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Dissecting US recoveries

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HIGHLIGHTS

- We propose a set of measures to characterize the features of economic recoveries.
- We apply the new set of measures to post-war US expansions and use cluster analysis.
- We find that expansions before and after 1984 (Great Moderation) are quite different.

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ABSTRACT

We propose a set of new quantitative measures to characterize more fully the features of economic recoveries. We apply these measures to post-war US expansions and use cluster analysis to determine that there are two different types of recoveries in recent US economic history, with most expansions before 1984 (Great Moderation) looking quite different from those after.

1. Introduction

The slow pace of the recovery in the US after the Great Recession is a concern for economists and policymakers [see e.g. Fernald, 2014; Summers, 2014 and Fischer, 2014]. GDP growth has been lower than expected and downward revisions of projections have become usual. To have a deep knowledge of the path and nature of recoveries is of great interest, as this has consequences on long-run economic activity and job creation capacity. However, since the seminal paper of Harding and Pagan (2002), in which they dissect the business cycle phases, little effort has been made to develop new measures of the features of the recoveries.[1] In this paper, we propose some new quantitative measures that enrich the analysis of the nature of recoveries. While the measures of Harding and Pagan (2002) are global and do not take into account the dynamics of recoveries, our measures allow to capture these dynamics, thus obtaining information on the different stages of recoveries. In particular, the early quarters of a recovery are key for an economy to recover the output lost during the recession. By means of a cluster analysis, we provide a comparison of different US recovery patterns, distinguishing a different behavior since the beginning of the Great Moderation (1984).[2] The results are of fundamental interest for policymakers and for macroeconomists since they allow to capture the business cycle accurately. The new measures are easily reproducible for different countries and so are expected to be useful to compare stylized facts of different expansions and relate them with other economic variables.

2. Measures

Harding and Pagan (2002) propose four measures to examine the business cycle phases once turning points have been established by dating methods. These are (i) *duration* (in quarters),

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[1] Bec et al. (2015) are an exception, but they work in a parametric framework.

[2] See Kim and Nelson (1999) and McConnell and Perez-Quiros (2000).

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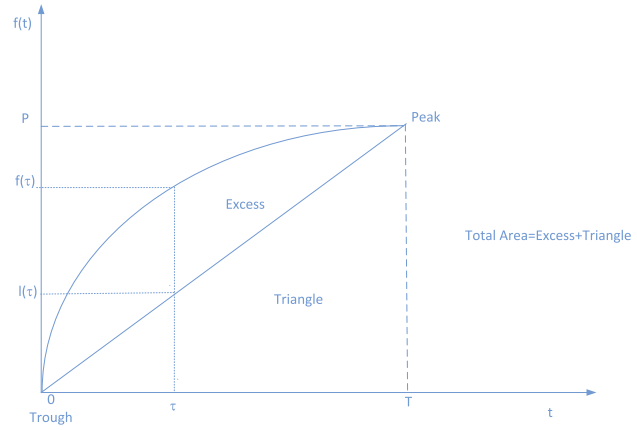
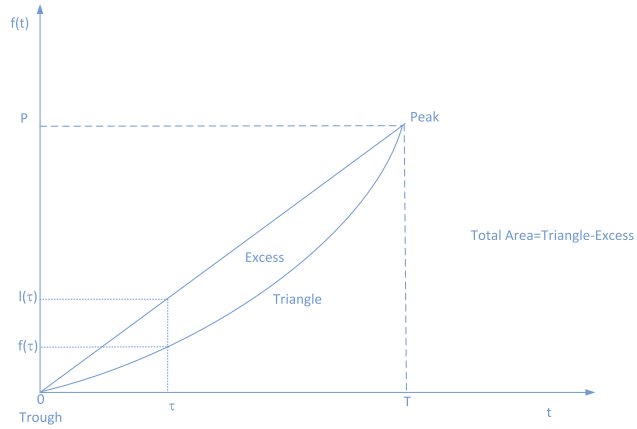


(a) Concave.



(b) Convex.

Fig. 1. Shape of recoveries. Notes: *Duration*: $\overline{0T}$; *Amplitude*: $\overline{0P}$; *Cumulation*: $\int_0^T f(t)dt$; and *Excess*: $\int_0^T f(t)dt - (\overline{0T} * \overline{0P})/2$.

(ii) *amplitude* (which compares the log level of GDP at the turning points), (iii) *cumulation* (the cumulated gain or loss and consists of the sum of the amplitudes of each cyclical phase or total area described by the GDP in logs) and (iv) *excess* (the difference between the real area drawn by the path of the GDP growth in logs and the hypothetical triangle which would have formed with a linear growth rate throughout the whole phase).[3] A positive *Excess* (concave path) means that the recovery starts with a high growth rate that subsequently slows down, whereas a negative *Excess* (convex path) is produced when the opposite happens. If the growth is uniform over the expansion period, then the *Excess* is zero. See Fig. 1 for an illustration.

Excess would be a good measure to characterize the shape of expansions if they had a clear concave, convex or linear form but, in practice, cyclical phases are not always so stylized, as can be seen in Fig. 2, so that this measure is not completely accurate.

To solve the difficulty in capturing the cycles depicted by the data, we propose a set of indicators that identify the evolution of the pattern of the expansions more comprehensively. If a recovery is quick (a V-shaped recovery), the effect of the recession is transitory and the economy continues its long-run growth trend but, if the improvement occurs slowly, it may have permanent effects on the economy (a L-shaped recovery). Specifically, we propose four types of measures: the first one captures the evolution over time of the shape of expansion. The second one captures the early stages of expansions, the third one focuses on the middle of the expansionary path. Finally, the fourth one shows the long-run consequences of the recoveries for future economic growth.

1. Time varying measures:
   (a) *Pointwise excess* during the expansion (E_t), being the excess at each point in time $t = 1, 2, \ldots \tau \ldots T$ defined as[4]:
   $$E_t(\tau) = \int_0^{\tau} f(t)dt - (\overline{0\tau} * \overline{0l(\tau)})/2. \quad (1)$$
   (b) *Acceleration of excesses*: difference of pointwise excess between two consecutive periods (ΔE_t).
   $$\Delta E_t(\tau) = E_t(\tau) - E_t(\tau - 1). \quad (2)$$
2. Early stages measures:
   (a) *Early shape*: the number of consecutive positive excesses at the beginning of the expansion or minus the number of consecutive negative excesses at the beginning of the expansion, in relation to the total duration of the expansion.
   $$Early\ shape = \frac{\tau^{ES}}{\overline{0T}}, \quad (3)$$
   where τ^{ES} is "i" such that $E_t(i) > 0\ \forall i$ and "$-i$" such that $E_t(i) < 0\ \forall i$.
   (b) *Inshape*: the number of consecutive periods with E_t positive and ΔE_t positive or minus the number of consecutive periods with E_t negative and ΔE_t negative. This measure captures changes in the shape, from concave to convex or from convex to concave.
   $$Inshape = \frac{\tau^{I}}{\overline{0T}}, \quad (4)$$
   where τ^{I} is "i" such that $E_t(i) > 0$ and $\Delta E_t(i) > 0\ \forall i$ and "$-i$" so that $E_t(i) < 0$ and $\Delta E_t(i) < 0\ \forall i$.
3. Middle of expansion measures:
   (a) *Half life*: number of periods τ needed to obtain half of the cumulation, relative to the total duration. A value of $\frac{1}{\sqrt{2}}$ is equivalent to a triangular path. A higher value means that it has taken longer to recover the total area, while a smaller value corresponds to fast expansions.
   $$Half\ life = \frac{\tau^{HL}}{\overline{0T}}, \quad (5)$$
   so that $C(\tau^{HL}) = C(T)/2$.
   (b) *Medium area*: area obtained in the middle of the duration of the expansion in relation to the hypothetical triangle. We normalize the measure so that a value of 1 is equivalent to a linear path, a value below (above) 1 means a growth slower (quicker) than linear.
   $$Medium\ Area = 4\frac{Area(\overline{0T}/2)}{\overline{0T} * \overline{0P}/2}. \quad (6)$$
4. Long-run trend measures:
   (a) *Welfare*: number of periods to recover the level of GDP previous to the recession in relation to the total duration of the expansion. Notice that this measure takes into account the depth of the recession.
   $$Welfare = \frac{\tau^{W}}{\overline{0T}}, \quad (7)$$
   where τ^{W}, so that $f_t(\tau^{W}) = f_t P_{-1}$, where P_{-1} is the peak of the previous expansion.

[3] Sichel (1993) suggests *steepness* and *deepness* and McQueen and Thorley (1993) introduce *sharpness*. However, these measures are calculated on filtered data, while ours are based on original data and therefore are invariant to future observations.

[4] Notice that E_t is computed until each t, that means E_{t+i} can be positive despite the shape turns to convex in $t + i$.