November 07, 2013

WELLS FARGO SECURITIES

Economics Group

Special Commentary

John E. Silvia, Chief Economist
john.silvia@wellsfargo.com • (704) 410-3275
Azhar Iqbal, Econometrician
azhar.iqbal@wellsfargo.com • (704) 410-3270
Blaire A. Zachary, Economic Analyst
blaire.a.zachary@wellsfargo.com • (704) 410-3359

Is the Unemployment Rate a Reliable Barometer?

Executive Summary

For a financial firm, one question that resurfaces is the reliability of the unemployment rate as an indicator of overall economic conditions and, particularly, the labor market. Policymakers place a high level of emphasis on using the unemployment rate to assess and predict the state of the labor market. Historically, we have observed structural changes in the labor market through changes in the unemployment rate.[1] However, in our view, the unemployment rate may not be the most reliable measure of the labor market. In our first paper on this topic, we focused on the development of the Labor Market Index that we use here. In our view, we have developed a more comprehensive measure of the labor market, the Labor Market Index.[2] Here we are interested in identifying a possible statistical relationship between our measure of labor market conditions, the Labor Market Index, and GDP. In addition, we compare the performance of the Labor Market Index versus the unemployment rate. The relationship between GDP and the unemployment rate (Okun's Law)[3] has traditionally been a rough guide for policymakers but has not been that useful for the private sector, even though the unemployment rate is given as a benchmark for stress testing by policy makers. The Labor Market Index uses six key labor market variables and information from a number of aspects of the labor market. In this essay, we focus on the relationship of the Labor Market Index to real GDP growth.

The relationship between GDP and the unemployment rate has not been as useful for the private sector.

Figure 1

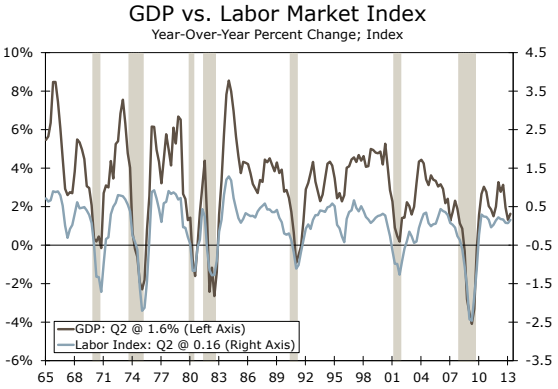
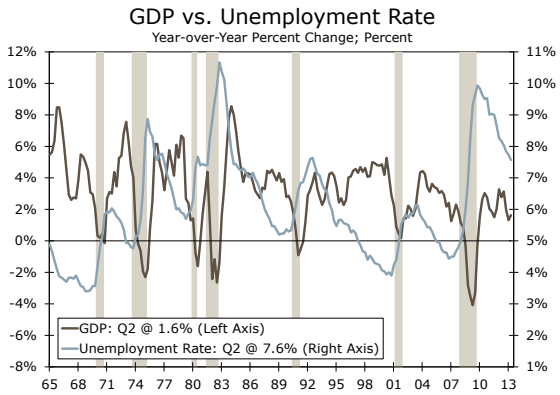


Figure 2



Source: U.S. Dept. of Commerce, U.S. Dept. of Labor and Wells Fargo Securities, LLC

[1] **Domestic Implications of a Global Labor Market, *Business* Economics, V. 1, No.3, July 2006. This paper received the Adolph G. Abramson award for the best written paper in *Business Economics*, 2006.**
[2] **John E. Silvia, Azhar Iqbal and Blaire A. Zachary. *Measuring the State of the U.S. Labor Market: A New Index*. Special Commentary, October 28, 2013.**
[3] **For a detailed discussion about Okun's law, see chapter 9 of Mankiw, N Gregory (2010), *Macroeconomics*, 7th edition, Worth Publishers.**

This report is available on wellsfargo.com/economics and on Bloomberg WFRE.

Our statistical analysis suggests that the Labor Market Index has a stronger relationship with real GDP compared to the unemployment rate. In addition, during the modern period (post 1990), the Labor Market Index can be used to predict future values of the real GDP growth rate. On the other hand, the unemployment rate should not be solely, or primarily, used to predict real GDP growth rate, as seen in Figure 2. The contrasting data from 1996-2001 and at present shows the lack of correlation between the two variables.

Statistical Tools to Determine a Relationship Between Variables

The relationship between two (or more) variables can be explored by conducting an econometric analysis to evaluate the strength of that relationship and its reliability as a predictor for economic activity overall. Several econometric techniques can characterize the statistical relationship between two (or more) variables.[4] We begin with a simple regression analysis using the variables of interest. We construct a simple model using real GDP and the unemployment rate, then compare that model's results with real GDP and the Labor Market Index model. A regression analysis provides a certain precision when proving a statistical relationship. Real GDP growth is our dependent variable. For a private sector financial services firm, real GDP growth estimates provide the first element in good due diligence in setting the framework for effective decision making. The regression analysis provides useful statistics to evaluate our models. For example, the R^2 quantifies how much variation in the dependent variable is explained by the independent variable. To compare models, we use the root mean square error (RMSE), which provides an average deviation of the estimated GDP from the actual GDP values. The t-value indicates whether an independent variable is useful to include in the model.

The Labor Market Index has a stronger relationship with real GDP compared to the unemployment rate.

Once an analyst identifies a statistical relationship between variables, the direction of the relationship can be determined.[5] Two questions can be asked: What is the leading and lagging variable? What is the cause and what is the effect? The Granger causality test helps to identify the direction of the relationship. For instance, in the case of Okun's Law, an analyst may want to test the relationship between real GDP and the unemployment rate.[6] The causality idea is very important and useful for business leaders and policy makers. In the present case, we want to know whether the Labor Market Index and unemployment rate can increase predictability of the GDP growth rate.[7]

Testing for an Existing Relationship: The Unemployment Rate

Next, we determine if the variables are statistically significant with real GDP growth. We find that, on both counts, the variables are statistically significant. Tables I and II provide the statistical detail supporting these conclusions. In Table I, estimated over the period Q1 1965-Q2 2013, the t-value of the coefficient on the unemployment rate is -19.27, which indicates the unemployment rate is a useful variable to explain the variation in the GDP growth rate. The R^2 is 0.66, and the RMSE of the regression is 1.37. The relationship between the GDP growth and the unemployment rate holds for the two sub-samples, which are Q1 1965-Q2 1990 and Q3 1990-Q2 2013 as the t-values for both sub-samples are greater than 2 (in absolute terms). For both sub-samples, R^2 is 0.69 and the RMSE values are 1.46 and 1.06, respectively.

However, we maintain that the U.S. labor market behavior is likely to be different for the past three business cycles compared to the previous business cycles. That is one major reason to divide

[4] Our approach here follows our treatment in *Economic and Business Forecasting*, John E. Silvia, Azhar Iqbal et. al.,Wiley, forthcoming 2014.
[5] C.W.J. Granger (1969), "Investigating Causal Relationships by Econometric Models and Cross-Spectral Methods," *Econometrica* 37, no. 3. 424-438.
[6] The Granger causality test identifies whether two (or more) variables have a statistically significant causality relationship and thereby, making it appropriate to say "Granger-causes" instead of "causes." The term "Granger-causes" implies quantifying statistical causality between the variables of interest. See Granger (1969) for more detail.
[7] The statistical techniques here are covered in more detail in *Economic and Business Forecasting*.

data into sub-samples and test whether the relationship in the past three business cycles is different than the previous business cycles (more details to follow).[8]

Table I

The Regression Analysis Results Dependent Variable : Real GDP					
Variable	**Sample Period**	**Coefficient**	**t-value**	**R^2**	**RMSE**
Unemployment Rate	1965:Q1-2013:Q2	-0.10	-19.27*	0.66	1.37
	1965:Q1-1990:Q2	-0.11	-14.79*	0.69	1.46
	1990:Q3-2013:Q2	-0.09	-14.25*	0.69	1.06

*Statistically Significant at 1%

Source: Wells Fargo Securities, LLC

Testing for an Existing Relationship: The Labor Market Index

When we use the Labor Market Index, we also obtain statistically significant results. In Table II, estimated over the period Q1 1965-Q2 2013, the t-value of the coefficient on the labor market index is 28.80, which is consistent with a probability of less than one percent, so we reject the null hypothesis that there is no relationship. The R^2 is 0.81, and the RMSE of the regression is 1.02. This implies that the labor market index has a closer association with the GDP growth rate, than the employment rate, because the model with the labor index has a higher R^2 than the unemployment rate model. Furthermore, a lower value of the RMSE, compared to the unemployment rate model, suggests that the estimated GDP growth rates, based on the labor market index, are closer to the actual GDP growth rates. In sum, these results are an improvement over the results with the unemployment rate.

The Labor Market Index provided improved relationship results over those associated with the unemployment rate.

For the two sub-samples, the model with the labor market index shows better statistical results compared to the unemployment rate model. For the complete sample as well as two sub-samples, the statistical results are better with the labor market index than with the unemployment rate.

Table II

The Regression Analysis Results Dependent Variable : Real GDP					
Variable	**Sample Period**	**Coefficient**	**t-value**	**R^2**	**RMSE**
Labor Market Index	1965:Q1-2013:Q2	3.05	28.80*	0.81	1.02
	1965:Q1-1990:Q2	3.19	22.34*	0.83	1.07
	1990:Q3-2013:Q2	2.72	17.51*	0.77	0.91

*Statistically Significant at 1%

Source: Wells Fargo Securities, LLC

Testing the Direction of the Relationship: Cause and Effect

A regression analysis cannot be interpreted as establishing a cause-and-effect relationship; it can only indicate how, or to what extent, variables are associated with each other. The regression coefficient indicates that the independent variable is statistically related with the dependent variable. Any conclusions about a cause-and-effect relationship must be based on the analyst's judgment. For business leaders and policy makers, it is imperative to distinguish leading and lagging variables, and the cause and the effect.

The Granger causality test provides a means to identify a causal relationship between two or more variables than simply assuming causality. According to Granger causality, if a variable X_t "Granger-causes" a variable Y_t, then past values of X_t should contain information that helps predict Y_t beyond the information contained in past values of Y_t alone.

The Granger causality test also indicates the direction of the causality, that is, whether it is one-way or two-way causality. For instance, if X_t "Granger-causes" Y_t but Y_t does not "Granger-cause"

[8] It is important to note that the Q3 1990 was the starting quarter of the 1990-91 recession , which is why we end the first sub-sample on Q2 1990. This separates the last three business cycles period from the previous business cycles.

X_t then the relationship would be called one-way causality. If X_t "Granger-causes" Y_t and Y_t also "Granger-causes" X_t, then the test indicates two-way causality.

Tables III and IV provide the Granger causality results on the relationships between GDP growth, the unemployment rate and the labor market index over the entire sample period. Our test criteria is the values reported under the label P_r > ChiSq, the last column of these tables. In the present case, if the probabilities are less than or equal to 0.05, we can reject the null hypothesis of no Granger-causality. Our results show that both the unemployment rate and labor market index are good predictors of future real GDP trends.

Table III, using Q1 1965- Q2 2013 sample period, shows the P_r > ChiSq values between the labor market index and real GDP are below the 0.05 benchmark suggesting that causality runs both ways, the labor market index causes the growth of real GDP and the real GDP growth rate is responsible of the variation in the labor market index.

Table III

The Granger Causality Test Results

Sample Period	Causality from Labor Index to Real GDP		Causality from Real GDP to Labor Index	
	Chi-Square	P-value	Chi-Square	P > ChiSq
1965:Q1-2013:Q2	18.61	0.00*	6.98	0.03**
1965:Q1-1990:Q2	11.91	0.00*	3.97	0.14
1990:Q3-2013:Q2	6.19	0.05**	12.83	0.00*

*Statistically Significant at 1%

**Statistically Significant at 5%

Source: Wells Fargo Securities, LLC

Table IV provides the results of the test on the relationship between GDP growth and the unemployment rate over the entire sample period. In this case, the P_r > ChiSq probabilities are less than 0.05 in both cases, and, therefore, we can reject the null hypothesis of no Granger-causality. This implies that causality runs both ways; GDP growth causes variation in the unemployment rate, and the unemployment rate causes the movement in the growth of real GDP.

Table IV

The Granger Causality Test Results

Sample Period	Causality from Unemployment Rate to Real GDP		Causality from Real GDP to Unemployment Rate	
	Chi-Square	P > ChiSq	Chi-Square	P > ChiSq
1965:Q1-2013:Q2	9.19	0.01*	12.24	0.00*
1965:Q1-1990:Q2	8.86	0.01*	7.29	0.03**
1990:Q3-2013:Q2	1.19	0.55	17.43	0.00*

*Statistically Significant at 1%

**Statistically Significant at 5%

Source: Wells Fargo Securities, LLC

Economies evolve over time, and the framework for effective decision making needs to be reevaluated.

Breaking Down History: Has the Labor Market Framework Changed?

Economies evolve over time, and the framework for effective decision making at the private and public sector levels needs to be reevaluated. This has been reflected in our analysis of the labor market since our paper in 2006. Simply stated, the labor market of the 21st century is quite different than in the past and, unfortunately, different from the mental images that frame many decision-makers' view of the labor market today.[9]

[9] For a view on the evolution of economic frameworks and the biases, such as the anchoring bias, that prevents effective decision making see John E. Silvia, *Dynamic Economic Decision Making*, Wiley, 2011.

Tables III and IV provide the results of the first set of tests on the relationships between GDP growth, the unemployment rate and the labor market index over the Q1 1965 to Q2 1990 sample period. This is the period of pre-NAFTA, the emergence of China/India/Brazil as global competitors and before the emergence of Windows 3.1 in 1992.

Our test criteria remains the P_r > ChiSq, the last column of these tables. In the case with Table III, the probabilities are less than 0.05 for the test such that the labor index can be judged as causing changes in real GDP. However, it also reveals that real GDP growth cannot be considered as causing labor market movements. We cannot reject the null hypotheses of no causality at the 5 percent level of significance.

Table IV provides the results of the test on the relationship between GDP growth and the unemployment rate over the sub-sample of the Q1 1965 to Q2 1990. In this case, the probabilities are less than 0.05 in both cases, and, therefore we can reject the null hypothesis of no Granger-causality. The 5 percent benchmark suggests that causality runs both ways, GDP growth causes movement in the unemployment rate and the unemployment rate causes variation in the growth of real GDP.

Labor Market Behavior in the Modern Era: 1990—2013

Tables III and IV also provide the results of the tests on the relationships between GDP growth, the unemployment rate and the labor market index over the Q3 1990 to Q2 2013 period. Our test criteria remains the P_r > ChiSq, the last column of these tables. In the case with Table III, the probabilities are less than 0.05, and that indicates the labor index can be judged as causing changes in real GDP and changes in GDP can cause changes in the labor market index. Here we have two-way causality between economic growth and the labor market—as we would expect. Conditions in the economy help us predict developments in the labor market, and developments in the labor market help us predict GDP.

The statistical analysis suggests that the Labor Market Index is a better predictor for the real GDP growth rate.

Table IV provides the results of the test on the relationship between GDP growth and the unemployment rate for Q3 1990 to Q2 2013. The probability is much too high (at 0.55) to reject the null hypothesis of no relationship. The unemployment rate cannot be used to predict future values of GDP growth. In contrast, we can use the growth rate of GDP to predict the unemployment rate.

Therefore, during the modern period, in contrast to the prior period (pre-1990), the labor market index can be used to predict future values of GDP; whereas, the link between unemployment rates and GDP growth has now disappeared. The unemployment rate should not be used to predict real GDP growth.

Conclusion

This report tests the predictive power of the labor market index and compares it with the unemployment rate. The real GDP growth rate is utilized as a benchmark, i.e., which indicator provides a relatively better predictive power to forecast the real GDP growth rate. The statistical analysis suggests that the Labor Market Index is a better predictor for the real GDP growth rate. Therefore, private decision makers might be better off to utilize the Labor Market Index as a measure of the current state of the labor market, rather than the unemployment rate, as well as a potential predictor of the GDP growth rate.

Wells Fargo Securities, LLC Economics Group

Diane Schumaker-Krieg	Global Head of Research, Economics & Strategy	(704) 410-1801 (212) 214-5070	diane.schumaker@wellsfargo.com
John E. Silvia, Ph.D.	Chief Economist	(704) 410-3275	john.silvia@wellsfargo.com
Mark Vitner	Senior Economist	(704) 410-3277	mark.vitner@wellsfargo.com
Jay H. Bryson, Ph.D.	Global Economist	(704) 410-3274	jay.bryson@wellsfargo.com
Sam Bullard	Senior Economist	(704) 410-3280	sam.bullard@wellsfargo.com
Nick Bennenbroek	Currency Strategist	(212) 214-5636	nicholas.bennenbroek@wellsfargo.com
Eugenio J. Alemán, Ph.D.	Senior Economist	(704) 410-3273	eugenio.j.aleman@wellsfargo.com
Anika R. Khan	Senior Economist	(704) 410-3271	anika.khan@wellsfargo.com
Azhar Iqbal	Econometrician	(704) 410-3270	azhar.iqbal@wellsfargo.com
Tim Quinlan	Economist	(704) 410-3283	tim.quinlan@wellsfargo.com
Michael A. Brown	Economist	(704) 410-3278	michael.a.brown@wellsfargo.com
Sarah Watt	Economist	(704) 410-3282	sarah.watt@wellsfargo.com
Michael T. Wolf	Economist	(704) 410-3286	michael.t.wolf@wellsfargo.com
Sara Silverman	Economic Analyst	(704) 410-3281	sara.silverman@wellsfargo.com
Zachary Griffiths	Economic Analyst	(704) 410-3284	zachary.griffiths@wellsfargo.com
Mackenzie Miller	Economic Analyst	(704) 410-3358	mackenzie.miller@wellsfargo.com
Blaire Zachary	Economic Analyst	(704) 410-3359	blaire.a.zachary@wellsfargo.com
Peg Gavin	Executive Assistant	(704) 410-3279	peg.gavin@wellsfargo.com
Cyndi Burris	Senior Admin. Assistant	(704) 410-3272	cyndi.burris@wellsfargo.com

WELLS FARGO SECURITIES