Researchers Finally Replicated Reinhart-Rogoff, And There Are Serious Problems

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In 2010, economists Carmen Reinhart and Kenneth Rogoff released a paper, "Growth in a Time of Debt." Their "main result is that ... median growth rates for countries with public debt over 90 percent of GDP are roughly one percent lower than otherwise; average (mean) growth rates are several percent lower." Countries with debt-to-GDP ratios above 90% have a slightly negative average growth rate, in fact.

This has been one of the most cited stats in the public debate during the Great Recession. Paul Ryan's Path to Prosperity budget states their study "found conclusive empirical evidence that [debt] exceeding 90 percent of the economy has a significant negative effect on economic growth." The *Washington Post* editorial board takes it as an economic consensus view, stating that "debt-to-GDP could keep rising -- and stick dangerously near the 90 percent mark that economists regard as a threat to sustainable economic growth."

Is it conclusive? One response has been to argue that the causation is backwards, or that slower growth leads to higher debt-to-GDP ratios. Josh Bivens and John Irons made this case at the Economic Policy Institute. But this assumes that the data is correct. From the beginning there have been complaints that Reinhart and Rogoff weren't releasing the data for their results (e.g., Dean Baker). I knew of several people trying to replicate the results who were bumping into walls left and right - it couldn't be done.

In a new paper, "Does High Public Debt Consistently Stifle Economic Growth? A Critique of Reinhart and Rogoff." Thomas Herndon, Michael Ash, and Robert Pollin of the University of Massachusetts, Amherst successfully replicate the results. After trying to replicate the Reinhart-Rogoff results and failing, they reached out to Reinhart and Rogoff and they were willing to share their data spreadhseet. This allowed Herndon et al. to see how how Reinhart and Rogoff's data was constructed.

They find that three main issues stand out. First, Reinhart and Rogoff selectively exclude years of high debt and average growth. Second, they use a debatable method to weight the countries. Third, there also appears to be a coding error that excludes high-debt and average-growth countries. All three bias in favor of their result, and without them you don't get their controversial result. Let's investigate further:

Selective Exclusions. Reinhart-Rogoff use 1946-2009 as their period, with the main difference among countries being their starting year. In their data set, there are 110 years of data available for countries that have a debt/GDP over 90%, but they only use 96 of those years. The paper didn't disclose which years they excluded or why.

Herndon-Ash-Pollin find that they exclude Australia (1946-1950), New Zealand (1946-1949), and Canada (1946-1950). This has consequences, as these countries have high-debt **and** solid growth. Canada had debt-to-GDP over 90% during this period and 3% growth. New Zealand had a debt/GDP over 90% from 1946-1951. If you use the average growth rate across all those years it is 2.58%. If you only use the last year, as Reinhart-Rogoff does, it has a growth rate of -7.6%. That's a big difference, especially considering how they weigh the countries.

Unconventional Weighting. Reinhart-Rogoff divides country years into debt-to-GDP buckets. They then take the average real growth for each country within the buckets. So the growth rate of the 19 years that the U.K. is above 90% debt-to-GDP are averaged into one number. These country numbers are then averaged, **equally by country**, to calculate the average real GDP growth weight.

In case that didn't make sense, let's look at an example. The U.K. has 19 years (1946-1964) above 90% debt-to-GDP with an average 2.4% growth rate. New Zealand has one year in their sample above 90% debt-to-GDP with a growth rate of -7.6. These two numbers, 2.4 and -7.6%, are given equal weight in the final calculation, as they average the countries equally. Even though there are 19 times as many data points for the U.K.

Now maybe you don't want to give equal weighting to years (technical aside: Herndon-Ash-Pollin bring up serial correlation as a possibility). Perhaps you want to take episodes. But this weighting significantly reduces the average; if you weight by the number of years you find a higher growth rate above 90%. Reinhart-Rogoff don't discuss this methodology, either the fact that they are weighing this way or the justification for it, in their paper.

Coding Error. As Herndon-Ash-Pollin puts it: "A coding error in the RR working spreadsheet entirely excludes five countries, Australia, Austria, Belgium, Canada, and Denmark, from the analysis. [Reinhart-Rogoff] averaged cells in lines 30 to 44 instead of lines 30 to 49 ... This spreadsheet error ... is responsible for a -0.3 percentage-point error in RR's published average real GDP growth in the highest public debt/GDP category." Belgium, in particular, has 26 years with debt-to-GDP above 90%, with an average growth rate of 2.6% (though this is only counted as one total point due to the weighting above).

Being a bit of a doubting Thomas on this coding error, I wouldn't believe unless I touched the digital Excel wound myself. One of the authors was able to show me that, and here it is. You can see the Excel blue-box for formulas missing some data:

This error is needed to get the results they published, and it would go a long way to explaining why it has been impossible for others to replicate these results. If this error turns out to be an actual mistake Reinhart-Rogoff made, well, all I can hope is that future historians note that one of the core empirical points providing the intellectual foundation for the global move to austerity in the early 2010s was based on someone accidentally not updating a row formula in Excel.

So what do Herndon-Ash-Pollin conclude? They find "the average real GDP growth rate for countries carrying a public debt-to-GDP ratio of over 90 percent is actually 2.2 percent, not -0.1 percent as [Reinhart-Rogoff claim]." (Update: To clarify, they find 2.2% if they include all the years, weigh by number of years, and avoid the Excel error.) Going further into the data, they are unable to find a breakpoint where growth falls quickly and significantly.

This is also good evidence for why you should release your data online, so it can be properly vetted. But beyond that, looking through the data and how much it can collapse because of this or that assumption, it becomes quite clear that there's no magic number out there. The debt needs to be thought of as a response to the contingent circumstances we find ourselves in, with mass unemployment, a Federal Reserve desperately trying to gain traction at the zero lower bound, and a gap between what we could be producing and what we are. The past guides us, but so far it has failed to provide evidence of an emergency threshold. In fact, it tells us that a larger deficit right now would help us greatly.

Update: People are responding to the Excel error, and that is important to document. But from a data point of view, the exclusion of the Post-World War II data is particularly troublesome, as that is driving the negative results. This needs to be explained, as does the weighting, which compresses the long periods of average growth and high debt.

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