

The B.E. Journal of Macroeconomics

Special Issue: Long-Term Effects of the Great Recession

Volume 12, Issue 3

2012

Article 3

First Discussant Comment on “The Statistical Behavior of GDP after Financial Crises and Severe Recessions”

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DOI: 10.1515/1935-1690.102

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1. Introduction

Papell and Prodan's (hereafter PP) paper asks two important questions. First, do severe recessions associated with financial crises, such as the recent "Great Recession" experienced in the United States, cause permanent reductions in the level of potential real GDP? Second, if there are no permanent reductions in real GDP, does the recovery take longer for recessions associated with financial crises than for those that are not?

These questions are not easy to answer, as both are fraught with econometric complexities that have long challenged empirical macroeconomists. Answering the first question requires evaluating whether or not shocks to real GDP have permanent effects, which is also the objective of an existing literature that is, after some 30 years of activity, unsettled.¹ As one example of the difficulty of the econometric problem, note that in order to demonstrate that recessions have only transitory effects, PP must document predictable reversals in real GDP growth following the end of recessions. However, such reversals can occur with varying lags and robustness, presenting a challenge for any reasonably parameterized model of dynamics. The second question is also difficult, as it requires identification of when real GDP has "recovered." A natural definition of full recovery, which PP use, is a return to a level of potential real GDP that would have occurred if the recession hadn't happened. However, this requires one to identify this counterfactual level of trend, a difficult task to say the least.

In their paper, PP develop a novel modeling strategy to shed light on both questions they pose. Specifically, they model real GDP as a univariate time-series process with a particular pattern of two structural breaks in its deterministic trend. These two structural breaks identify the beginning and end of a "slump," which is the time from the beginning of a recession carrying through the early stages of an expansion, and ending when the economy returns to a "normal" expansion. The model provides a formal definition of trend versus cycle, and restrictions placed on model parameters can be tested to answer the key question of whether slumps permanently reduce the level (or even the growth rate) of real GDP. Also, the structural break dates are identified from the data to provide estimates of the beginning and end, and therefore length, of slumps.

PP apply their model to analyze the Great Depression in the United States, as well as all postwar U.S. recessions prior to the Great Recession. They also analyze

¹ Early examples include Nelson and Plosser (1982) and Campbell and Mankiw (1987), who investigate this question using linear autoregressive moving-average models. Perron (1989) and a substantial ensuing literature investigate the evidence for permanent shocks beyond a small number of structural changes in the trend function of real GDP. Others, for example Beaudry and Koop (1993) and Kim and Murray (2005), zero in specifically on the long-run effects of shocks that lead to recessions, although using different methods than those employed by PP.

slumps associated with a number of financial crises in both advanced and emerging market economies. They conclude that for the cases that appear most relevant to the recent U.S. Great Recession, in terms of magnitude and duration of the slump, there is little evidence that slumps have permanent effects on potential real GDP. Also, the median length of these slumps is nine years. Using these results to project the eventual outcome of the U.S. Great Recession, they conclude that output will fully recover to a level that would have occurred in the absence of the recession. However, this recovery will take until the end of 2016 to complete.

In my comments, I begin with a summary and critique of the modeling strategy used by PP to identify and measure slumps. I then revisit the question of whether the recent Great Recession is likely to have permanent effects, reaching a somewhat less sanguine conclusion than PP.

2. Identifying and Measuring Slumps

2.1 Summary of PP's Approach

The empirical model used by PP to identify and measure slumps is as follows:

$$y_t = \mu + \beta t + \gamma_1 DU_{1t} + \theta_1 DT_{1t} + \theta_2 DT_{2t} + \sum_{i=1}^k \rho_i y_{t-i} + u_t, \quad (1)$$

where y_t is the log of the level of real GDP at time t , $DU_{1t} = 1$ if $t > Tb_1$ and 0 otherwise, $DT_{1t} = t - Tb_1$ if $t > Tb_1$ and 0 otherwise, and $DT_{2t} = t - Tb_2$ if $t > Tb_2$ and 0 otherwise. In PP's model, log real GDP follows a broken-trend stationary process, so that fluctuations in y_t caused by the disturbance term, u_t , are purely transitory. The deterministic trend function undergoes two structural breaks, which are meant to capture slumps. At the first break, occurring at date Tb_1 , the level of the trend function falls by $\gamma_1 < 0$, and the slope of the trend function changes by the amount θ_1 . At the second break, occurring at date Tb_2 , the slope of the trend function changes again, by the amount θ_2 . A "slump" is defined as the period of time between the first and second break. This implicitly defines the second break date as marking a return to a "normal" trend growth rate.

To assess the long-run effects of slumps, PP focus on testing two parameter restrictions on equation (1). The first ensures that the deterministic trend growth rate of real GDP is the same both before and after the slump, which is equivalent to the restriction $\theta_2 = -\theta_1$. The second restriction further ensures that the slump has no long-run effect on the level of trend real GDP, which is parameterized as the constraint:

$$\theta_1(Tb_2 - Tb_1) = -\gamma_1. \quad (2)$$

In words, this restriction ensures that the reduction in the level of potential real GDP occurring at date Tb_1 is offset by faster growth of the series between Tb_1 and Tb_2 . Thus, with this restriction imposed, the slump defined by PP is equivalent to a period of recession plus an ensuing recovery phase.

PP work with three versions of the model, a “more-restricted model,” which enforces both restrictions above, a “less-restricted model,” which enforces only the first restriction, and an unrestricted model. For the less-restricted model there are permanent effects of slumps that occur in the form of a level shift of the trend function. For the unrestricted model there are additional permanent effects in the form of changed trend growth following the end of the slump. It is worth emphasizing that the structural breaks are the only source of potential permanent variation in real GDP in this model.

To identify slumps PP statistically test for the presence of breaks in their model, or the null hypothesis that $\gamma_1 = \theta_1 = \theta_2 = 0$. The length of slumps is in turn identified by the estimates of Tb_1 and Tb_2 . In cases where they are interested in testing for multiple slumps in the same country, PP repeatedly apply the test for breaks on split samples, as in the well-known procedure of Bai and Perron (1998).

2.2 Comparing the PP Model to Other Models of the Long-Run Effects of Recessions

A number of existing studies have estimated time-series models designed to investigate the long-run effects of recessions. Most of these models generate three phases of business cycle dynamics, as does the model of PP. Particularly relevant examples include Sichel (1994) and Boldin (1996), who propose a Markov-switching model of U.S. recessions in which the mean growth rate of real GDP cycles between three regimes, corresponding to normal growth, recession, and recovery. The pattern of recession generated by this model is very similar to the more restricted model of PP. Beaudry and Koop (1993) and Kim, Morley and Piger (2005) propose an alternative three-phase model in which the strength of the recovery phase is explicitly tied to the depth of the preceding recession. Such models imply that growth in the recovery phase will be strongest in the early stages of the recovery phase.

The PP strategy for modeling slumps differs from these previous studies in several ways. Most importantly, when investigating multiple slumps for a single country, PP do so sequentially, thus estimating a unique set of parameters for each slump. Among other things, this approach allows the mean growth rate of the recovery phase to be different across recessions. The previous literature has instead estimated one set of parameters describing business cycle phases for all recessions. The U.S. recession record, in which the robustness of recoveries has differed markedly, suggests that this added flexibility is likely important. Also, the PP model allows for a richer set of possibilities for the postrecession path of

real GDP than do the models employed in earlier studies. For example, rather than having a recovery phase following recessions, the less-restricted and unrestricted models allow for growth to potentially be *lower* than normal following recessions.

2.3 Testing for Slumps

Not surprisingly, the increased flexibility of the PP model comes at the cost of additional parameters. Even their more-restricted model of slumps relies on three new parameters for each slump analyzed.² This raises concerns about the power of the procedure when statistically testing the null hypothesis of “no slump,” a concern highlighted by the failure to reject this null hypothesis at the 10 percent level for seven of nine postwar U.S. recessions (see table 2 of PP). As such, PP’s model and estimation is probably best thought of as an algorithm to identify the dates of slumps *conditional* on the existence of slumps, as a reliance on statistical significance to identify slumps would lead to many known slumps being missed. Although they do not explicitly acknowledge this, PP largely use their model in this way, as they analyze characteristics of a number of slumps that are not statistically significant.

2.4 Missing Slumps

A primary question asked by the authors is whether slumps associated with financial crises last longer than other slumps. In answering this question, I believe the authors have missed many slumps that should be part of the nonfinancial crises comparison group. PP explicitly look at nonfinancial crises slumps for the postwar United States. Beyond that, nonfinancial crises slumps are largely found by accident, as a byproduct of searching for slumps associated with financial crises in advanced economies (see table 4a of PP.) This leads to only seven nonfinancial crises slumps outside the United States being investigated, one each for Australia, Canada, France, Germany, Italy, New Zealand, and the United Kingdom. Two additional financial crises slumps are identified for these countries, one each in Australia and the United Kingdom. By comparison, the Economic Cycle Research Institute (ECRI) dates 38 recession episodes for these seven countries.³

As an example of missing slumps, consider Canada, for which the authors only identify one slump, occurring in 1953–1954. As figure 1 shows, a Markov-switching model of recessions additionally identifies relatively severe recession in both the early 1980s and early 1990s, consistent with ECRI dating. In sum, PP’s conclusions regarding differences between slumps that are and aren’t associated with financial crises would be more forceful if additional nonfinancial crises slumps were considered.

² There are five parameters describing each slump, but two are eliminated by the restrictions imposed by the more-restricted model.

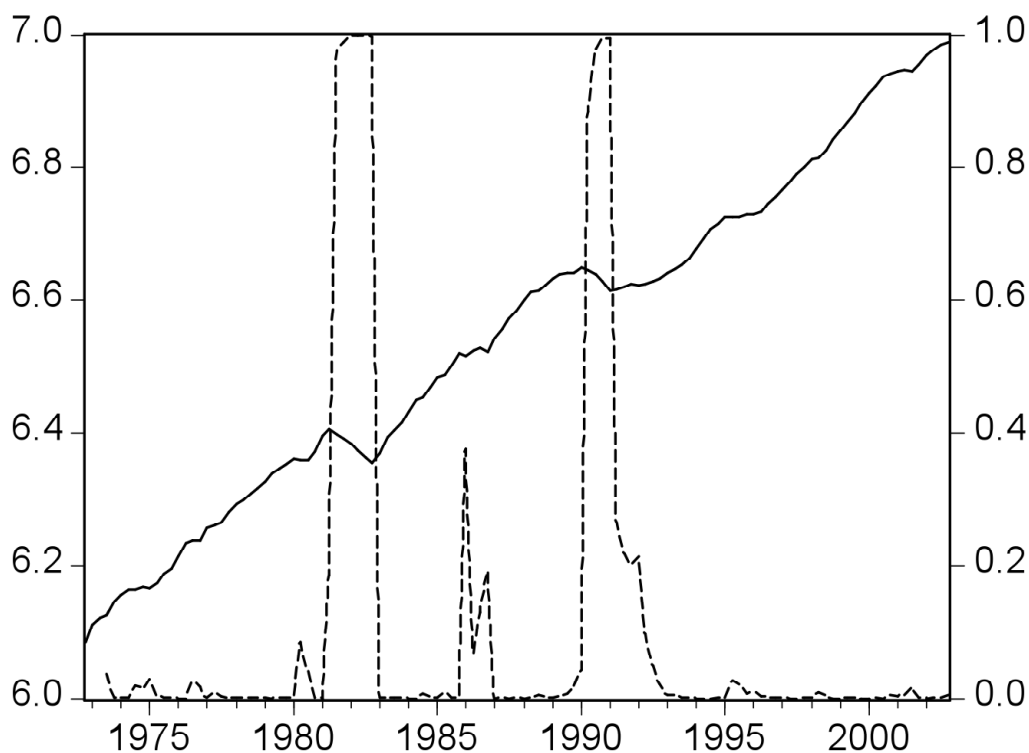
³ <http://www.businesscycle.com/download/report/2441>.

2.5 Weak Identification of the Length of Slumps

Estimates of the beginning and end of slumps are crucial to this paper's goals, as they are necessary to answer the question of whether slumps associated with financial crises are lengthier than those that are not. Thus, it is of particular importance to have a sense of how well these lengths are identified empirically. Here I will focus on the end of slumps, which occur at the date Tb_2 . This date is identified in the data as the date of a change in the slope function of the deterministic trend. For the more-restricted model, this slope change represents the shift from the higher-growth recovery phase to a more mature, normal, expansion phase. In the case of strong recoveries, such as in a so-called V-shaped recession, this change in slope is likely well identified. However, for more gradual recoveries, the shift out of the recovery phase will be difficult to pin down. Such cases are empirically relevant for several of the slump episodes analyzed in this paper, with a good example provided by the 1990–1998 Australian slump (see figure 3 of PP).

It is true that with the more-restricted version of the PP model, identification of the change in slope is aided by the fact that this change is restricted to occur when the series hits the deterministic trend line extrapolated from before the recession began. However, this may be of less help than at first appears in many cases, as PP identify the preslump growth rate separately for each slump. In cases where they repeatedly split the sample to identify multiple slumps, this can lead to the preslump growth rate being identified on very short samples, enhancing the identification problem. In sum, it is probable that the estimated length of slumps established for many of the episodes in this paper have considerable uncertainty associated with them.

Figure 1
Real GDP in Canada and the Probability of Recession



Reproduced from figure 6 of Kim, Morley, and Piger (2005).

Note: This figure shows the log level of real GDP in Canada (left scale) and the probability of recession obtained from the Markov-switching “bounceback” model of real GDP dynamics proposed in equation (1) of Kim, Morley and Piger (2005).

3. The Long-Run Effects of Recessions

For most of the slumps they consider relevant to the U.S. Great Recession, PP cannot reject the null hypothesis of the more-restricted model in favor of the less-restricted model, meaning they cannot reject the null hypothesis that these slumps had only transitory effects on real GDP. Based on this they conclude that the historical evidence is consistent with a prediction that U.S. real GDP will fully recover from the Great Recession. In this section I will revisit this question, with generally less optimistic conclusions.

3.1 Existing Evidence on the Long-Run Effects of Recessions

A substantial existing literature has investigated the long-run effects of recessionary episodes in both the United States and abroad, with some of this literature focusing on recessions associated with financial crises. Studies of the U.S. recession record have generally found, consistent with the evidence documented by PP, that postwar recessions have had only small permanent effects on the level of real GDP.⁴ However, studies focused on financial crises have found larger permanent effects. Perhaps the most comprehensive previous study on this topic was provided by Cerra and Saxena (2008), who document the long-run effects of various types of events, including financial crises, on the level of output in 190 countries. Their results suggest that financial crises have large and permanent effects on real GDP, and this remains true when attention is restricted to a relatively wealthy set of industrialized countries. Further, Kim, Morley, and Piger (2005) document large and permanent GDP effects of recessions in the United Kingdom, where the timing of these recessions match dates of UK financial crises identified by Reinhart and Rogoff (2009). While the results of PP are compelling, this existing literature provides conflicting evidence regarding the likely long-run effects of the Great Recession.

3.2 Japan

A common point of comparison for the U.S. Great Recession is the behavior of the Japanese economy following that country's financial crisis of the early 1990s. PP find that the slump associated with this financial crisis had long-run effects on Japanese real GDP, in the form of both lower trend growth during the slump period (rather than higher as would be suggested by a recovery phase), as well as a lowered trend growth rate following the end of the slump as compared to the precrisis growth rate. However, PP largely discard this episode as being irrelevant for the U.S. experience, noting that the peak-to-trough decline in the level of output observed for Japan following the financial crises was mild as compared to that observed for the United States in the Great Recession. However, given the rapid output growth that Japan had experienced in the decades leading up to the financial crisis, the decline in real GDP *growth* associated with the recession was substantial, and within shouting distance of the decline in real GDP growth observed during the Great Recession.⁵ Also, the U.S. data following the trough of the Great Recession is, so far, consistent with lower growth during the slump period, as was the experience of Japan, rather than a recovery. In sum, a case can be made for the relevance of Japan's postcrisis GDP dynamics in predicting the aftermath of the U.S. Great Recession.

⁴ See, for example, Kim and Murray (2002) and Kim, Morley, and Piger (2005).

⁵ Average quarterly real GDP growth in the decade prior to Japan's 1991 recession was 4.6 percent at an annualized rate, versus 0.07 percent in the period from 1991:Q3–1993:Q3. The comparable averages for U.S. real GDP growth prior to and during the U.S. Great Recession were 2.6 percent and –3.4 percent respectively.

4. Conclusion

Pappell and Prodan have provided a thought-provoking analysis of the likely long-run effects of the recent Great Recession on the level of U.S. real GDP and the likely length of the recovery of real GDP. They have provided us with a novel modeling approach to identify the effects of such episodes, with some notable advantages over the models used in existing studies.

One issue that PP have not tackled is the likely reality that the dynamics of real GDP following recessions depends not only on the source of the recession (for example, a financial crisis), but also on a host of other factors, most notably the policy response to the recession. Thus, their results can be thought of as describing an average recovery of real GDP across alternative policy responses. Future research investigating the role of policy in generating different paths of recovery following recessions will be of considerable interest.

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