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Profit Rate in the U.S., 1949-2007: a Markov Switching Assessment

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Abstract

The paper investigates the growth in the general profit rate in the U.S. during the 1949-2007 period with a Markov switching model. The evidence is consistent with a long swing with means displaying opposite signs under the two regimes (increasing or declining) and high degree of persistence within each regime. The results for this non-linear approach reinforce previous empirical evidence that does not provide support for a systematic and declining tendency in profit rate as advanced in the Marxian literature

1 Introduction

The law of the tendencial decline of the profit rate in capitalist economies can be traced back to Marx (1894) 1993. Such tendency plays a central role in Marxian theories of crises and Weisskopf (1979) highlights three possible variants of the theories of crises that consider distinct underlying causes pertaining to the technological change, to the labor strength and to the "realization" problem.

There are different types of objections for such tendency:

> At the theoretical level, Okishio (1961) has considered a n-sector model without fixed capital and with labor as the single non-produced input. The introduction of a new technique by a particular firm can induce increases in the general rate of profit. Woods (1985) adds fixed capital to the analysis and corroborates the previous result. Later, Okishio (2001) relaxed some stringent assumptions of his previous work, notably the constancy of the real wage rate, and reinforced his theorem. Cribari-Neto (1992), on the other hand, criticizes the assumption of homogeneous labor in Marxian analysis and shows that the introduction of human capital can support an increasing profit rate. It is necessary to note the increasing complexity of modern capitalism;
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> Measurement issues associated, for example, with capital stock and depreciation quantification were discussed at least since Gilman (1957). A unifying approach has been advanced with the use of data based on national income accounts and complementary sources for capital stock, as exemplified by Wolff (2001, 2003), and Duménil and Lévy (2002);
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> The majority of studies focus on visual and descriptive assessments of the trajectory of the profit rate or yet simpler econometric estimations with a deterministic trend as in Feldstein and Summers (1977). Basu and Manolakos (2012) econometrically addressed the non-stationarity of the data and made salient that not only the quality of the data but additional care in the choice of the econometric method is important.

The aforementioned contributions essentially provide negative support for the declining tendency hypothesis yet in some cases identify specific time periods with such pattern as during the 70s. This paper contributes by considering a non-linear model that

accommodates both increasing and declining regimes for profit rates. In fact, within longer time horizons structural changes are more likely to occur and a reappraisal of the hypothesis of a systematic declining tendency of profit rate in terms of a more flexible econometric framework can be relevant.

The paper is organized as follows. The second section discusses the econometric background and the data set. The third section presents the results. The fourth section concludes.

2 Empirical Analysis

2.1 Markov switching models: a brief digression

Markov switching-MS models constitute a flexible class of models that allow to capture different forms of abrupt changes between unobservable regimes for a given time series and can accommodate different degrees of persistence [see Hamilton (1994)]. We focus on a MS model with no autoregressive dynamics and constant transition probabilities as advanced by Hamilton (1990). It can be summarized as follows.

Let $\{y_t\}^T_{t=1}$ be the sample path of a time series depending on unobserved regimes $\{s_t\}^T_{t=1}$ as follows:

$$(y_t | s_t = i; \theta) \sim N(\mu_i, \sigma_i^2) \qquad (1)$$

The transition probabilities across regimes are given by

$$p(s_t = j | s_{t-1} = k) \equiv p_{jk}$$

for j,k =1.2, where in the case of j = k, one is dealing with staying probabilities that capture persistence. The parameters in $\theta \equiv (\mu_1, \mu_2, \sigma_1^2, \sigma_2^2, p_{11}, p_{22})$ are sufficient to describe the conditional distribution. Moreover, $p(s_1 = 1; \theta) \equiv \rho = (1 - p_{22})[(1 - p_{11}) + (1 - p_{22})]$.

Maximum likelihood estimates can be obtained with the EM algorithm [see Laird (1993)].

Additionally, Engel and Hamilton-EH (1990) suggest the implementation of Wald tests for differences in the means of the unobserved states and for assessing a random walk specification. In the first case, the test statistic under the null hypothesis of equal means is given by:

$$W_1 = \frac{(\hat{\mu}_1 - \hat{\mu}_2)^2}{\hat{\text{var}}(\hat{\mu}_1) + \hat{\text{var}}(\hat{\mu}_2) - 2\hat{\text{cov}}(\hat{\mu}_1, \hat{\mu}_2)} \sim \chi^2(1) \qquad (2)$$

Testing the null hypothesis of a random walk against the segmented trend model is complex as it would imply that the parameters p_{11} and p_{22} would be unidentified under the null hypothesis. The null hypothesis is given by

H_0: $p_{11} = 1 - p_{22}$, $\mu_1 \neq \mu_2$, $\sigma_1 \neq \sigma_2$ and is tested against the alternative hypothesis of $p_{11} \neq 1 - p_{22}$, and the test statistics is:

$$W_2 = \frac{[\hat{p}_{11} - (1 - \hat{p}_{22})]^2}{\hat{\text{var}}(\hat{p}_{11}) + \hat{\text{var}}(\hat{p}_{22}) + 2\hat{\text{cov}}(\hat{p}_{11}, \hat{p}_{22})} \sim \chi^2(1) \qquad (3)$$

Hamilton (1996) advances different dynamic (Lagrange multiplier-LM) specification tests that will be later considered.

Finally, one can use smoothed probabilities for dating growth regimes for profit rate. Those probabilities assess the conceivability of a certain state given the full sample ex-post available information. A regime of increasing profit rate will be assumed to prevail if $p(s_1|y_{1,\ldots,} y_T; \theta) > 0.5$ and a regime of declining profit rate otherwise.

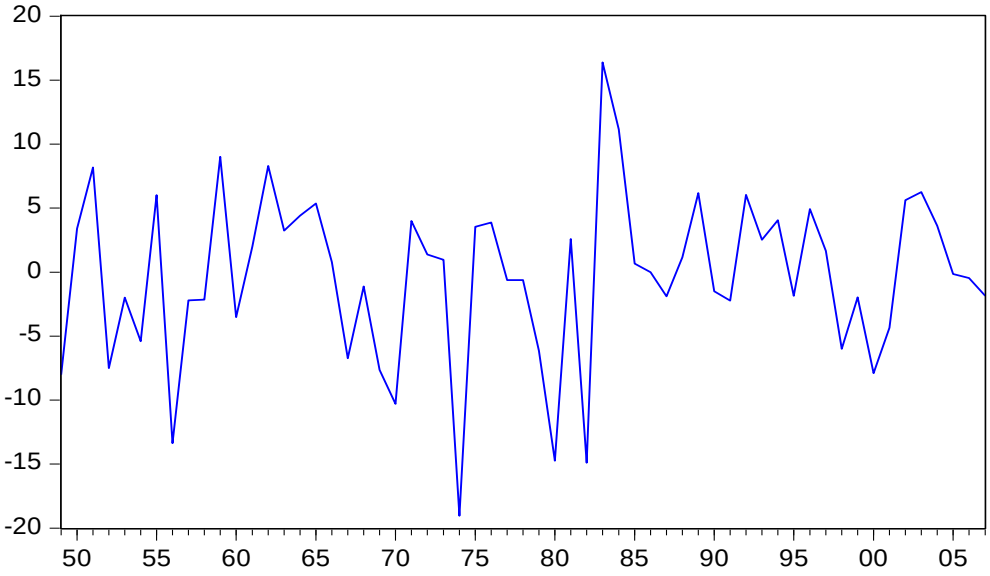
2.2 Data

Data based on national income accounts are available in Duménil and Lévy (2009) and used by Duménil and Lévy (2002) and by Basu and Manolakos (2012) in its augmented version.[1] The data refers the general profit rate for the U.S. economy during the 1948-2007 period and includes a post WWII period that excludes the subprime crisis in 2008. A MS approach is considered in terms of the growth in profit rate (GPR) as defined bellow and delineates a sample for the 1949-2007 period and depicted in Figure 1:

$$GPR_t = [\ln(PR_t) - \ln(PR_{t-1})]*100$$

[1] I thank Deepankar Basu for kindly providing the data used in this paper

Figure 1
Growth in the profit rate in the U.S. – 1949-2007



Source: author´s elaboration upon data from Duménil and Lévy (2009)

3 Empirical Results

This section presents the estimation results for the MS model and some related tests. All results were obtained with the Gauss software [version 14.03] by using specific codes developed by James Hamilton [emest.new and gradcall] that were readily adapted for the particular data set used in this paper. Those are available at: http://econweb.ucsd.edu/~jhamilto/software.htm#Markov.

The main results for the MS model appear in Table1.

Table 1
Estimates from the Markov switching model for changes in the profit rate in the U.S., 1949-2007

μ_1	μ_2	p_{11}	p_{22}	σ_1^2	σ_2^2	ρ
2.053 (1.003)	-2.166 (1.693)	0.731 (0.191)	0.794 (0.178)	11.313 (5.659)	59.385 (17.358)	0.433
Specification Wald Tests						
W_1= 4.560 (0.033)			W_2 = 2.685 (0.101)			

An initial inspection of the table indicates distinct and symmetric means for the regimes of increasing and declining profit rates. In the case of the variances, a greater volatility appears to prevail under the declining rate of profit regime. The W_1 test clearly suggests the rejection of the null hypothesis and indicates markedly distinct means across regimes. There is some evidence from the W_2 test against a random walk specification if one is willing to consider a less strict significance level.

Table 2 presents dynamic specification tests for serial dependence.

Table 2
Dynamic specification tests for serial dependence

Test	Test Statistic	p-value
LM test for autocorrelation in regime 1 [$\chi^2(1)$]	0.581	0.416
LM test for autocorrelation in regime 2 [$\chi^2(1)$]	1.142	0.285
LM test for autocorrelation across regimes [$\chi^2(1)$]	0.198	0.656

In all the reported cases one cannot reject the null of no serial correlation and therefore more confidence can be obtained on the portrayal of the growth in profit rate in terms of a MS model.

Altogether, the consideration of a non-linear model indicated that long swings appear to prevail as μ_1 and μ_2 are opposite in sign and the values for p_{11} and p_{22} are both large. A similar pattern had been identified in the context of exchange rates by EH.

The results provide additional evidence against the Marxian hypothesis of a general declining tendency of the profit rate as it is not possible to ascertain a salient dominance of that regime. Such observation is further reinforced when the chronology of the regimes is established in Table 3.

Table 3
Dates of regimes for changes in the profit rate

Regime	Dates
Increasing rates of profit	1961-66; 1971-72; 1975-77; 1985-97; 2002-07
Declining rates of profit	1949-60; 1967-70; 1973-74; 1978-84; 1998-01

The evidence suggests that the declining profit rate regime tended to be more prevalent in the 70s, in line with some previous literature, either based on descriptive assessments or simpler econometric approaches.

4 Final Comments

The paper investigated the growth in the U.S. profit rate during the 1949-2007 period by means of a non-linear approach with MS across the unobserved regimes. The model appears to provide a satisfactory portrayal of the evolution of the profit rate and the pattern of long swings reinforces previous rejections of the hypothesis of a consistent declining tendency of the profit rate. In fact, no dominance appears to prevail in connection with the referred regime.

The considered model embodies the potentially limiting assumption of constant transition probability across regimes. A more general model along the lines of Diebold et al. (1994) considers time-varying transition probabilities and thus would allow to assess the role of particular economic variables on the switch between increasing and declining regimes in the profit rate. Such approach could provide a more fruitful avenue for future research. Rather than searching for a consistent tendency for a declining profit rate, one should acknowledge the increasing complexity of modern capitalist economies. One could investigate, under the more general referred model, the role of specific economic variables what would not necessarily preclude the consideration of proxies for Marxian categories as for example those considered in Basu and Manolakos (2012).

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