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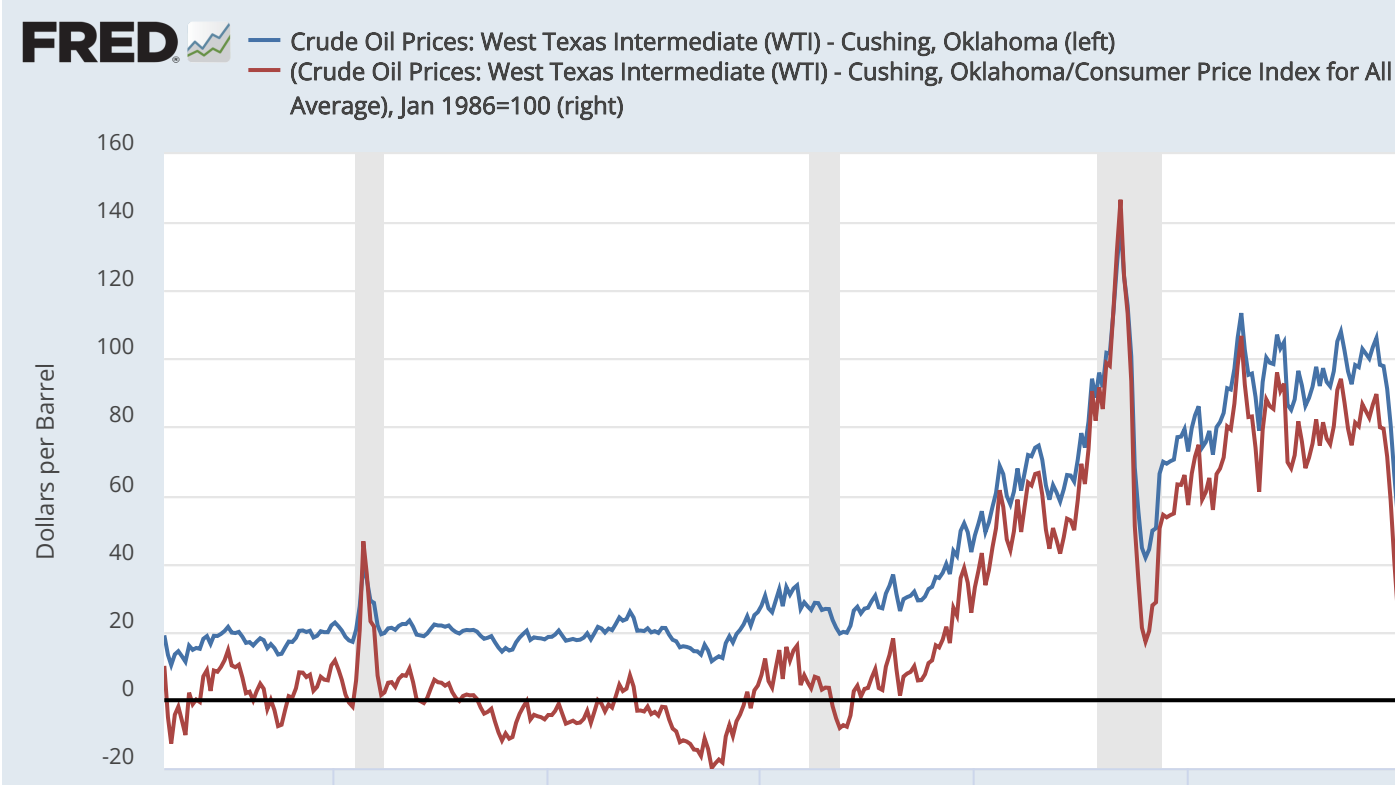
The FRED® Blog

FRED gets real, unless you want to keep it nominal

Oil prices vs. oil prices deflated by the CPI

Posted on November 3, 2022



Let's start with nominal. Economic variables are often quoted in *nominal* terms—that is, terms that are not adjusted for changes in prices over time. For example, it's easy to find nominal oil prices in FRED.

In the FRED graph above, the blue line (left scale) depicts the end-of-month prices for West Texas Intermediate crude, an important oil market. This series is not adjusted for changes in the general price level. So, if one wants to know how much consumption of other goods one has to give up to buy a barrel of oil, then one needs to "deflate" the price of that barrel of oil by a price level that corresponds to a relevant basket of goods.

Now let's get real. Fortunately, FRED allows us to construct and graph the *real* price of oil by deflating the nominal price by just such a price level. The red line (right scale) in the graph shows a real oil price series, after dividing the nominal price series by the consumer price index (CPI). The series is also normalized to equal 100 in January 1986, making it easy to calculate percentage changes from that date.

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Comparing nominal and real prices. Placing the blue nominal price series next to the red real price series in the same graph provides a new perspective on recent oil price movements. Nominal oil prices rose to near-record levels in the first half of 2022, surpassed only by prices in 2008. This rise was associated with the Russian invasion of Ukraine: The green vertical line denotes March 2022, the first full month of the invasion. But deflating the nominal price by the CPI shows that real oil prices in early 2022 were not as high as the nominal series might suggest. In March and April 2022, real prices were 130% higher than in January 1986 but lower than they were for most of the 2010-2015 period.

Of course, the CPI isn't the only price level or even necessarily the best price level to use as a deflator. For example, one could deflate by the personal consumption expenditures price index (PCE), which is the Fed's favored inflation measure. Because PCE inflation tends to be lower than CPI inflation, using PCE inflation would produce a real oil price series that does not deviate quite as far from the nominal series as our graph above shows.

How this graph was created: This graph employs three features of FRED that will help you illustrate features of the data more effectively: formulas, 2-scale graphs, and marking of dates with vertical lines.

1. Open **FRED** and type "oil prices" in the search window. Select "Crude oil Price: West Texas Intermediate," which will likely be the second choice in the search results.
2. Select "Edit Graph," change the frequency from daily to monthly, and select "End of period" as the aggregation method.
3. From the same "Edit Graph" panel, select "Add Line" and search for "oil prices" in the search window and select "Crude oil Price: West Texas Intermediate." Click "Add data series." Again, change the frequency from daily to monthly and select "End of period" as the aggregation method.
4. Select "Edit lines" and choose "Edit line 2": Go down to the "Customize data:" section and type "cpi" in the search box. Select "Consumer Price Index for all urban consumers: All items in the US city average" and click the "Add" button to the right.
5. Within the "Formula" box under "Customize data," type "a/b" to create a real oil price series (that is, monthly oil prices deflated by the CPI price level). Click "Apply" to the right of the formula box. Select "Index (Scale value to 100 for chosen date") under the "Units" window.
6. Select the "Format" tab at the top of the editing box and select "Right" under "Y axis position" for "Line 2."
7. One can also mark chosen dates with vertical lines by selecting "Add line" in the "Edit Graph" panel: Click "Create user-defined line? [+]" and then "Create line." For example, one can mark the approximate date of

- August 2021
- July 2021
- June 2021
- May 2021
- April 2021
- March 2021
- February 2021
- January 2021
- December 2020
- November 2020
- October 2020
- September 2020
- August 2020
- July 2020
- June 2020
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- September 2018
- August 2018
- July 2018
- June 2018

the early weeks of the Russian invasion of Ukraine —an important event in oil markets —by defining both the start and ending dates as “2022-03-01” and the “values start/end” as “0” to “140.”

8. Close the editing box. On the main graph page, select “Max” as the date range.

Suggested by Christopher Neely.