

Economic Trends

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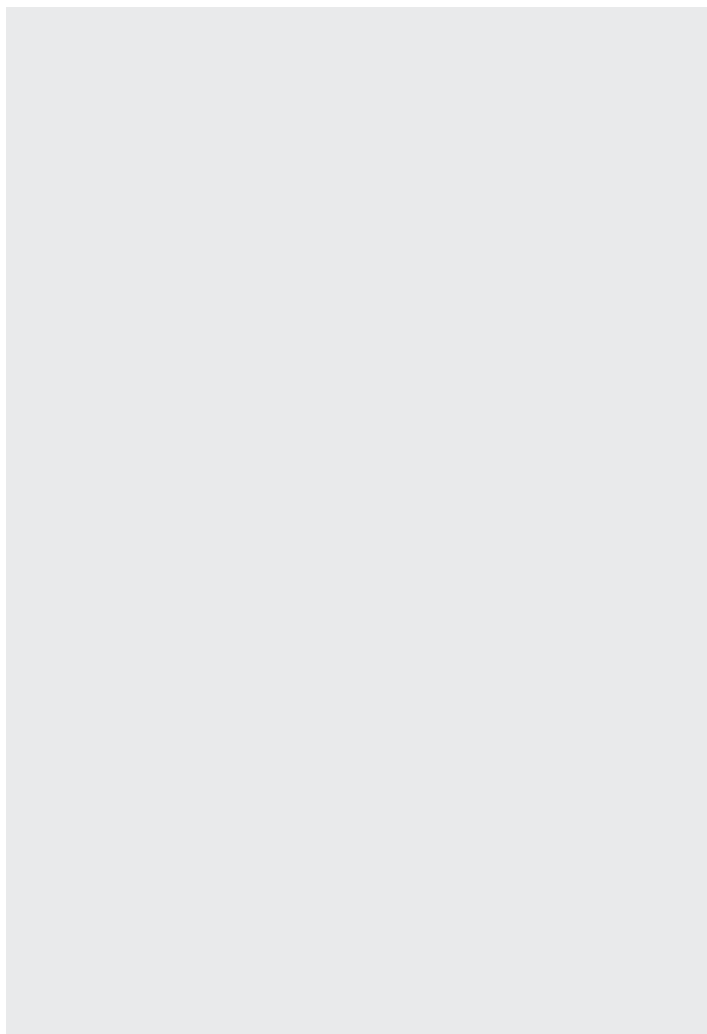
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Does GDI Data Change Our Understanding of the Business Cycle?

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The Bureau of Economic Analysis constructs two different measures of aggregate output: Gross Domestic Product (GDP) and Gross Domestic Income (GDI). As a matter of accounting, the expenditure-side GDP measure should be identical to the income-side GDI measure. In practice, however, it is difficult to measure nearly \$17 trillion worth of value precisely, and this measurement error always leaves a substantial discrepancy between GDP and GDI. Recently, a number of researchers have considered the possibility that GDI may contain useful information about the true level of aggregate output beyond that in GDP alone. For example, a substantial strain of research has called attention to the potential value of combining GDP and GDI to gain a more accurate picture of the state of the economy (see, for example, Nalewaik (2010), Nalewaik (2012) and Aruoba, Diebold, Nalewaik, Schorfheide, and Song (2015)).

In light of the recent interest in GDI, we assess whether using GDI to measure output would change our understanding of key features of the business cycle. In particular, we look at whether GDP and GDI indicate the same business cycles with respect to output and whether the cyclical components of GDP and



GDI move in the same way in relation to the cyclical component of a number of other macroeconomic indicators. We form our assessment by revisiting the canonical exercise of Stock and Watson (1999) in which they document business cycle regularities, but in addition to GDP, we also redo the calculations using GDI as the measure of output.

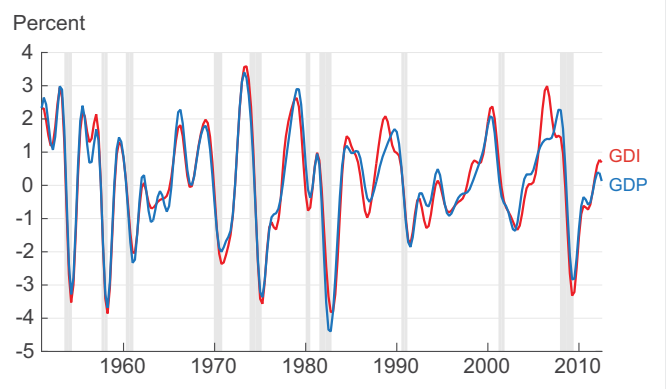
Of course, the long-run trend of both real GDP and real GDI is upwards, but since our interest is in movements corresponding to business cycles, we first strip the trend out of the data. We follow the same method as Stock and Watson (1999) and use the band-pass filter of Baxter and King (1994). We filter each series independently to extract the business cycle component of each, which we define as fluctuations in the series lasting between six quarters and eight years.

To see how the cyclical components line up across GDP and GDI, we plot the two detrended series from 1951 to 2012 and compare. We find that over this period, cyclical fluctuations in both measures have been broadly in line with one another, with two notable exceptions: Before two of the last three recessions, the cyclical component of GDI peaked substantially earlier than did the cyclical component of GDP. Prior to the early 1990s recession, cyclical GDI peaked in 1988:Q4 compared to 1989:Q4 for cyclical GDP, whereas before the Great Recession, cyclical GDI peaked in 2006:Q3 versus 2007:Q4 for cyclical GDP. These results suggest that GDI may hold particular value for detecting business cycle turning points, which supports the findings in Nalewaik (2012).

To compare how various macroeconomic indicators move in relation to the cyclical components of GDP and GDI, we repeat the cross-correlation exercise of Stock and Watson (1999). We use the same filter as before to extract the cyclical component of measures of aggregate consumption and investment, unemployment, prices, and interest rates, as well as leading indicators of economic activity.

In the table below, we report the correlation between the cyclical component of each of these series and lags and leads of the cyclical components of real GDP and real GDI. For example, the large positive correlation between the cyclical components of CPI inflation

Cyclical Component of GDP and GDI, 1951-2012



Note: Shaded bars indicate recessions.

Sources: Authors' calculations using data from the Bureau of Economic Analysis.

and current and lagged GDP and GDI indicate that economic expansions in the current and preceding quarters are associated with contemporaneous increases in the cyclical component of inflation, and contractions are associated with decreases. Correlations taken across the period 1953-1996 are very close to those taken across 1953 to the present, and so we follow Stock and Watson (1999) and report results only for the former period. Most importantly for our purposes, the correlations are relatively unaffected by which measure of aggregate output is used.

Cross Correlations with GDP and GDI, 1953-1996 (GDP in bold; GDI in italics)

	Number of Lags or Leads												
	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
GDP	-0.27	-0.16	0.04	0.33	0.66	0.91	1	0.91	0.66	0.33	0.04	-0.16	-0.27
GDI	<i>-0.27</i>	<i>-0.14</i>	<i>0.07</i>	<i>0.35</i>	<i>0.66</i>	<i>0.89</i>	<i>0.97</i>	<i>0.88</i>	<i>0.64</i>	<i>0.32</i>	<i>0.03</i>	<i>-0.18</i>	<i>-0.28</i>
Consumption	<i>-0.31</i>	<i>-0.17</i>	<i>0.05</i>	<i>0.35</i>	<i>0.67</i>	<i>0.91</i>	<i>1.00</i>	<i>0.91</i>	<i>0.67</i>	<i>0.35</i>	<i>0.05</i>	<i>-0.17</i>	<i>-0.31</i>
Consumption (nondurables + services)	-0.29	-0.17	0.01	0.24	0.50	0.73	0.86	0.87	0.74	0.53	0.28	0.05	-0.12
Consumption (durables)	<i>-0.38</i>	<i>-0.28</i>	<i>-0.09</i>	<i>0.17</i>	<i>0.47</i>	<i>0.72</i>	<i>0.87</i>	<i>0.88</i>	<i>0.76</i>	<i>0.55</i>	<i>0.32</i>	<i>0.12</i>	<i>-0.03</i>
Investment (total fixed)	-0.44	-0.36	-0.19	0.09	0.41	0.69	0.85	0.86	0.73	0.53	0.32	0.16	0.04
Unemployment rate	<i>-0.44</i>	<i>-0.37</i>	<i>-0.19</i>	<i>0.08</i>	<i>0.39</i>	<i>0.67</i>	<i>0.83</i>	<i>0.85</i>	<i>0.74</i>	<i>0.55</i>	<i>0.36</i>	<i>0.19</i>	<i>0.06</i>
CPI index	-0.32	-0.17	0.06	0.34	0.62	0.83	0.90	0.84	0.66	0.41	0.18	-0.01	-0.14
CPI inflation	<i>-0.34</i>	<i>-0.18</i>	<i>0.05</i>	<i>0.33</i>	<i>0.60</i>	<i>0.81</i>	<i>0.88</i>	<i>0.83</i>	<i>0.66</i>	<i>0.43</i>	<i>0.20</i>	<i>0.00</i>	<i>-0.14</i>
Federal funds rate	0.14	-0.03	-0.27	-0.56	-0.80	-0.93	-0.89	-0.69	-0.39	-0.07	0.17	0.31	0.35
Consumer expectations	<i>0.17</i>	<i>-0.01</i>	<i>-0.26</i>	<i>-0.54</i>	<i>-0.80</i>	<i>-0.94</i>	<i>-0.91</i>	<i>-0.72</i>	<i>-0.42</i>	<i>-0.11</i>	<i>0.14</i>	<i>0.30</i>	<i>0.38</i>
Building permits	0.33	0.24	0.11	-0.04	-0.21	-0.38	-0.52	-0.64	-0.70	-0.69	-0.61	-0.50	-0.36
Vendor performance	<i>0.34</i>	<i>0.24</i>	<i>0.11</i>	<i>-0.05</i>	<i>-0.22</i>	<i>-0.39</i>	<i>-0.52</i>	<i>-0.64</i>	<i>-0.69</i>	<i>-0.68</i>	<i>-0.61</i>	<i>-0.50</i>	<i>-0.36</i>
Unfilled orders	0.34	0.46	0.58	0.64	0.63	0.53	0.35	0.14	-0.07	-0.26	-0.40	-0.48	-0.51
New orders	<i>0.36</i>	<i>0.49</i>	<i>0.59</i>	<i>0.64</i>	<i>0.62</i>	<i>0.51</i>	<i>0.34</i>	<i>0.15</i>	<i>-0.06</i>	<i>-0.25</i>	<i>-0.39</i>	<i>-0.48</i>	<i>-0.52</i>
	0.28	0.40	0.52	0.61	0.63	0.55	0.37	0.11	-0.18	-0.43	-0.62	-0.72	-0.72
	<i>0.26</i>	<i>0.39</i>	<i>0.51</i>	<i>0.61</i>	<i>0.65</i>	<i>0.58</i>	<i>0.41</i>	<i>0.16</i>	<i>-0.13</i>	<i>-0.39</i>	<i>-0.59</i>	<i>-0.71</i>	<i>-0.74</i>
	-0.63	-0.67	-0.63	-0.51	-0.30	-0.04	0.22	0.42	0.53	0.53	0.46	0.34	0.23
	<i>-0.65</i>	<i>-0.69</i>	<i>-0.64</i>	<i>-0.50</i>	<i>-0.28</i>	<i>-0.02</i>	<i>0.23</i>	<i>0.44</i>	<i>0.56</i>	<i>0.58</i>	<i>0.52</i>	<i>0.40</i>	<i>0.26</i>
	-0.49	-0.51	-0.48	-0.37	-0.17	0.10	0.38	0.62	0.75	0.76	0.66	0.51	0.35
	<i>-0.47</i>	<i>-0.49</i>	<i>-0.47</i>	<i>-0.37</i>	<i>-0.18</i>	<i>0.07</i>	<i>0.33</i>	<i>0.57</i>	<i>0.71</i>	<i>0.74</i>	<i>0.67</i>	<i>0.55</i>	<i>0.39</i>
	-0.40	-0.40	-0.32	-0.15	0.09	0.33	0.52	0.60	0.56	0.41	0.22	0.03	-0.11
	<i>-0.41</i>	<i>-0.42</i>	<i>-0.33</i>	<i>-0.15</i>	<i>0.09</i>	<i>0.35</i>	<i>0.54</i>	<i>0.63</i>	<i>0.58</i>	<i>0.44</i>	<i>0.24</i>	<i>0.06</i>	<i>-0.09</i>
	0.48	0.61	0.71	0.74	0.71	0.61	0.45	0.25	0.04	-0.16	-0.32	-0.43	-0.48
	<i>0.50</i>	<i>0.63</i>	<i>0.72</i>	<i>0.76</i>	<i>0.72</i>	<i>0.61</i>	<i>0.44</i>	<i>0.23</i>	<i>0.01</i>	<i>-0.19</i>	<i>-0.35</i>	<i>-0.46</i>	<i>-0.51</i>
	-0.02	0.18	0.40	0.61	0.78	0.86	0.84	0.70	0.48	0.23	-0.01	-0.20	-0.34
	<i>-0.02</i>	<i>0.19</i>	<i>0.41</i>	<i>0.63</i>	<i>0.80</i>	<i>0.88</i>	<i>0.86</i>	<i>0.72</i>	<i>0.49</i>	<i>0.23</i>	<i>-0.02</i>	<i>-0.23</i>	<i>-0.38</i>

Source: Authors' calculations using data from the Bureau of Economic Analysis, Bureau of Labor Statistics, the Board of Governors of the Federal Reserve System, the Conference Board, and the Institute for Supply Management.

By revisiting the exercise of Stock and Watson (1999) we can see that whether we examine GDP or GDI makes little systematic difference to our understanding of how various indicators comove over the business cycle. However, the “GDI business cycle” has notably turned downwards earlier than GDP in two out of the three most recent official recessions, suggesting that further research exploiting the information content of GDI is warranted.

References

Aruoba, S. Boragan, Francis X. Diebold, Jeremy J. Nalewaik, Frank Schorfheide, and Dongho Song, 2015. “Improving GDP Measurement: A Measurement-Error Perspective,” *Journal of Econometrics*, forthcoming.

Baxter, Marianne, and Robert G. King, 1999. “Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series,” *The Review of Economics and Statistics*, 81:4, 575-593.

Stock, James H., and Mark W. Watson, 1999. “Business Cycle Fluctuations in US Macroeconomic Time Series,” in *Handbook of Macroeconomics*, Volume 1, edited by J.B. Taylor and M. Woodford. Elsevier Science B.V.

Nalewaik, Jeremy J., 2012. “Estimating Probabilities of Recession in Real Time using GDP and GDI,” *Journal of Money, Credit and Banking*, 44:1, 235-253.

Nalewaik, Jeremy J., 2010. “The Income- and Expenditure-Side Estimates of U.S. Output Growth,” *Brookings Papers on Economic Activity*, 1: 71–127.



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