



ECONOMIC ACTIVITY DURING THE GOVERNMENT SHUTDOWN AND DEBT LIMIT BRINKSMANSHIP

Council of Economic Advisers

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Introduction

The government shutdown and debt limit brinksmanship have had a substantial negative impact on the economy. The shutdown directly affected the economy by withdrawing government services for a sixteen day period, which not only had direct impacts but also had a range of indirect effects on the private sector. For example the travel industry was hurt by the closing of national parks, businesses in oil and gas and other industries were hurt by the cessation of permits for oil and gas drilling, the housing industry was hurt by the cessation of IRS verifications for mortgage applications, and small businesses were hurt by the shutdown of Small Business Administration loan guarantees. In addition, a reduction in consumer confidence and an increase in uncertainty associated not just with the shutdown but also the brinksmanship over the debt limit affected consumer spending, investment and hiring as well.

A number of private sector analyses have estimated that the shutdown reduced the annualized growth rate of GDP in the fourth quarter by anywhere from 0.2 percentage point (as estimated by JP Morgan) to 0.6 percentage point (as estimated by Standard and Poor's), with intermediate estimates of 0.2 percentage point and 0.5 percentage point from Macroeconomic Advisers and Goldman Sachs respectively. Most of the private sector analyses are based on models that predict the impact of the shutdown based on the reduction in government services over that period. Very few of them are based on an actual analysis of economic performance during the period of the shutdown and very few take into account the secondary effects on the private sector of the cessation of government services or the effects on confidence and uncertainty associated with both the shutdown and the debt limit brinksmanship. But we know that these effects can be large; for example, the debt limit brinksmanship in the summer of 2011 had an adverse economic impact even though it was not accompanied by a shutdown nor did it lead to an actual default on U.S. government obligations. While useful in understanding the costs of the shutdown and brinksmanship, the available private-sector analyses present only part of the picture.

This report attempts to estimate the actual impact of the shutdown and default brinksmanship on economic activity as measured by eight different daily or weekly economic indicators. **Overall it finds that a range of eight economic indicators combined in what this report calls a "Weekly Economic Index" are consistent with a 0.25 percentage point reduction in the annualized GDP growth rate in the fourth quarter and a reduction of about 120,000 private-sector jobs in the first two weeks of October (estimates use indicators available through October 12th.)**

These estimates could understate the full economic effects of the episode to the degree it continues to have an effect past October 12th.

Summary of Economic Data for the First Half of October and the Weekly Economic Index

The attempt to create an immediate estimate of economic impact is frustrated by the fact that most economic data are reported with a long lag (for example, most October data will be released in mid-to-late November), are reported on a monthly rather than a weekly basis and the weekly and daily data have substantial volatility. These limitations were compounded during the shutdown as virtually all government data, with the exception of weekly unemployment insurance claims, were halted. By combining a range of indicators that are individually noisy it is possible to gather evidence about the trajectory of the economy over shorter periods, including during the first half of October. Such short windows are often uninteresting given the noise in the data and the generally slow shifts in major economic trends. However, during periods with a sharp break in the economic environment—like the recent shutdown and debt limit brinksmanship—such estimates can provide a valuable clue to the direction of the economy.

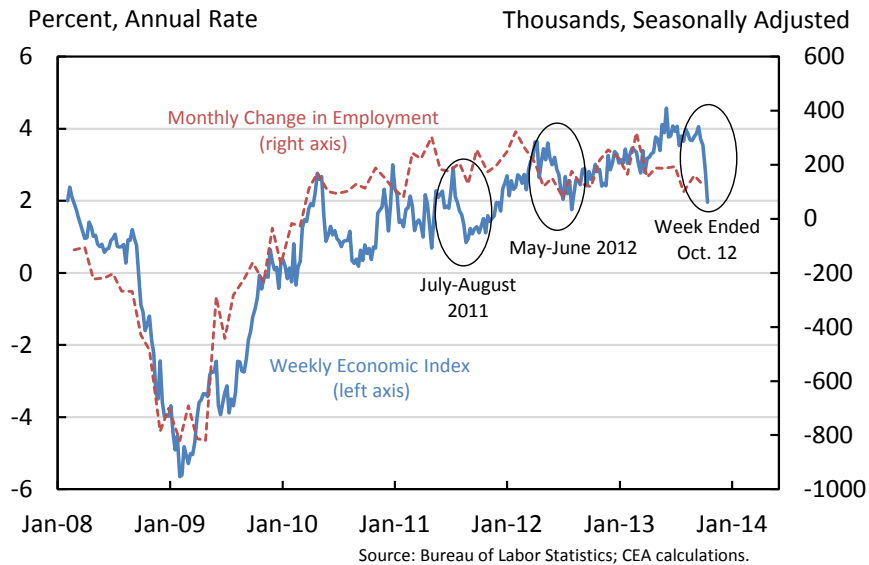
Table 1 shows eight different measures of economic performance and sentiment in the first half of October. All eight indicators deteriorate in the first half of October, with the contractions being very sharp in several cases.

Table 1. Weekly Economic Indicators and Index, October 2013

	Week ending 9/28	Week ending 10/12	Change
Johnson-Redbook Same-Store Sales Index (y/y % chge)	3.8	3.2	-0.6
ICSC Same-Store Sales Index (y/y % chge)	2.1	1.0	-1.1
New UI Claims (thousands)	308	358	50
Gallup Job Creation Index	19.7	16.8	-2.8
Gallup Economic Confidence Index	-21.5	-38.2	-16.7
Rasmussen Consumer Index	99.9	91.8	-8.1
AISI Raw Steel Production (y/y % chge)	4.0	6.2	2.2
MBA Mortgage Applications (y/y % chge)	-2.5	-11.5	-9.0
Weekly Economic Index	3.6	2.0	-1.6

To understand what this means for overall economic activity CEA combined these indicators into a “Weekly Economic Index” that is scaled to match the overall growth rate of economic activity (see Figure 1). This “Weekly Economic Index” is designed to extract the main common “signal” from the noise of these different indicators. As discussed in more detail later in this Report, this Weekly Economic Index was designed to estimate the co-movements among these eight indicators, not to predict any particular monthly data series. Nevertheless, the Weekly Economic Index turns out to be highly correlated with standard monthly measures of economic activity, notably changes in employment and the growth of industrial production.

Figure 1. Weekly Economic Index and Monthly Change in Private Employment



This Weekly Economic Index is calibrated to be consistent with the magnitudes of growth rates in GDP and shows a sharp 1.6 percentage point reduction in the economic growth rate in the fourth quarter if it were sustained for the full 13 weeks of the fourth quarter. Our focus is on the first two weeks of October, and these data suggests that the decline over this period will reduce the GDP growth rate by 0.25 percentage point at an annual rate (about two-thirteenths of the reduction in the index reflecting the two weeks we are analyzing). When calibrated to employment growth the Index suggests 120,000 fewer private-sector jobs were created in the first two weeks of October than would have been created without the shutdown and debt limit brinksmanship.

The Weekly Data Series

The eight series used to construct the index include two measures of retail sales, two measures of consumer confidence, two measures of labor market activity, one measure of production, and one measure of housing market activity. The series, their source, and release dates relative to the observation][period are listed in Table 2. Seven of the series are privately produced and

are based on privately-reported data, while one series, new claims for unemployment insurance (UI), is produced by the Department of Labor. All these series were released during the shutdown. Three of the series – the Gallup Economic Confidence Index, the Rasmussen Consumer Index, and the Gallup Job Creation Index – are available daily, while the rest are reported weekly.¹

Table 2. Description of Variables

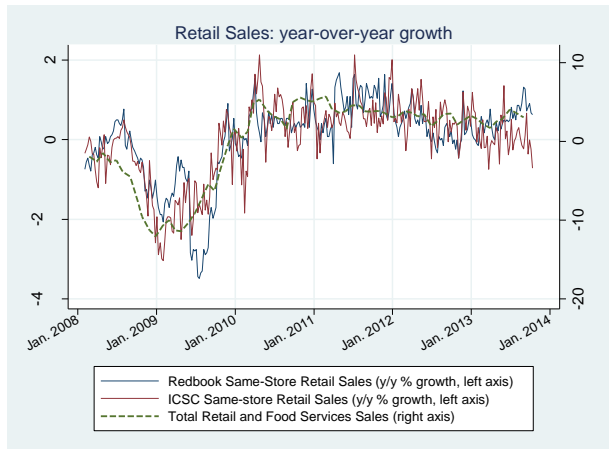
Series Name	Frequency	Release Date	Source
A. Consumer Spending			
ICSC Same-Store Retail Sales (52-week growth, %)	Weekly	Following Tuesday	International Council of Shopping Centers
Redbook Same-Store Retail Sales (y/y growth, %)	Weekly	Following Tuesday	Johnson Redbook Service
B. Consumer Confidence			
Gallup Economic Confidence	Daily	Next day	Gallup
Rasmussen Consumer Index	Daily	Same day	Rasmussen Reports
C. Labor Market			
Gallup Job Creation Index	Daily	Next day	Gallup
Unemployment Insurance (Initial Claims)	Weekly	Following Thursday	Department of Labor
D. Industrial Production			
Raw Steel Production (52-week growth, %)	Weekly	Following Monday	American Iron and Steel Institute
E. Housing Market			
Mortgage Purchase Applications (52-week growth, %)	Weekly	Following Wednesday	Mortgage Bankers Association

The eight indicators are plotted in Figures 2-5. Figure 2 shows the two retail sales indexes, one constructed by the International Council of Shopping Centers (ICSC) the other by Johnson Redbook Service. These series measure the growth in same-store sales over the past 52 weeks. Both series are noisy partly because the sample of stores is small and because sales fluctuate

¹ CEA considered a number of other weekly indicators In addition to these eight but they were not used in the index based on considerations including the length of the sample, the presence of strong seasonal patterns that could not be adequately addressed using 52-week growth rates, reporting dates more than 6 days after the week in question, or data irregularities.

considerably depending on dates of holidays and major weather systems. Figure 2 also shows the 12-month growth in monthly Real Retail Sales and Food Services, a measure of sales that includes a wider segment of the retail sector and is based on a larger sample. Although the two weekly series have a long-term trend similar to that of the monthly sales series, at any given date the two weekly series diverge from the Census series and from each other. Recently, the Redbook series has shown stronger sales growth than the ICSC series.

Figure 2



The two labor market variables, shown in Figure 3, are weekly initial claims for unemployment insurance and the daily Gallup Job Creation Index. The Gallup Job Creation Index is based on a daily random digit dial telephone survey that asks respondents whether their employer is increasing or reducing employment (the job creation index is presented here on an inverted scale to make it easier to compare with unemployment insurance claims). These two series track each other closely and share many common features, including the spike in the week ending October 5.

Figure 3

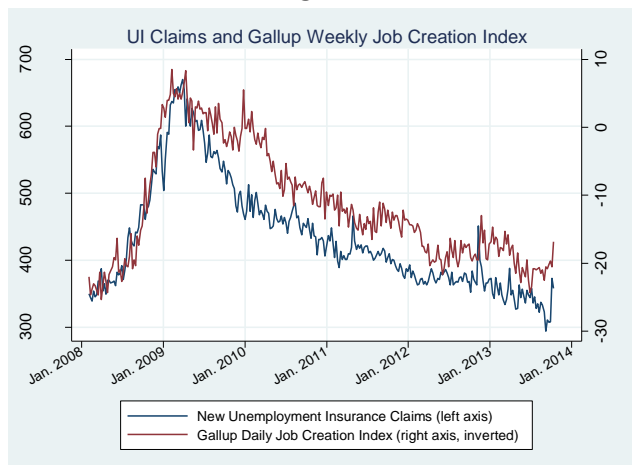


Figure 4 shows the two daily confidence measures, the daily Gallup Economic Confidence Index and daily Rasmussen Consumer Index, which are plotted on a standardized scale to simplify comparison. The two daily indexes track each other and also track the monthly University of Michigan Index of Consumer Sentiment. The three confidence measures are based on independent surveys and use differently worded questions. All three measures show a sharp decline in the first two weeks of October.

Figure 4

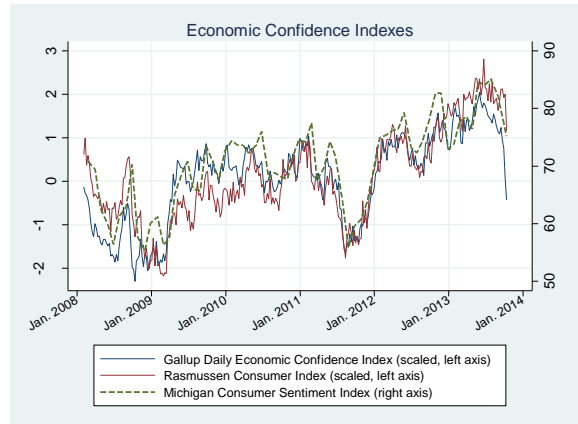
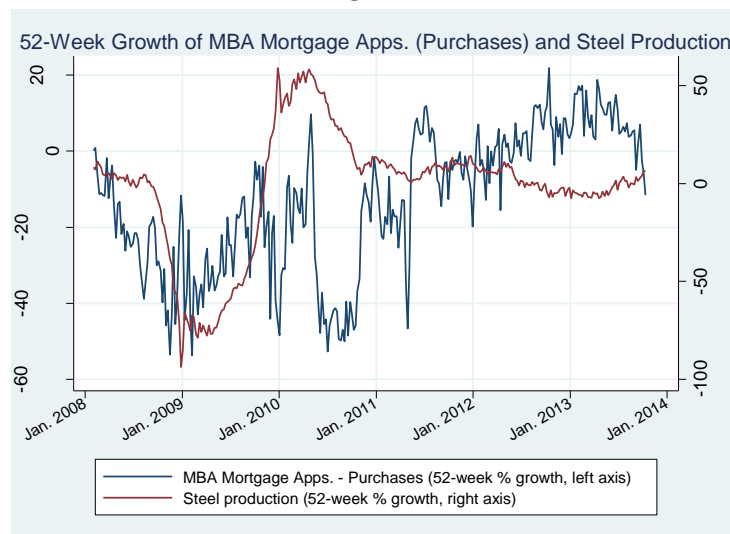


Figure 5 shows the 52-week growth in the Mortgage Bankers' Association weekly mortgage applications for new purchases and the 52-week growth in the American Iron and Steel Institute's raw steel production series. Although both series slumped sharply during the recession, they show different patterns during the recovery: weekly steel production grew quickly early in the recovery, then slowed, whereas the mortgage applications for new purchases started to recover only later, both because of the delayed recovery of the housing market and because of the relatively large fraction of cash purchases early in the recovery.

Figure 5



Construction of the Weekly Economic Index

As can be seen in Figures 2-5, these weekly series exhibit considerable noise from week to week, so that gleaning broader trends from any one series is difficult. They also, however, display a clear cyclical pattern, which suggests that these series might usefully be combined into a single index. The Weekly Economic Index is computed from these eight series using the method of principal component analysis. The principal component of these eight series provides an estimate of a signal about the economy which is common to all eight. The mathematics of principal components analysis is summarized in the Appendix.

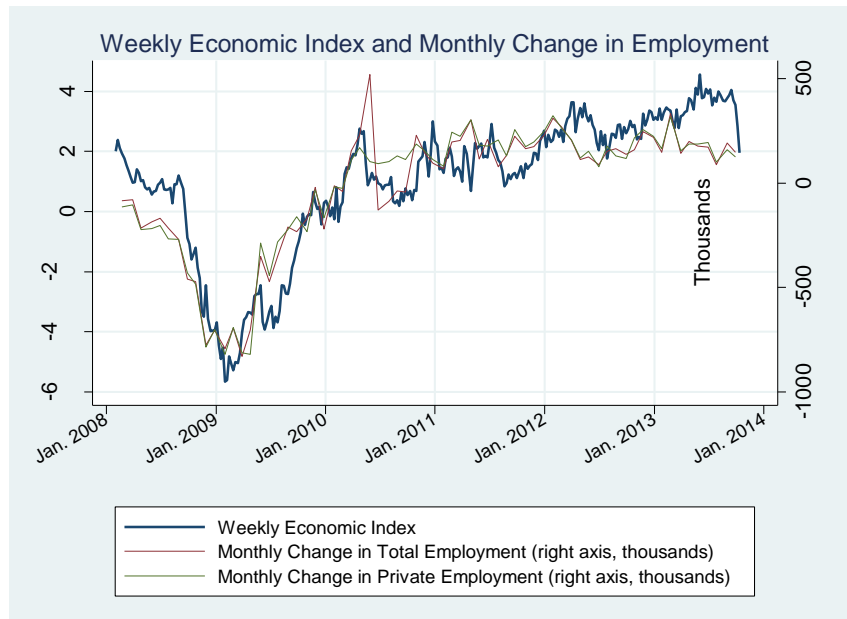
The resulting Weekly Economic Index is shown in Figure 1. By construction, the Weekly Economic Index is a weighted average of the eight series. The weekly index explains 58% of the overall variance of the eight component series. The Weekly Economic Index is a measure of economic growth, and for ease of interpretation it has been scaled to have the same mean as the four-quarter growth in real GDP from 2008 to the present. The units of the Weekly Index are therefore the units of GDP growth at an annual rate.²

Relationship of the Weekly Index to Monthly Employment and Industrial Production

The weekly index is designed to be a gauge of overall economic activity in the current week and is not intended to forecast the growth of any specific major economic indicator. Nevertheless, as seen in Figure 6, the index tracks the overall pattern of changes in monthly private and total employment. When the weekly index is aggregated to the monthly level, the correlation between the index and the monthly change in total employment is 0.86 (0.87 excluding Census workers), and the correlation between the index and the monthly change in private employment is 0.87.

² Specifically, the mean and standard deviation of the Weekly Economic Index have been adjusted so that they match the mean and standard deviation of the four-quarter growth of GDP from 2008 through the second quarter of 2011.

Figure 6



The weekly index also tracks other major economic indicators. The correlation between the index and the twelve-month growth of the Index of Industrial Production is 0.84, and its correlation with the twelve-month growth of real manufacturing and trade sales is 0.86.

Regression results and sensitivity checks.

Figure 6 indicates that the Weekly Economic Index moves together with changes in monthly employment. This co-movement can be summarized in a regression of the changes of monthly employment on monthly values of the index, and the results of this regression are shown in Table 3 for monthly changes in private payroll employment. For the Weekly Economic Index, the adjusted R^2 of this regression is 75%.

We computed a number of other indexes as sensitivity checks. Two of these indexes are computed as the principal component of a subset of the eight variables: the 6-variable index drops steel production and MBA mortgage applications, and the 5-variable index also drops UI claims. An alternative 6-variable index was also computed using state space methods, with the index estimated using the Kalman filter as discussed in the appendix. Regressions relating changes in private employment to these three additional indexes are reported in Table 3. The regressions confirm that the three indexes have very similar predictive content for monthly changes in private employment, and the results for total employment (not shown) are similar to those in Table 3.

Table 3. Monthly Aggregate of the Weekly Index and Private Employment: Regression Results

Sample: monthly, February 2008 – August 2013
 Dependent variable: Change in Private Employment

Regressors	(1)	(2)	(3)	(4)
Weekly Economic Index	115**			
Sensitivity checks:	(8)			
5-variable index		114**		
		(8)		
6-variable index			111**	
			(9)	
6-variable index estimated by the Kalman Filter				120**
				(8)
Adjusted R ²	0.75	0.74	0.72	0.77
Standard Error of the Regression	154	157	164	147

Notes: Each column summarizes the results of a regression of monthly change in private payroll employment on a weekly index, where the weekly index is aggregated to monthly (data for a week overlapping two months are assigned proportionately to the two months). Entries are regression coefficients, with heteroskedasticity- and autocorrelation-robust standard errors in parentheses. The sample size is shorter for the regressions involving the 9-indicator index because that index is available starting February 2009. Coefficients are statistically significant at the ⁺10%, *5%, **10% significance level.

Table 3 answers, in the affirmative, the question of whether the index is correlated with changes in employment. A separate question is whether the index contains information useful for predicting monthly changes in employment going forward, beyond the information contained in past values of changes of employment. This question is examined in Table 4. The regressions in Table 4 take advantage of the weekly nature of index and use values of the index for the four weeks between the two measurement reference weeks for payroll employment. Broadly speaking, the Establishment Survey aims to estimate payroll employment on the 12th day of the month. The weekly data structure permits estimation of the effect of economic developments between these reference dates from one month to the next. Accordingly, in these regressions, payroll employment in a given month is predicted using data for the first two seven-day periods of the month, the third seven-day period of the previous month, and the final seven-to-ten day period of the previous month – that is, the weeks between the Establishment Survey reference date – along with changes of payroll employment from the previous month.

Table 4. Weekly Values of the Index as a Predictor of Changes in Employment
Sample: monthly, February 2008 – August 2013

Regressors	(1)	(2)	(3)	(4)
	Weekly Economic Index	5-variable index	6-variable index	6-variable index, Kalman Filter
Current month, week 2	81.1 (33.7)	56.5 (28.2)	62.1 (34.1)	75.3 (48.0)
Current month, week 1	4.9 (48.9)	28.1 (37.8)	28.6 (46.9)	41.6 (67.4)
Last month, week 4	-17.4 (50.9)	-56.7 (35.7)	-41.3 (45.5)	-118.6 (59.6)
Last month, week 3	-65.6 (42.0)	-20.6 (31.9)	-48.5 (40.6)	6.9 (45.0)
first lag of change in empl.	0.61 (0.12)	0.62 (0.12)	0.65 (0.12)	0.61 (0.12)
second lag of change in empl.	0.30 (0.13)	0.27 (0.12)	0.29 (0.13)	0.30 (0.13)
F-test of that coefficients on all four weekly variables = 0	3.82 (0.01)	3.96 (0.01)	3.72 (0.01)	3.27 (0.02)
F-test of equality of coefficients on all four weekly variables	4.99 (0.00)	5.27 (0.00)	4.77 (0.00)	4.21 (0.01)
Adjusted R ²	0.90	0.90	0.90	0.89
Standard Error of the Regression	99	99	99	100
Predicted Change in Total Employment (Thousands)	-120	-126	-128	-106

Notes: Each column summarizes the results of a regression of monthly change in private employment on weekly values of an index, where the first three weekly values in a month correspond to the first through third 7-day period of the month and final weekly value corresponds to the final 7-10 day period, where data for calendar weeks overlapping adjacent 7-day periods are assigned to the two periods proportionately. Entries in the top panel are regression coefficients, with standard errors in parentheses, and in the lower panel are *F*-statistics with *p*-values in parentheses. The sample size is shorter for the regressions involving the 9-indicator index because that index is available starting February 2009. Coefficients are statistically significant at the +10%, *5%, **10% significance level.

Two findings in Table 4 are noteworthy. First, the test of the hypothesis that the coefficients on the four weekly values of the index are zero constitutes a test of marginal predictive content (a so-called Granger Causality test). For the Weekly Index and the four sensitivity check indexes, this hypothesis is rejected at the 5% significance level, indicating that the indexes help to forecast employment changes beyond the lagged value of employment. Second, the hypothesis that the coefficients on the four weeks are equal is rejected for all the indexes;

instead of equality, the coefficients show a similar pattern across indexes in which the change in the index between the last two weeks of the previous month and the first two weeks of the current month is a useful predictor of employment. Because these regressions contain lagged changes in employment, this pattern is consistent with the interpretation of this regression as estimating changes in employment, relative to the previous month.

The final line of Table 4 reports estimates of the change in private employment arising from the shutdown. These estimates were computed by comparing the actual value of the index for the first two weeks of October to the counterfactual in which those values for the first two weeks of October were the same as for the last week in September. The estimate based on the Weekly Economic Index is a reduction in job changes in October – the immediate cost of the shutdown, measured in terms of jobs – is 120 thousand jobs lost. The estimates based on the other indexes range between 106 -128 thousand jobs lost.

Conclusion

In normal times estimating weekly changes in the economy is likely to detract from the focus on the more meaningful longer term trends in the economy which are best measured over a monthly, quarterly, or even yearly basis. But when there is a sharp shift in the economic environment, analyzing high-frequency changes with only a very short lag since they occurred can be very valuable. This paper shows that a range of indicators show that sentiment, job creation, consumption, and some elements of production grew more slowly in the first half of October than in previous months. Moreover, it combines all of these indicators into a single measure termed the Weekly Economic Index which is consistent with a 0.25 percentage point reduction in the annualized GDP growth rate in the fourth quarter or a reduction of about 120 thousand jobs in October, based solely on the indicators available covering the period through October 12th. These estimates could understate the full economic effects of the episode to the degree it continues to have an effect past October 12th—as it most likely would. This is just a first attempt to analyze these data and as updated data and further research becomes available it could lead to refinements in these estimates.

APPENDIX: Principal Components Estimation of Dynamic Factor Models

A leading framework for the construction of an economic index from multiple time series is the so-called dynamic factor model, developed by Geweke (1977). The dynamic factor model posits the existence of a small number of unobserved or latent series, called factors, which drive the co-movements of the observed economic time series. Application of dynamic factor models to estimating economic indexes range from the construction of state-level indexes of economic activity (Crone and Clayton-Matthews (2005)) to large-scale indexes of economic activity (for example, the Chicago Fed National Activity Index, or CFNAI). Stock and Watson (2011) provide a review of the econometric theory of dynamic factor models, including recent applications.

The premise of a dynamic factor model is that a small number – in the application of this Report, a single – latent factor, f_t , drives the co-movements of a vector of N time-series variables, X_t . The dynamic factor model posits that the observed series is the sum of the dynamic effect of the common factor and an idiosyncratic disturbance, e_t , which arise from measurement error and from special features that are specific to an individual series:

$$X_t = \lambda(L)f_t + e_t \quad (1)$$

where L is the lag operator. The elements of the $N \times 1$ vector of lag polynomials $\lambda(L)$ are the dynamic factor loadings, and $\lambda_i(L)f_t$ is called the common component of the i^{th} series. The dynamic factor can be rewritten in static form by stacking f_t and its lags into single vector F_t , which has dimension up to the number of lags in $\lambda(L)$:

$$X_t = \Lambda F_t + e_t \quad (2)$$

where Λ is a matrix with rows being the coefficients in the lag polynomial $\lambda(L)$.

The two primary methods for estimating the unobserved factor f_t are by principal components and using state space methods, where the factor is estimated by the Kalman filter. Broadly speaking, early low-dimensional applications used parametric state-space methods and more recent high-dimensional applications tend to use nonparametric principal components or variants. The key theoretical result justifying the use of principal components is that the principal components estimator of the factor (or, more generally, the space spanned by the factors) is consistent and moreover, if N is sufficiently large, then the factors are estimated precisely enough to be treated as data in subsequent regressions.

The principal components estimator of F_t is the weighted average $\hat{\Lambda}'X_t$, where $\hat{\Lambda}$ is the matrix of eigenvectors of the sample variance matrix of X_t , $\hat{\Sigma}_X = T^{-1} \sum_{t=1}^T X_t X_t'$, associated with the r

largest eigenvalues of $\hat{\Sigma}_X$, where here $r=1$. The principal components estimator can be derived as the solution to the least squares problem,

$$\min_{F_1, \dots, F_T, \Lambda} V_r(\Lambda, F), \text{ where } V_r(\Lambda, F) = \frac{1}{NT} \sum_{t=1}^T (X_t - \Lambda F_t)'(X_t - \Lambda F_t), \quad (3)$$

subject to the normalization $N^{-1}\Lambda'\Lambda = I_r$. Consistency of the principal components estimator of F_t was first shown for T fixed and $N \rightarrow \infty$ in the exact static factor model by Connor and Korajczyk (1986). Stock and Watson (2002a) proved uniform consistency of the factors under weaker conditions along the lines of Chamberlain and Rothschild's (1983) approximate factor model, allowing for weak serial and cross-correlation in the idiosyncratic errors. Stock and Watson (2002a) also provided rate conditions on N and T under which \hat{F}_t can be treated as data for the purposes of a second stage least squares regression (that is, in which the estimation error in \hat{F}_t does not affect the asymptotic distribution of the OLS coefficients with \hat{F}_t as a regressor). Bai (2003) provides limiting distributions for the estimated factors and common components. Bai and Ng (2006a) provide improved rates, specifically $N \rightarrow \infty$, $T \rightarrow \infty$, and $N^2/T \rightarrow \infty$, under which \hat{F}_t is consistent and can be treated as data in subsequent regressions; they also provide results for construction of confidence intervals for common components estimated using \hat{F}_t .

The main alternative estimation method is to specify a parametric factor model, to estimate the parameters by maximum likelihood, and to estimate the factor using the Kalman filter; for initial applications of this approach see Engle and Watson (1981), Sargent (1989), and Stock and Watson (1989, 1991). In practice the resulting estimates can be sensitive to the parametric specification of the model, so principal components estimation is used in this Report. As a sensitivity check, however, we also considered the six-variable index estimated using the Kalman filter. Regression results for that index are similar to those reported in Tables 3 and 4.

An alternative approach to using high-frequency data for real-time monitoring ("nowcasting") is to focus on forecasting a specific economic release, such as the monthly change in employment, and to construct a model that updates those forecasts as new data comes in. The dynamic factor model and its state space implementation is useful for this purpose because a single model automatically adapts to new data becoming available to estimate the variable of interest. For applications of dynamic factor models to nowcasting, see Giannone, Reichlin and Small (2008) and Aruoba, Diebold and Scotti (2009).

References

- Aruoba, S.B., F.X. Diebold, and C. Scotti, (2009), "Real-Time Measurement of Business Conditions," *Journal of Business & Economic Statistics* 27, 417-427.
- Bai, J., (2003), "Inferential Theory for Factor Models of Large Dimensions," *Econometrica*, 71, 135-172.
- Bai, J., and S. Ng, (2006), "Confidence Intervals for Diffusion Index Forecasts and Inference for Factor-Augmented Regressions," *Econometrica*, 74,1133-1150.
- Chamberlain, G., and M. Rothschild, (1983), "Arbitrage Factor Structure, and Mean-Variance Analysis of Large Asset Markets," *Econometrica*, 51,1281-1304.
- Crone, T.S. and A Clayton-Matthews, (2005), "Consistent Economic Estimates for the 50 States," *The Review of Economics and Statistics*, 87, 593-603.
- Engle, R.F., and M.W. Watson, (1981), "A One-Factor Multivariate Time Series Model of Metropolitan Wage Rates," *Journal of the American Statistical Association*, 76, 774-781.
- Geweke, J., (1977), "The Dynamic Factor Analysis of Economic Time Series," in *Latent Variables in Socio-Economic Models*, ed. by D.J. Aigner and A.S. Goldberger, Amsterdam: North-Holland.
- Giannone, D., L. Reichlin, and D. Small, (2008), "Nowcasting: The Real-Time Informational Content of Macroeconomic Data," *Journal of Monetary Economics*, 55, 665-676.
- Sargent, T.J., (1989), "Two Models of Measurements and the Investment Accelerator," *Journal of Political Economy* 97:251–287.
- Stock, J.H., and M.W. Watson, (1989), "New Indexes of Coincident and Leading Economic Indicators," *NBER Macroeconomics Annual 1989*, 351-393.
- Stock, J.H., and M.W. Watson, (1999), "Forecasting Inflation," *Journal of Monetary Economics*, 44, 293-335.
- Stock, J.H., and M.W. Watson, (2002), "Forecasting Using Principal Components from a Large Number of Predictors," *Journal of the American Statistical Association*, 97, 1167-1179.
- Stock, J.H., and M.W. Watson, (2011), "Dynamic Factor Models," ch. 2 in M. Clements and D. Hendry (eds.), *Oxford Handbook of Economic Forecasting*. Oxford: Oxford University Press.