



Alternative Measures of U.S. Economic Activity in Business Cycles and
Business Cycle Dating

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August 5, 2005
WP 2005-05

The views expressed in this paper are solely those of the author and not necessarily those of the U.S. Bureau of Economic Analysis or the U.S. Department of Commerce. The author thanks Dennis Fixler for helpful comments and encouragement.

The Business Cycle Dating Committee of the National Bureau of Economic Research (NBER) has determined that there have been 10 recessions since WW-II. The first was in 1948-49, and the most recent was in 2001.¹ In recent years, the dating committee has primarily relied on four monthly indicator measures of economic performance to determine cyclical peaks and troughs; the Federal Reserve Board of Governors' monthly index of industrial production, the Bureau of Labor Statistics' estimates of monthly payroll employment, BEA's monthly estimates of real manufacturing and trade sales, and BEA's monthly estimates of real personal income less current transfers.² In addition, the committee "...places considerable weight on the estimates of real GDP..." and also "looks at monthly estimates of real GDP, such as those prepared by Macroeconomic Advisers..."³

The NBER-determined cyclical peaks and troughs are the primary reference points in this review. Although some analysts have suggested somewhat different timing for cycles, and even whether cycles occurred—particularly in the pre-WW-I era—this review finds no reason for revising the timing of the NBER post-WW-II cyclical peaks and troughs.

The NBER dating committee's methodology appears to be very robust. However some observers, who are primarily interested in business cycles before either WW-II or WW-I, have developed rules for quantifying peaks and troughs that are based on the performance of the Federal Reserve Board's index of industrial production in the post-WW-II era—see Romer (1994) and Davis (2005). The results of applying their rules do not fully match the NBER's turning points in the postwar era. Romer uses a rule that she describes as an updated quantification of the Burns and Mitchell (1946) description of recessions. Her methodology is based on a quantitative loss rule that is used when there are local peaks in periods of mild general declines leading up to recessions. She uses monthly estimates of the index of industrial production and obtains peak and trough estimates that have absolute average differences from the NBER dating determinations of 0.9 months and 1.3 months, respectively. Davis uses a methodology that is based on Romer's dating methodology, but uses annual data and the rule "...A year immediately preceding an absolute decline in the aggregate level of ... (the) industrial production index defines a peak and the last consecutive decline following a peak is the trough" (Davis, *op. cit.*, p. 5). He uses his own estimates of industrial production prior to 1915, but also applies the methodology to the Federal Reserve's industrial production index in the post-WW-II era. Within the limits of converting the NBER's monthly peak and trough determinations to annual ones, his annual results are in generally in line with the

¹ A complete list of all U.S. business cycles since 1854 may be found the NBER's web site, at <http://www.nber.org/cycles/cyclesmain.html>. See also the description of the recession dating procedures at <http://www.nber.org/cycles>.

² A more complete description of the indicator measures is in the appendix.

³ Although BEA publishes quarterly estimates, it does not publish monthly GDP or GDI estimates. The dating committee's documentation indicates that it views real GDP as the best measure of overall economic activity, but uses the monthly measures to determine peak and trough months. It emphasizes the personal income and employment measures in determining the peak and trough months. However, the NBER does not follow a fixed rule about other measures that contribute information to the dating process.

NBER's peak and trough dates, but his methodology does not capture the 1960-61 recession.

It is interesting to compare the results of applying rules similar to those of Romer and Davis to the four monthly individual performance measures featured by the NBER. The latest estimates, as available March 15, 2005, are used for the four measures. All of the four measures are subject to revisions following the NBER's initial determinations of peaks and troughs. Historically, such revisions have sometimes led to revised timing of peaks and troughs. For example, in estimates published between 1965 and 1985 the NBER moved 3 peaks and one trough by at least one month.

Table 1 shows the NBER-determined monthly peaks and troughs for the 10 post-WW-II recessions. It also shows the different peaks and troughs that are produced by the four monthly measures of economic performance, using rules that are adapted to the monthly-frequency measures as follows. First, an analog to Davis' rule is used: Put the peak in the month before the first decline and the trough in the month before the first increase. Second, an analog to Romer's rule is then used in situations where the indicator measure is fluctuating up and down with little trend: Date the turning point at the latest peak or trough month, provided that there is not a significant decline before the latest peak, or a significant increase before the latest trough. However, instead of using the quantitative loss measure used by Romer, a judgmental standard is used: The decline following the peak must be large relative to the decline prior to the peak. (Using this rule for troughs had no effect on timing.) This rule affects the timing of peaks from the individual series in some cases where the peaks from the individual measures would otherwise lead the NBER peaks by more than one month. Using this rule to supplement Davis' rule moves peaks closer to the NBER peaks for 4 recessions as indicated by industrial production, one peak as indicated by employment, and 2 peaks as indicated by manufacturing and trade sales; the reductions range from 4 to 10 months.

The last 8 columns of the table show the leads and lags of the peaks and troughs in the individual indicator measures—as determined by the above rules—in months, relative to the NBER peaks and troughs. For the first 3 recessions, where only industrial production and employment estimates are available, all 3 peaks and 2 of the troughs have no leads or lags for at least one measure. In the other, the trough of the 1953-54 recession, industrial production leads by one month and employment lags by 3 months. For the most recent 7 recessions, there are multiple instances of agreements of the individual indicator measures with the NBER's timing of peaks, or else at least one bracketing where a lead for one or more measures is matched by a lag for at least one other measure. The troughs likewise show substantial agreement between the indications of the individual measures and those determined by the NBER. An exception is the trough of the 1973-75 recession, where 3 measures indicate lags and one indicates agreement. However, taken as a group, the monthly measures are in general agreement with the NBER timing, and do not suggest any changes in the months identified as peaks and troughs by NBER, even though none of the measures is in complete agreement with the NBER peaks and troughs.

For the 10 post-WW-II recessions, industrial production indicates the same timing as the NBER-determined peaks for just 5 recessions, and the same timing as the NBER-determined troughs for 7 recessions. The other individual performance measures indicate fewer agreements with the NBER-determined peaks and troughs. Employment indicates the same months for just 3 peaks and 5 troughs. Manufacturing and trade sales indicate the same months for just 2 peaks and 2 troughs out of the 7 recessions for which data are available. Personal income indicates the same months for just 4 peaks and 2 troughs. Thus, the individual performance measures generally do not agree with the NBER determinations for a majority of recessions.

The average lags and leads for peaks range from a lag of 1.6 months for personal income to a lead of 1.6 months for manufacturing and trade sales. The average lags and leads for troughs range from a lag of 1.2 months for employment to a lead of 0.7 month for manufacturing and trade sales. The average absolute lags or leads at peaks range from 1.1 to 1.9 months for peaks, and 0.4 to 1.2 months for troughs. Thus, the peaks and troughs determined from the individual performance measures show general, but not perfect agreement with the NBER's cyclical timing determinations.

More than just indicating differing peak and trough months, the four monthly performance measures have patterns of movement that also differ considerably with one another in terms of volatility and amplitude. Chart 1 shows the measures for the months in and around the 2001 recession. The lack of agreement supports the NBER's methodology of using multiple measures to determine the performance of the U.S. economy in and around cyclical contractions. The use of fewer monthly performance measures might indicate a revision of the timing of peaks or troughs that is not supported by a broader analysis that uses all four measures.

The monthly performance measures used by NBER are less-than-comprehensive measures of aggregate U.S. economic activity. However, real GDP is such a comprehensive measure. BEA's estimates of real GDP are available only quarterly, so they lack the monthly-frequency timing of the monthly performance measures. Even so, the NBER places "considerable weight" on real GDP in determining whether a recession has occurred and in identifying the approximate dates of peaks and troughs. Conversely, peaks and troughs in real GDP may be identified by using the NBER turning points as starting points and then using a quarterly rule comparable to that used by Davis for annual estimates. This methodology uses the rule that the highest value of real GDP in a quarter near the NBER peak is identified as the peak, and the lowest value of real GDP in a quarter near the NBER trough is identified as the trough. Using this rule, 9 of the 10 recessions have at least two quarters of decline in real GDP; the exception is the recession of 2001.⁴

⁴ With the rule, the highest levels of real GDP near the contractions are also the peak quarters for all 10 recessions, and the lowest levels of real GDP near the contractions are also the trough quarters for 9 recessions.

Gross domestic income (GDI) provides an alternative and equally valid measure of aggregate U.S. economic activity. Published real GDI is calculated by BEA by dividing current-dollar GDI by the GDP price deflator. The same rules that are used for identifying peak and trough real GDP may be used to identify peaks and troughs using real GDI.

Table 2 shows the peak and trough quarters for the 10 recessions as determined by the NBER, and as indicated by real GDP and real GDI using the quarterly rule (the NBER identifies the quarter in which the peak or trough month occurs as the peak or trough quarter). Both GDP and GDI agree with the timing of the NBER peaks in 7 of the 10 recessions, and both miss by one quarter in the 1960-61 and 1969-70 recessions. The timing of the GDP-indicated troughs agrees with the timing of the NBER troughs in 5 recessions, and the GDI-indicated troughs agree in 6 recessions. GDP's trough leads the NBER trough by 3 quarters in the 1981-82 recession, and GDI's trough leads the NBER trough by 2 quarters in the 1953-54 recession.⁵ All other leads and lags are one quarter. GDP and GDI both lead the NBER peak and trough in the 1960-61 contraction. Also, GDP and GDI both lead the NBER peak in the 1969-70 contraction and lead the NBER trough in the 1953-54 contraction. Thus, GDP and GDI both disagree with the NBER timing for just 2 peaks and 3 troughs. The average leads at peaks and troughs for GDP and GDI relative to the NBER peaks and troughs range from 0.1 quarter to 0.7 quarter. As a result, the timing of peaks and troughs indicated by GDP and GDI is in close but not complete agreement with the NBER's timing.⁶

As with the monthly measures, the amplitudes and patterns of the GDP and GDI vary considerably from one another. Chart 2 shows both measures in and around the 2001 recession. Real GDP peaks in the second quarter and troughs in the third quarter. In contrast, real GDI agrees with the NBER's dating and peaks in the first quarter and troughs in the fourth quarter.

As shown in table 2, the quarterly timing of peaks and troughs indicated by real GDP and real GDI are not only sometimes different from those determined by the NBER, those indicated by GDP often disagree with those indicated by GDI. As a result, the durations of 5 of the 10 contractions indicated by GDP are different from those indicated by GDI (table 3). On average, the GDP-indicated contractions last 2.9 quarters, and GDI-indicated contractions last 3.4 quarters. As shown in the third and fourth columns of table 3, the sizes of the contractions are larger for GDI in 6 recessions, and the average contraction as measured by GDI is 0.19 percentage point larger than as measured by GDP. Similarly, the average rate of decline as measured by GDI is 0.20 percentage point larger than that measured by GDP. Thus, contractions indicated by GDI are somewhat longer and deeper than those indicated by GDP.

⁵ The amplitude of the 1981-82 recession is little affected by this timing. GDP in the NBER-determined trough quarter is just 0.2 percent higher than its value three quarters earlier.

⁶ A one-quarter lead or lag does not necessarily indicate disagreement with the NBER peak or trough months. For example, a sharp increase in real GDP in the last month of a quarter, followed by months of only mild decreases in the following quarter could quite possibly result in a peak in the quarter following the peak month.

Table 4 shows the amplitude of the recessions as measured by the percent contractions in real GDP, real GDI, and the four monthly performance measures—from the peaks to troughs as determined by the NBER. The contractions in GDP and GDI are from the NBER-determined peak to trough quarters, and the other contractions are measured from peak to trough months. Because 2 of the monthly performance measures are not available for the first 3 recessions, the last 2 rows show average sizes of contractions for all 10 recessions and for the last 7 recessions, respectively. The average sizes of contractions as measured by GDP, GDI, employment and personal income are roughly 1½ to 2 percent. The sizes measured the other two performance measures are much larger, about 7 percent for industrial production and somewhat more than 5 percent for real manufacturing and trade sales.

The average decrease in real GDI during the 10 NBER-determined contractions is 2.04 percent, 0.34 percentage point larger than the 1.70 percent average decrease in real GDP. This result does not hold when measuring contractions from the GDP-indicated peak quarters to trough quarters (table 2). In that latter case, the average decline in real GDI is 1.99 percent, 0.02 percentage point smaller than the average decline in real GDP of 2.01 percent. A stronger result is obtained when measuring from the GDI-indicated peaks to troughs. In this case, the average decline in real GDI is 2.20 percent, 0.40 percentage point larger than the average decline in real GDP of 1.80 percent. These averages reflect the fact that the decreases in real GDI are larger in 7 of the 10 contractions periods as determined by either NBER or as indicated by GDI, and in 5 contractions as indicated by GDP.

Almost by definition, the differences in the timing and sizes of contractions in real GDI and real GDP show up as differences in the movements of the statistical discrepancy. Larger declines in GDI result in more positive (or less negative) changes in values for the discrepancy from the peak to the trough. Although there are difficulties making comparisons because of the increasing size of the economy over time—after allowing for differences in scale—the recessions of 1948-49, 1973-75, and 2001 lead to large upward (toward plus infinity) movements in the discrepancy.⁷ Thus, there is a strong, but not universal tendency for the discrepancy to become more positive (or less negative) during recessions.⁸ Because there is no particular tendency for the discrepancy to become increasingly positive over multi-cycle periods, these movements must generally be reversed during expansions.

⁷ The sizes of current-dollar GDI and GDP at the beginning of the 2001 recession were more than 36 times their sizes at the beginning of the 1948-49 recession.

⁸ As an experiment, the effects of the differences on the discrepancy were approximated by using the size of the percent contractions in real GDI and GDP for the GDI-determined contractions and multiplying them by the values of current-dollar GDI and GDP in the peak quarters prior to the contractions. The resulting estimates had a correlation with actual movements in the statistical discrepancy during the GDI-determined contractions of 0.999. Other differences, presumably due to price changes, were therefore small.

Conclusions

- Cyclical turning points indicated by the four monthly indicator measures of economic performance featured by NBER often do not agree with one another, and often do not match those determined by NBER.
- All of the monthly and quarterly measures examined indicate that there are 10 postwar recessions, with cyclical turning points only generally similar to those determined by NBER. Thus, the NBER's judgmental methodology appears to be more robust than would any alternative methodology that relies on just one performance measure.
- Quarterly cyclical turning points indicated by real GDP and by real GDI often do not agree with one another, and often do not match those determined by the NBER.
- Real GDI generally, but not always, declines more than real GDP during recessions, and the GDI-indicated contractions typically last half a quarter longer. Mirroring this, the statistical discrepancy tends to increase (or become less negative) during recessions.

References

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Appendix: Data Sources

The NBER website identifies the time series of estimates of the four performance measures principally used in guiding the determination of cyclical peaks and troughs. Although it publishes the historical values of the measures, all four have undergone revisions since their last publication by NBER, and this analysis uses the latest-available estimates. In addition, the 2003 comprehensive NIPA revision resulted in differences in the tabular presentations of personal income. As a result, definitions of some of the measures used in this analysis do not agree precisely with those of the NBER's published estimates. In addition, it is possible that other differences may exist. Spot checks of the differences suggest that they are generally small, and that the revisions are unlikely to have affected the principal observations presented here.

The Federal Reserve Board's seasonally adjusted "total index" (B50001) of industrial production may be found on the Federal Reserve's web site, at <http://www.federalreserve.gov/releases/G17/iphist/iphist.sa>. The Bureau of Labor Statistics' series for seasonally adjusted "total nonfarm" employment (EES00000001), which uses CES payroll survey data, may be found at the BLS web site, at <http://data.bls.gov/PDQ/servlet/SurveyOutputServlet>. BEA's estimates of monthly real manufacturing and trade sales are available in line 1 of tables 2AU and 2BU of the "underlying tables" subsection of the "gross domestic product" tables section of BEA's web site, www.bea.gov. Table 2AU includes monthly estimates for the period 1967-96, and the estimates are in chained 1996 dollars; details are on an SIC basis. Table 2BU includes monthly estimates for the period 1997-2004, and the estimates are in chained 2000 dollars; details are on a NAICS basis. Both tables are titled "Real Manufacturing and Trade Sales, Seasonally Adjusted at Monthly Rate." Although the NBER data set begins in 1959, BEA does not now publish estimates prior to 1967. BEA's estimates of monthly real personal income may be derived by subtracting line 14 of table 2.6 "Personal Income and Its Disposition, Monthly"—personal current transfers receipts—from line 1—personal income, and dividing by the price index for personal consumption expenditures from line 1 of table 2.8.4, "Price Indexes for Personal Consumption Expenditures by Major Type of Product Monthly." The transfers estimates are the gross inflows, and are different from the estimates of "transfer persons to persons" from the previous table 2.8. The new estimates should more accurately reflect business conditions' immediate effects on personal income than did the old estimates. Again, the new estimates are published beginning in 1967. As a result of the unavailability of estimates prior to 1967, the flows of real monthly sales and personal income around the 1960-61 recession are not included in this review.

Quarterly estimates of real GDP may be found in the "gross domestic product" section of BEA's web site, most prominently on line 1 of NIPA table 1.1.6, "Real Gross Domestic Product, Chained Dollars." Real GDI may be found on line 11 of NIPA table 1.7.6, "Relation of Real Gross Domestic Product, Real Gross National Product, and Real Net National Product, Chained Dollars."

Table 1.--Leads (+) and Lags (-) of Monthly Indicator Series Relative to NBER Peaks and Troughs
(Months)

Recession	NBER		Industrial production		Employment		Manufacturing/trade		Personal income	
	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
1	1948:11	1949:10	0	0	2	0	---	---	---	---
2	1953:7	1954:5	0	1	1	-3	---	---	---	---
3	1957:8	1958:4	0	0	1	-1	---	---	---	---
4	1960:4	1961:2	3	0	0	0	3	1	-1	2
5	1969:12	1970:11	2	0	-3	0	2	0	-8	0
6	1973:11	1975:3	0	-2	-1	-1	0	0	0	-1
7	1980:1	1980:7	0	0	-2	0	0	1	0	0
8	1981:7	1982:11	-1	-1	0	0	1	-1	-2	1
9	1990:7	1991:3	1	0	1	-2	-1	2	0	1
10	2001:3	2001:11	6	0	0	-5	6	2	0	1
Number of agreements on leads or lags			5	7	3	5	2	2	4	2
Average lead or lag			1.1	-0.2	-0.1	-1.2	1.6	0.7	-1.6	0.6
Absolute average lead or lag			1.3	0.4	1.1	1.2	1.9	1.0	1.6	0.9

Table 2.--Cyclical Turning Points as Identified by the NBER, Real GDP, and Real GDI

Recession	Cyclical Turning Point Quarters						Leads (+) and Lags Relative to NBER			
	NBER		Real GDP		Real GDI		Peak		Trough	
	Peak	Trough	Peak	Trough	Peak	Trough	GDP	GDI	GDP	GDI
1	1948Q4	1949Q4	1948Q4	1949Q4	1948Q4	1949Q4	0	0	0	0
2	1953Q2	1954Q2	1953Q2	1954Q1	1953Q2	1953Q4	0	0	1	2
3	1957Q3	1958Q2	1957Q3	1958Q1	1957Q3	1958Q1	0	0	1	1
4	1960Q2	1961Q1	1960Q1	1960Q4	1960Q1	1960Q4	1	1	1	1
5	1969Q4	1970Q4	1969Q3	1970Q4	1969Q3	1970Q4	1	1	0	0
6	1973Q4	1975Q1	1973Q4	1975Q1	1973Q4	1975Q1	0	0	0	0
7	1980Q1	1980Q3	1980Q1	1980Q3	1980Q1	1980Q2	0	0	0	1
8	1981Q3	1982Q4	1981Q3	1982Q1	1981Q3	1982Q4	0	0	3	0
9	1990Q3	1991Q1	1990Q3	1991Q1	1990Q2	1991Q1	0	1	0	0
10	2001Q1	2001Q4	2001Q2	2001Q3	2001Q1	2001Q4	-1	0	1	0
Number of agreements on leads or lags							7	7	5	6
Average lead or lag							0.1	0.3	0.7	0.5

Table 3.--Post-WW-II Cyclical Turning Points as Indicated by GDP and GDI

Recession	Duration (quarters)		Percent change, peak to trough		Average rate of decline, a.r.	
	GDP	GDI	GDP	GDI	GDP	GDI
1	4	4	-1.69	-3.26	-1.69	-3.26
2	3	2	-2.65	-2.76	-3.52	-5.44
3	2	2	-3.75	-3.18	-7.36	-6.26
4	3	3	-1.64	-0.95	-2.18	-1.26
5	5	5	-0.64	-1.08	-0.52	-0.86
6	5	5	-3.10	-4.06	-2.49	-3.26
7	2	1	-2.18	-2.22	-4.32	-8.59
8	2	5	-2.87	-2.51	-5.65	-2.01
9	2	3	-1.26	-0.91	-2.51	-1.21
10	1	3	-0.35	-1.10	-1.40	-1.46
Average	2.9	3.4	-2.01	-2.20	-3.16	-3.36

Table 4.--Contractions from NBER Peaks to Troughs in Measures of Economic Activity
(percent)

Recession	Quarterly series		Monthly series			
	GDP	GDI	Industrial production	Employment	Manufacturing-trade sales	Personal income
1	-1.69	-3.26	-8.58	-5.02	---	---
2	-2.56	-2.38	-8.97	-3.04	---	---
3	-3.18	-3.07	-12.73	-3.98	---	---
4	-0.54	-0.52	-6.17	-2.30	-4.72	0.00
5	-0.17	-0.91	-5.84	-1.17	-4.15	0.08
6	-3.10	-4.06	-13.02	-1.82	-12.92	-5.21
7	-2.18	-1.73	-6.55	-1.16	-5.57	-2.57
8	-2.63	-2.51	-8.67	-3.02	-5.90	-0.03
9	-1.26	-0.87	-3.70	-1.26	-4.09	-2.37
10	0.35	-1.10	-3.16	-1.04	-0.19	-1.39
Average:	-1.70	-2.04	-7.74	-2.38	---	---
Average/1/:	-1.36	-1.67	-6.73	-1.68	-5.36	-1.64

1. Recessions 4 through 10.

Chart 1. Measures of Economic Performance, September 2000 = 100

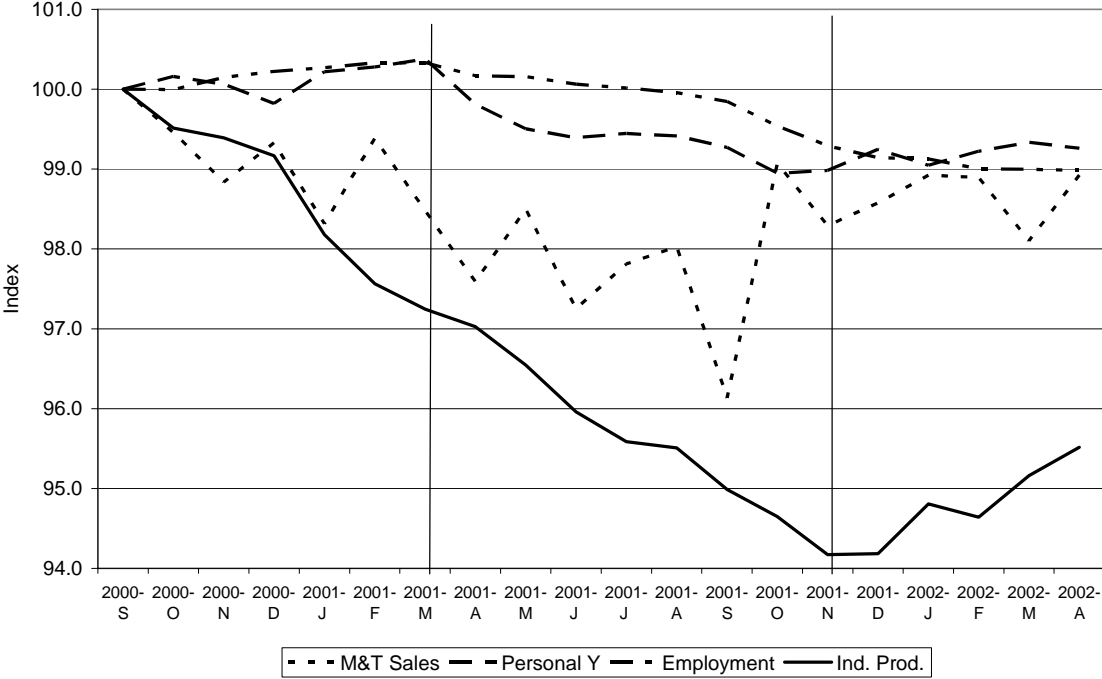


Chart 2. Real GDP and Real GDI; 2000:II = 100

