averaged only 5,700 jobs. By 2013, the average job gap had risen to 10,300 jobs. In 2014, the average job gap had risen again, to almost 21,000 jobs. And in 2015, it was again higher still, averaging 35,700 jobs in the first 6 months, and over 55,000 jobs in the last 2 of those months.[15]

So yes, Wisconsin has done an excellent job of bringing down its unemployment rate. But it has done a terrible job at job creation. And now we can see that those two statements are not contradictory. The piece of the puzzle that had been missing was Wisconsin's population growth rate. And that, the evidence tells us, has been abysmal.

9 Summary

In this paper, I have found that:

1. Wisconsin's unemployment rate has been consistently below the projected value for the last year and a half. The difference has been fairly large – since Jan. 2014 it has averaged about a half percentage point lower than projected – and it has been growing, averaging almost two thirds of a percent in the 5 months of 2015. The difference is also statistically significant. Thus, the Governor's office is correct in

[15]These results are generally consistent with my job gap estimates elsewhere; see McGee, *Measuring Wisconsin's Job Gap*, www.uwosh.edu/faculty_staff/mcgee/Measuring_WIs_Job_Gap_Revised.pdf. That paper used QCEW data from Jan. 2001 to Dec. 2008 for the fitted model, and estimated the job gap for Sept. 2013 to be at 45,000 jobs. This study finds a considerably smaller Sept. 2013 gap, of only 12,100 jobs. However, both studies find job gaps that have been steadily growing over the last 4 years.

The estimate job gaps here are however not statistically significant; the June 2015 margin of error is 93,000 jobs.

stating that on this measure, we are outperforming our neighbors.

2. Wisconsin's labor force participation rate (LFPR) had been falling over the last 20 years, but so have everyone else's. Our LFPR has been consistently above its projected value for the last several years, but has recently fallen below projection. However, that recent drop may be merely a temporary anomaly. The safest conclusion is that our LFPR is dropping roughly on par with that of our neighbors.

3. Multiplying the employment rate (*i.e.*1 - the unemployment rate) by the LFPR gives the percent of the civilian population 16 and older that is employed. Wisconsin's percent employed is basically at the projected value, suggesting we are doing neither better or worse than our neighbors at getting our people back to fully employed.

4. Wisconsin's population growth rate has been consistently below projection over the last 4 plus years, and is steadily falling further behind. The difference between the reported value and our projected population is now consistently statistically significant. Had our population growth stayed at the level consistent with our neighbor's growth rates, we would have had an additional 46,000 state residents 16 and over – so roughly 1% of our projected population is missing.

5. Wisconsin's low population growth rate, combined with our falling LFPR, has resulting in a labor force whose size is essentially stagnant. In the last year, only Illinois did a worse job at increasing the size of its labor force.

6. Wisconsin's anemic labor force growth rate has resulted in the lowest job growth rate in the area in the last year (May 2014 to May 2015). As a result, in June 2015 Wisconsin had roughly 58,000 fewer jobs than it would have had if it had kept up with its neighbors.

7. All in all, Wisconsin has done an acceptable job of getting its current population reemployed. However, it has done a terrible job of attracting workers to the state, or of retaining workers in the state. It is the latter problem that is the source of our failure to create anything close to the 250,000 jobs Scott Walker promised to create.

10 Appendix

In this section, I will describe briefly the statistical procedures I used. I will include some explanations for readers who do not have a statistical research background, but at least parts of the description will probably be mostly incomprehensible to most readers. A more complete discussion of the procedures I used is available on request.

My data for the regression analysis, taken from the BLS website, involved 252 monthly observations from Jan. 1990 through Dec. 2010. My basic model, for each of the employment and population measures, assumes that Wisconsin's measure can be explained by a linear function of the corresponding measures for the US and for the six neighboring states. To account for seasonal differences, 11 monthly dummy variables were also included.[16] A linear time trend was also included. The basic model is then:

$$WI_t = \alpha t + \beta_{US} US_t + \sum \beta_{st} State_{i,t} + \sum \delta_m Month_t.$$

Not surprisingly, my models all showed very high levels of autocorrelation. That is to say, most of any divergence from the fitted model at any time t continued to persist into the following time period. For example, if in February Wisconsin's unemployment rate was a bit lower than the level predicted by the model, it was also likely to be lower in March, April, and maybe the subsequent months as well. Such autocorrelation is routinely encountered in time series data like this. The model was corrected for autocorrelation using Prais-Winsten estimation.[17]

In every case, the estimated degree of autocorrelation (symbolized by "rho") was quite high, in all but one case exceeding 0.99. A fellow econometrician might therefore rightly ask, why not assume that rho equals 1, *i.e.* a unit root? There are two reasons I did not adopt unit root models. The first is that such models make no real sense here. A unit root model assumed the process being estimated follows a random walk. Random walks are nonstationary, that is, they are prone to wander off in either direction, without limit.

A quick glance at the observed values in Figures 13, 14, 15, 16, 17, and 18 suggests that none of these patterns are truly random walks. Somewhat erratic, yes, but that erratic process is subject to deterministic forces that will ultimately bound the series – exactly what a process with a very high but less than unit root is meant to model.

The second reason why I did not adopt unit root models is that they do a poor job of fitting the data series. A unit root model estimates the rate of change; if the model includes an intercept then necessarily the average estimated rate of change will exactly

[16]Monthly dummy variables are variables that take the value of 1 for the month in question, and 0 for other months. Thus, the "Jan" dummy equals 1 for every January and 0 for the other 11 months. It is standard practice, when there are n seasons, to include $n-1$ seasonal dummies. See any basic Econometrics textbook for an explanation.

[17]See *e.g.* Wooldridge, J. (2003). Introductory Econometrics: A Modern Approach (2nd ed.). South-Western. p. 405.

equal the average observed rate of change. This forces the model to exactly fit the first and last observations. However, when I estimated unit root models for the LF and Total Employment series, I found they provided very poor fits to most of the central part of both series. In contrast, as the Figures portraying the fitted models show, the autocorrelation models provided near exact fits.

In a number of regressions, one or more of the state coefficients were negative (but not statistically significant). In these models, negative coefficients make no sense. Under what circumstances would every *decrease* in Ohio's unemployment rate automatically lead to an *increase* in Wisconsin's unemployment rate? However, such nonsensical negative values can easily arise in models like these, where there is a high level of collinearity among the state explanatory variables.

To eliminate negative coefficients, without dropping any states from the model, I summed the offending state's value to some neighboring state's value, thereby forcing both to have the same coefficient. I have noted wherever that occurred in the tables of coefficients below. Notice that for the population regression, all 6 neighboring states had to be constrained to having the same coefficient, undoubtedly necessitated by the extremely high correlations in population changes in those states.

Based on the estimated coefficients presented in each of the "Estimated Coefficients" tables, fitted values for each of the six series were calculated. These fitted values were subtracted from the observed values to get the observed divergences. To account for the autocorrelation in the model, the lagged divergences were then used to adjust the fitted values in the following time period. That is, if e_t is the observed divergence in period t, the fitted value at time $t+1$ had the value ρe_t added to it, where ρ is the Greek letter "rho". The resulting adjusted fitted values were then used to construct the fitted lines in Figures 13, 14, 15, 16, 17, and 18.

The projected values in Figures 2, 4, 6, 8, 10, and 12 were calculated in the same way, with one exception. Since they were fitted for the period after Dec. 2010, they were "outside the sample" used to estimate the model. As such, there are no divergences to use to adjust the values for autocorrelation. Rather, each previous period's adjustment was multiplied by rho, and that value was then used to adjust the fitted values. So if the Dec. 2010 divergence was e_{Dec10}, the Jan. 2011 fitted value had $\rho\, e_{Dec10}$ added to it, the Feb. 2011 fitted value had $\rho^2\, e_{Dec10}$ added to it, and so on. This is the standard approach for forecasting with autoregressive models.

The projected values were calculated up to May 2015. These projected values estimate the levels of employment and population we should expect if nothing had changed. In particular, if any policies adopted during the Walker administration have had any impact on economic performance, they should show up as a divergence between the actual numbers and those predicted by the models.

Figure 13: WI Fitted Unemployment Rates

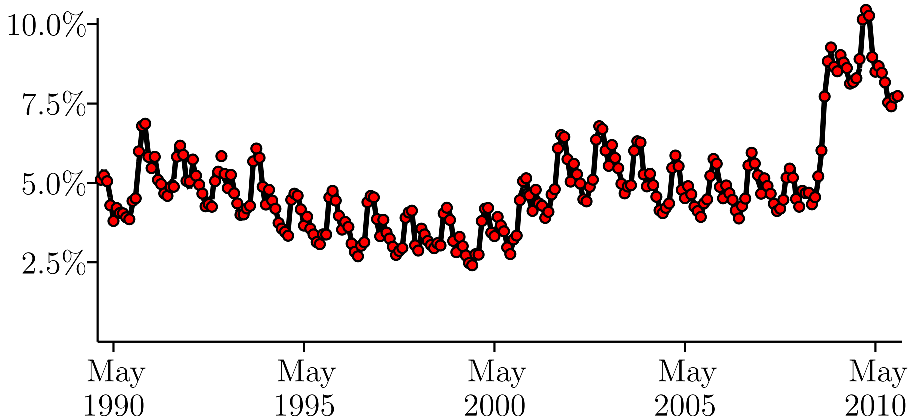


Table 8: Estimated Coefficients, WI Employment Rate

Variable	Coefficient	Standard error	t-stat
time	-0.0046	0.0016	-2.91
US	0.1799	0.1129	1.59
IL	0.0547	0.0555	0.99
IN*	0.0459	0.0353	1.30
IA	0.3675	0.0691	5.32
MI	0.1001	0.0406	2.46
MN	0.1422	0.0653	2.18
OH*	0.0459	0.0353	1.30
Jan	-0.2326	0.0590	-3.94
Feb	-0.7482	0.0532	-14.06
Mar	-0.7764	0.0570	-13.61
Apr	-0.5934	0.0478	-12.41
May	-0.3744	0.0574	-6.53
Jun	-0.4659	0.0566	-8.24
Jul	-0.2459	0.0745	-3.30
Aug	-0.1729	0.0568	-3.05
Sep	0.0364	0.0544	0.67
Oct	-0.0015	0.0557	-0.03
Nov	-0.1498	0.0444	-3.37
constant	7.1080	5.9853	1.19
rho		0.9448	
R-squared		0.9956	

*State coefficients constrained to equal each other.

Figure 14: WI fitted LFPRs

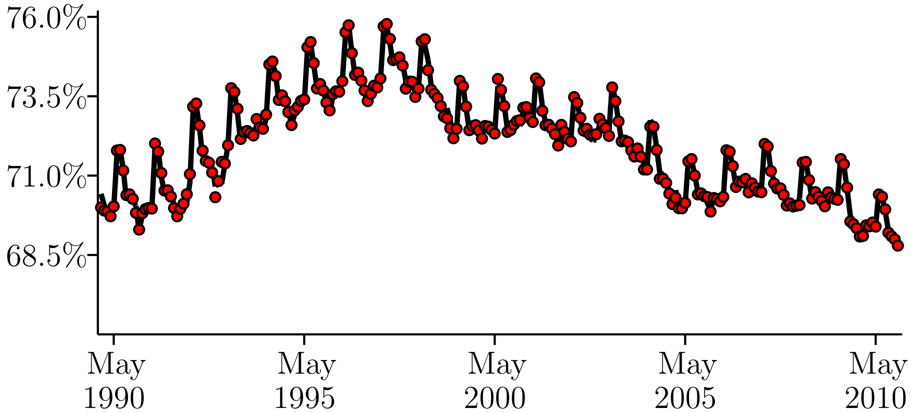


Table 9: Estimated Coefficients, WI LFPR

Variable	Coefficient	Standard error	t-stat
time	0.0016	0.0053	0.31
US	0.5480	0.1205	4.55
IL	0.0030	0.0725	0.04
IN*	0.0675	0.0381	1.77
IA	0.1640	0.0549	2.99
MI	0.0367	0.0594	0.62
MN	0.1726	0.0731	2.36
OH*	0.0675	0.0381	1.77
Jan	0.0059	0.0321	0.18
Feb	0.2234	0.0376	5.94
Mar	0.0134	0.0402	0.33
Apr	-0.0558	0.0543	-1.03
May	-0.1272	0.0547	-2.33
Jun	0.6041	0.0832	7.26
Jul	0.3620	0.0929	3.90
Aug	0.3296	0.0672	4.90
Sep	0.1263	0.0481	2.63
Oct	-0.0328	0.0486	-0.67
Nov	-0.0380	0.0366	-1.04
constant	-1.3283	4.9973	-0.27
rho		0.9933	
R-squared		0.9765	

*State coefficients constrained to equal each other.

Figure 15: WI Fitted Pct Employed

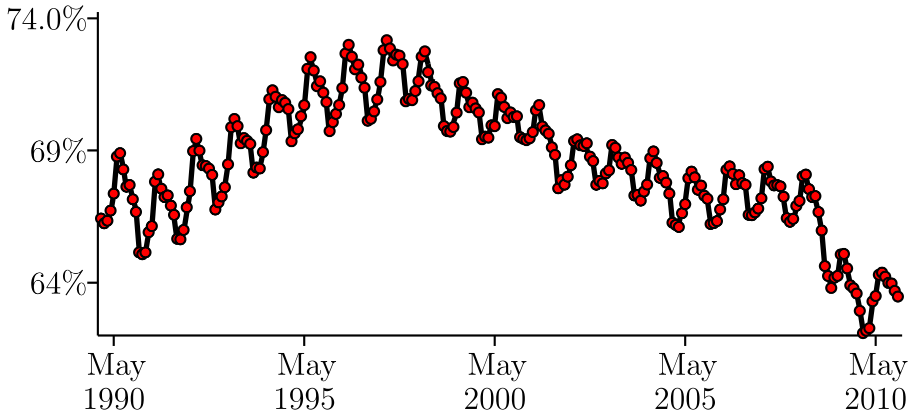


Table 10: Estimated Coefficients, WI Percent Employed

Variable	Coefficient	Standard error	t-stat
time	0.0021	0.0045	0.47
US	0.2626	0.1217	2.16
IL	0.1589	0.0503	3.16
IN*	0.0287	0.0334	0.86
IA	0.0990	0.0441	2.24
MN	0.3505	0.0901	3.89
OH	0.2212	0.0803	2.75
MI*	0.0287	0.0334	0.86
Jan	0.0651	0.0762	0.85
Feb	-0.1036	0.0668	-1.55
Mar	-0.3750	0.0520	-7.21
Apr	-0.4016	0.0339	-11.84
May	-0.3755	0.0542	-6.93
Jun	0.2494	0.0724	3.45
Jul	0.1442	0.1058	1.36
Aug	0.1159	0.0805	1.44
Sep	0.1615	0.0503	3.21
Oct	-0.0604	0.0762	-0.79
Nov	-0.1574	0.0586	-2.69
constant	-7.5685	4.6205	-1.64
rho		0.9972	
R-squared		0.9849	

*State coefficients constrained to equal each other.

Figure 16: WI Fitted Civilian 16+ Pop'n

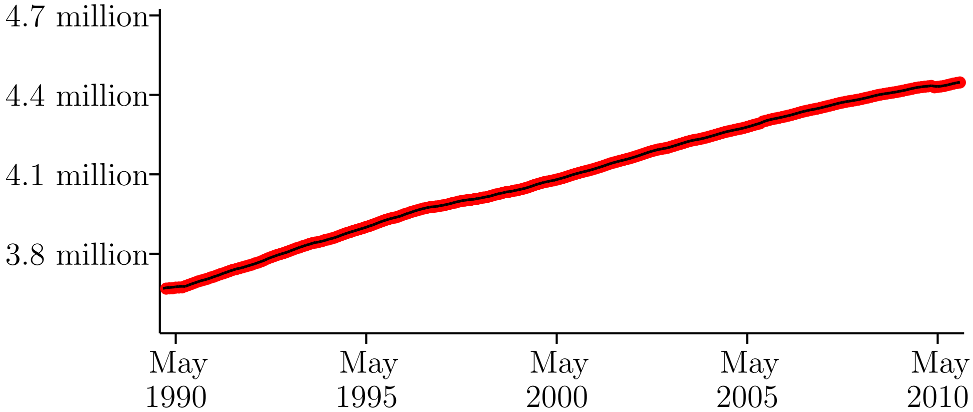


Table 11: Estimated Coefficients, WI Pop'n

Variable	Coefficient	Standard error	t-stat
time	2035.45	162.88	12.50
US	0.3019	0.3146	0.96
IL*	0.0518	0.0071	7.33
IN*	0.0518	0.0071	7.33
IA*	0.0518	0.0071	7.33
MI*	0.0518	0.0071	7.33
MN*	0.0518	0.0071	7.33
OH*	0.0518	0.0071	7.33
Jan	-56.12	195.82	-0.29
Feb	-609.83	264.47	-2.31
Mar	-926.27	309.83	-2.99
Apr	-1303.37	344.65	-3.78
May	-1333.03	356.97	-3.73
Jun	-1420.45	357.17	-3.98
Jul	-1427.24	348.76	-4.09
Aug	-1134.66	329.00	-3.45
Sep	-738.52	297.85	-2.48
Oct	-223.36	255.58	-0.87
Nov	12.54	190.05	0.07
constant	1890668	245417	7.70
rho		0.9988	
R-squared		0.9937	

*State coefficients constrained to equal each other.

Figure 17: WI Fitted LF over Time

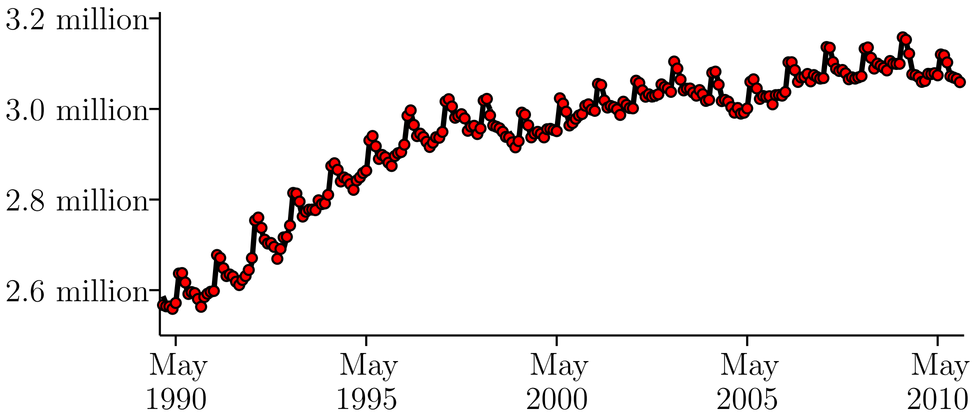


Table 12: Estimated Coefficients, WI Labor Force

Variable	Coefficient	Standard error	t-stat
time	396.47	310.30	1.28
US	4.2453	1.7619	2.41
IL	0.0293	0.0309	0.95
IN	0.1497	0.0419	3.57
IA	0.4323	0.0991	4.36
MI	0.0373	0.0321	1.16
MN	0.1535	0.0800	1.92
OH	0.0251	0.0352	0.71
Jan	-934.53	1535.43	-0.61
Feb	7966.49	1661.88	4.79
Mar	-322.79	1697.84	-0.19
Apr	-4258.75	2258.06	-1.89
May	-7264.60	2223.32	-3.27
Jun	24694.89	3359.87	7.35
Jul	17529.79	3883.05	4.51
Aug	16738.00	2842.67	5.89
Sep	5829.93	1956.49	2.98
Oct	-1286.70	2100.15	-0.61
Nov	-1141.00	1583.00	-0.72
constant	170668	195464	0.87
rho		0.9944	
R-squared		0.9728	

Figure 18: WI Fitted Employment

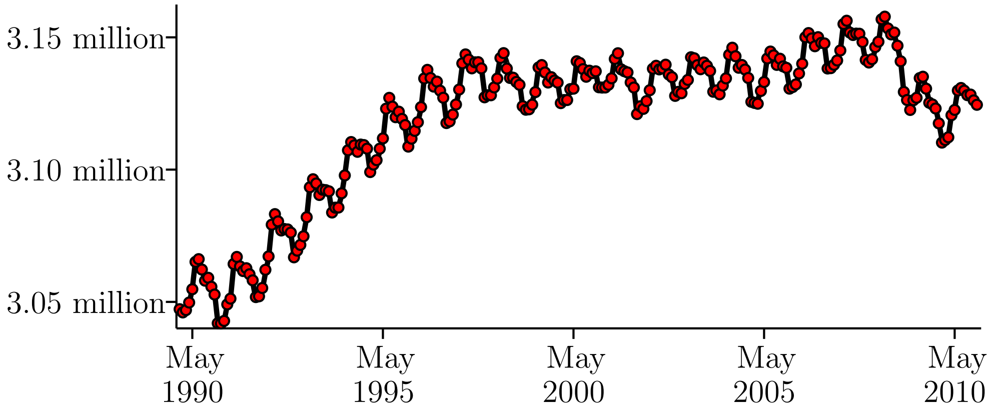


Table 13: Estimated Coefficients, WI Employment

Variable	Coefficient	Standard error	t-stat
time	421.32	282.65	1.49
US	0.0052	1.4830	0.00
IL	0.0843	0.0212	3.98
IN	0.1362	0.0430	3.17
IA	0.1999	0.0818	2.44
MI	0.0044	0.0271	0.16
MN	0.2742	0.0991	2.77
OH	0.1578	0.0358	4.41
Jan	-494.82	3014.68	-0.16
Feb	-6217.67	2603.45	-2.39
Mar	-17046.62	2040.51	-8.35
Apr	-18488.66	1730.10	-10.69
May	-16928.69	2053.04	-8.25
Jun	9588.15	2799.21	3.43
Jul	7057.53	4428.87	1.59
Aug	5656.32	3030.92	1.87
Sep	5634.39	1867.21	3.02
Oct	-2596.19	2872.95	-0.90
Nov	-6283.64	2139.83	-2.94
constant	-73244	176657	-0.41
rho		0.9970	
R-squared		0.9848	