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Comparing the shape of recoveries: France, the UK and the US[☆]

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ABSTRACT

Progresses in fiscal consolidation programs are often expressed in cyclically-adjusted terms, meaning that business cycles have to be accurately estimated. In this paper, we put forward a parametric framework enabling to assess business cycles, especially at the end of recession periods by accounting for bounce-back effects. We explore the various shapes that the recoveries may exhibit within an extended Markov-Switching model as proposed by Kim, Morley and Piger (2005) and extend the methodology by proposing *i)* a more flexible bounce-back model, *ii)* explicit tests to select the appropriate bounce-back function, if any, and *iii)* a suitable measure of the permanent impact of recessions. By applying this approach to post-WWII quarterly growth rates of US, UK and French real GDPs, we show that the shape of recoveries is country-specific.

1. Introduction

In the wake of the Great Recession that simultaneously affected all industrialized countries in 2008–09, a global debt crisis arise thus leading the governments to launch fiscal consolidation programs. Those programs raised some issues related to their impact on economic growth but beyond such debates, the issue of business cycle measurement clearly appears. Indeed, when policy-makers put forward cyclically-adjusted measures to assess the sustainability of public finances, it means that an accurate assessment of economic cycles has to be undertaken. Similarly, gauging the sensibility of fiscal multipliers to the business cycle requires a clear specification of the economic cycles. In this paper, our aim is to provide a precise description of business cycles in industrialized countries especially focusing on the end of recessions. Indeed, it typically turns out that output growth rate just after the end of a recession overshoots the *normal* growth rates during expansion phases. This challenges one pessimistic implication of the model put forward by Hamilton (1989) which predicts that the effects of a recession will be permanent for the output level. In other words, this latter model implies that following the end of a recession, the economy will grow from a permanently lower level.

From an economic theory perspective, the conclusions of endogenous growth models regarding the long term impact of recessions are not clear-cut. Some authors such as Caballero and Hammour (1994) or Aghion and Saint Paul (1998) conclude that the cleansing effect of recessions has a permanent positive impact on output. By contrast, a negative long term impact of recessions is predicted by Martin and Rogers's (1997) model, due to the adverse effect of recessions on learning-by-doing and hence on human capital accumulation. A negative long term effect is also predicted by Stadler (1990) when technology is endogenous or by Stiglitz (1993) in the presence of credit markets' imperfections. Some recent empirical studies provide support to the latter view. For instance, using a large panel of countries, Cerra and Saxena (2008) point to a significant cumulative output loss due to recessions whose magnitude depends on the crisis type. Furceri and Mourougane's (2012) analysis of 30 OECD countries focuses on financial crises only and exhibits a permanent loss in the output level of around 4% on average. These recent results contrast with Friedman's (1993) view, first advocated by the author in 1964[1], according to which "a large contraction in output tends to be followed on by a large business expansion; a mild contraction, by a mild expansion". Indeed, such a view allows for revivals as strong as the previous recession and hence possibly contradicts Hamilton's model prediction regarding long term effects.

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1 See "Monetary Studies of the National Bureau", *The National Bureau Enters Its 45th Year*, 44th Annual report, 1964, pp. 7–25.

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To account for such a bounce-back effect (BB hereafter), we consider an extension of the well-known Markov-Switching (MS) model developed by Hamilton (1989), which is the most popular framework for business cycle analysis[2]. Here, we build on the extension put forward by Kim et al. (2005): While maintaining the two-regime assumption of Hamilton's model, these authors have extended it so as to allow for more flexible end of recessions than the "L"-shaped recessions implied by Hamilton's model. In particular, they introduce a bounce-back term — or function — in the expression of the state-dependent mean which accounts for the possibility of a post-recession recovery: following the end of a recession, the output growth rate could be large enough to imply a recovery toward the output level before the recession. This extended framework allows not only for "U"-shaped or "V"-shaped recessions, but also for recoveries which explicitly depend on the duration and depth of the previous recession.

From a technical point of view, our main contribution to this empirical literature is to propose a more general version of the bounce-back (BB) MS model which extends the existing one in two directions. Firstly, contrary to the models considered in Kim et al. (2005) or Morley and Piger (2009), it allows the bounce-back effect to appear later than immediately after the trough. This extension seems relevant for countries which are less flexible than, say, the U.S. For instance, some countries may experience more inertia around a trough in terms of GDP growth rate dynamics which in turn may delay the bounce-back effect. Secondly, our general bounce-back MS model makes it possible to let the data select the appropriate bounce-back shape. Actually, it allows for a larger set of recovery shapes than the existing ones and also encompasses the latter: the "depth"-based bounce-back MS model (denoted BBD hereafter), the "U"-shaped, the "V"-shaped recovery bounce-back MS models (denoted BBU and BBV) as well as Hamilton's original model (denoted H) are special cases of ours. As such, they can be tested from simple linear restrictions on the coefficients of the bounce-back function. Since in our general framework Hamilton's (1989) measure of the permanent effect of recessions has no closed-form solution, we also propose a measure adapted to the general case.

The empirical part of our work proposes an international comparison of the shape of recoveries using post World War II quarterly growth rates of US, UK and French real GDPs. This empirical comparison includes a country constrained by its membership of the euro area (France), a European country not belonging to the euro monetary zone (United Kingdom) and a non-European industrialized country (United States). The empirical results emphasize the relevance of the extended framework and the country-specific nature of the shape of recoveries.

2. Bounceback effects

2.1. The basic Hamilton MS-model

Let y_t denotes the log of real output. The model we will consider throughout this paper is the following:

$$\phi(L)(\Delta y_t - \mu_t) = \varepsilon_t, \tag{1}$$

where Δ is the first difference operator, $\phi(L)$ is a lag polynomial of order p with roots lying outside the unit circle, ε_t i.i.d. $\mathcal{N}(0,\sigma)$ and μ_t are allowed to switch across regimes. The Markov-Switching model proposed by Hamilton (1989) postulates the existence of an unobserved variable, denoted S_t, which takes on the value zero or one. S_t characterizes the "state" or "regime" of the economy at date t. The standard version of Hamilton's model could be written as:

$$\mu_t = \gamma_0 + \gamma_1 S_t, \tag{2}$$

which means that the growth rate of y_t is γ_0 if $S_t = 0$ and $\gamma_0 + \gamma_1$ otherwise. Here, $S_t = 1$ is identified as the recession regime by assuming $\gamma_0 > 0$ and $\gamma_0 + \gamma_1 < 0$. Hamilton (1989) further assumes that the unobserved state variable S_t is the realization of a two-state Markov chain with transition probability $P(S_t = j | S_{t-1} = i) = p_{ij}$. This Markov chain implies that S_t depends on past realizations of y and S only through S_{t-1}. The model given by Eqs. (1) and (2) allows for an asymmetric behavior across regimes.

2.2. Existing bounce-back functions

Recently, Kim et al. (2005) have proposed extensions of Eq. (2) in the Hamilton's model presented above which allow for the length and/or depth of each recession to influence the growth rate of output in the periods immediately following the recession. We will follow their terminology and refer to these models as "bounce-back" MS models. They consider three kinds of bounce-back functions, which correspond respectively to "U"- or "V"-shaped recessions, or "Depth" nonlinear bounce-back models. For these models, Eq. (1) above remains unchanged since the bounce-back function is introduced in the regime-dependent mean of Δy_t. In the U-shaped recession model, denoted BBU hereafter, the equation for μ_t becomes:

$$\mu_t = \gamma_0 + \gamma_1 S_t + \lambda \sum_{j=1}^{m} \gamma_1 S_{t-j}, \tag{3}$$

where the m and λ parameters respectively govern the duration and the magnitude of the bounce-back effect. For the V-shaped recession model, denoted BBV, the bounce-back function takes the form:

$$\mu_t = \gamma_0 + \gamma_1 S_t + (1 - S_t)\lambda \sum_{j=1}^{m} \gamma_1 S_{t-j}. \tag{4}$$

Finally, the expression of μ_t in the "Depth" bounce-back model, denoted BBD, is:

$$\mu_t = \gamma_0 + \gamma_1 S_t + \lambda \sum_{j=1}^{m} \left(\gamma_1 + \Delta y_{t-j}\right) S_{t-j}. \tag{5}$$

The value of the bounce-back parameter, λ, is crucial for the shape of the recovery. First, it is worth noticing that all these models differ from Hamilton's model if and only if $\lambda \neq 0$. Then, for a bounce-back effect to occur, this parameter must be negative: in this case, the last term of the right hand side of the three equations above is positive and makes the growth rate larger for the quarters immediately following a recession. To illustrate the difference between these bounce-back models and Hamilton's original model, we simulate the following process:

$$y_t = y_{t-1} + \mu_t$$

where μ_t is given in Eqs. (2), (3), (4) and (5) respectively, with $\gamma_0 = 1$, $\gamma_1 = -2$, $m = 4$ and $\lambda = \{-0.2, -0.4\}$. The initial value of y_t is set to 10. At time $t = 6$, the state variable switches from the expansion to the recession regime, and remains in the latter for three consecutive quarters before switching back to the expansion regime. Fig. 1 reports the impact of these various bounce-back functions on the growth rate of y_t for $\lambda = -0.2$ (top panel, left) and $\lambda = -0.4$ (top panel, right). First, by contrast with Hamilton's model — denoted (H) in this figure, all bounce-back models imply growth rates values greater than γ_0 for the four quarters following the end of the recession. Of course, this

[2] Actually, this model and its direct extensions by e.g. Sichel (1994), Clements and Krolzig (1998) or Clements and Krolzig (2003) have proved to be quite successful in disentangling expansion vs recession periods (see e.g. Ferrara (2003) for an application to the US).

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