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SECULAR STAGNATION: IS IT IN THE DATA?

Abstract

The anemic recovery of advanced economies, after eight years into the great recession, has recently been attributed to the persistent slump in demand and its effects on long-run growth rates through hysteresis effects. If adverse secular trends are at work, then the data should show that the long-run growth rate has shifted to a lower level. Hence, using a simple Markov switching regimes model, we investigate whether the growth rate of potential GDP has exhibited a persistent switch, based on OECD data for nine economies over the period 1990-2017. It turns out that, in all cases, potential GDP growth is characterized by switching dynamics and this provides necessary evidence that secular stagnation cannot be ruled out empirically.

Keywords: Secular Stagnation, Switching Regimes, Long-Run Growth
JEL Classification: E30, E32

Riassunto

Una stagnazione secolare è nei fatti?

La anemica ripresa delle economie avanzate dopo otto anni di grande recessione è stata recentemente attribuita al persistente calo della domanda ed ai suoi effetti sulla crescita nel lungo periodo tramite effetti di isteresi. Se intervenissero tendenze secolari contrarie, allora i dati dovrebbero mostrare che i tassi di crescita nel lungo periodo sono diminuiti. Di conseguenza, usando un modello Markoviano a regime variabile, si analizza se il tasso di crescita del PIL potenziale ha evidenziato una variazione persistente, basandosi su dati OCSE relativi a nove economie nel periodo 1990-2017. Vi sono evidenze che per tutti i paesi la crescita del PIL potenziale è caratterizzata da dinamiche variabili e ciò indica che la stagnazione secolare non può essere empiricamente esclusa.

1. Introduction

In a series of recent writings Summers (2014a, 2014b, 2016a, 2016b) revived the idea of secular stagnation whereby adverse long-run trends in demographics, income distribution, capital prices, and financial markets, all contribute to increase the propensity to save and decrease the propensity to invest. The resulting excess savings lead to a chronic deficiency in aggregate demand since the low long-run (Wicksellian or neutral) real interest rate required to equilibrate the loanable funds market cannot be achieved through conventional monetary policy. Under these circumstances, fiscal action takes on new importance and a major rethinking of macroeconomic policy may be in order (e.g. Kirikos, 2017).

Despite underlying uncertainty, recent empirical research has provided rather convincing indications of secular stagnation for several advanced economies. For instance, Lukasz and Smith (2015) suggest that secular drivers account for a 400 basis points fall in the global neutral real rate, while Rawdanowicz *et al*. (2014) outline signs of secular stagnation which are stronger for Japan and the euro area but less important for the UK and the USA.

As it happens, it may be more productive to examine whether the dynamics of the long-run growth rate is compatible with the secular stagnation hypothesis, before looking for other signs of adverse secular trends. In other words, we can let the data say if and when a downturn in the long-run growth trend has occurred as well as whether such a shift is persistent. Therefore, in this paper we estimate a switching regimes model to see if there is a downward shift in the potential GDP growth rate, using data on nine economies and the euro area.

The approach taken here has several advantages. First, it focuses on long-run growth trends and thus evidence of lower potential growth cannot be associated with short-run phenomena that may impinge on the actual growth rate. Second, a regime of lower potential growth is *prima facie* evidence of a lower neutral interest rate since the latter depends positively on long-run growth (Laubach and Williams, 2003). Third, a persistent downward shift in potential growth points firmly to hysteresis effects, for inflation has been declining throughout the period considered.

2. The model

Let the potential GDP growth rate x_t follow the switching process:

$$x_t = \mu_{s_t} + \varepsilon_t,\ \ \varepsilon_t \sim N(0, \sigma_{s_t}^2) \tag{1}$$

where ε_t is an error term and s_t denotes the unobserved state of the process assumed to take on two values, 1 or 2. Apparently, under process (1), the mean value of the long-run growth rate μ as well as its variance σ^2 depend on the realized state s_t. Also, the state variable s_t is taken to switch between states 1 and 2 according to a Markov chain with transition probabilities:

$$P = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} \tag{2}$$

where p_{ij} is the probability of going to state j from state i (i,j = 1,2) and, therefore, the sum of the elements of each row of P is unity.

The process described by (1) and (2) is nonlinear and estimates of the parameters μ_1, μ_2, p_{11}, p_{22}, σ_1^2, σ_2^2 are based on the so-called filter inferences about the state of the process, given information up to the relevant period. These conditional probabilities, $Pr(s_t=1|s_1, s_2,..., s_t)$, are nonlinear in the data (Hamilton, 1993). Besides, this model does not require pre-specification of regime change dates, but it has the particularly desirable property that allows the data to say if and when a switch between states takes place. Such inference can rely on estimates of the conditional probabilities of the state at any date, given the full set of available information, i.e. based on the full sample. The latter probabilities are referred to as smoothed inferences, are nonlinear in the data, and are denoted $Pr(s_t=1|s_1, s_2, ..., s_T)$, where T is the full sample size. Probably, as long as $Pr(s_t=1|s_1, s_2, ..., s_T)>1/2$ the process is taken to be in state 1, whereas for $Pr(s_t=1|s_1, s_2, ..., s_T)<1/2$ state 2 occurs.

Estimates of the switching model parameters are obtained via the EM algorithm whereby the sample likelihood function is maximized through iterations on the normal equations after an initial guess of the parameter vector. Also, tests of the presence of switching dynamics can be taken as a byproduct of the estimation process. More precisely, the hypotheses H_o: $\mu_1 = \mu_2$ and H_o: $p_{11} = 1 - p_{22}$ can be tested by means of the Wald test statistics:

$$\frac{(\hat{\mu}_1 - \hat{\mu}_2)^2}{Var(\hat{\mu}_1) + Var(\hat{\mu}_2) - 2Cov(\hat{\mu}_1, \hat{\mu}_2)} \sim \chi^2(1) \text{ and } \frac{(\hat{p}_{11} + \hat{p}_{22} - 1)^2}{Var(\hat{p}_{11}) + Var(\hat{p}_{22}) + 2Cov(\hat{p}_{11}, \hat{p}_{22})} \sim \chi^2(1)$$

where hats denote estimates of the relevant parameters, and these tests are predicated on the assumption $\sigma_1^2 \neq \sigma_2^2$ (Hamilton, 1993). The hypothesis H_o: $\mu_1 = \mu_2$ implies that the growth rate does not change significantly between states, whereas the validity of H_o: $p_{11} = 1 - p_{22}$ refutes the

Markov property since the probability of being currently in state 1 is independent of the previous period state. Thus, rejection of these hypotheses is compatible with switching dynamics of the long-run growth rate.

3. DATA AND RESULTS

We use annual OECD data on potential GDP estimates for nine different countries (Germany, Greece, Ireland, Italy, Japan, Portugal, Spain, UK, USA) and the euro area, over the period 1990-2017[1]. All data are drawn from OECD Economic Outlook (2016/1), available through the OECD official data warehouse (stats.oecd.org). The mnemonic of the series is GDPVTR and it refers to volume estimates expressed in currency units (base year 2010). Potential GDP growth rate series are computed by the first differences of the logarithms of the potential GDP series multiplied by 100.

Table 1 contains the estimates of the switching model parameters and their respective standard errors, for all countries considered. These were obtained by application of the EM algorithm and computations were carried out by GAUSS code. The value of the logarithmic likelihood function at the estimated parameter vector is also reported.

The results show rather different mean growth rates across states as well as persistent regimes since the probabilities p_{11} and p_{22} are above 0.9 for all countries. These findings are corroborated by tests of the hypotheses Ho: $\mu_1 = \mu_2$ and Ho: $p_{11} = 1 - p_{22}$, reported in Table 2. In all cases, the null hypotheses are strongly rejected and this provides compelling evidence in favor of switching dynamics in the data.

Also, the smoothed probabilities of state 1, shown in Figure 1, verify the persistence of each regime and reveal that a switch between states has occurred only once over the sample period considered, albeit at different times for different countries. In particular, the downturn of the long run growth rate seems to have taken place in the period 2002-2003 for Germany, Japan, Portugal, and the USA, whereas the respective switches for Greece, Ireland, Italy, Spain, the UK, and the Euro area appear to be around the outburst of the financial crisis in 2008.

[1] Data for Greece cover the period 1995-2017 and those for the euro area cover the period 1991-2017.

TABLE 1 - *Parameter Estimates of the Switching Regimes Model*

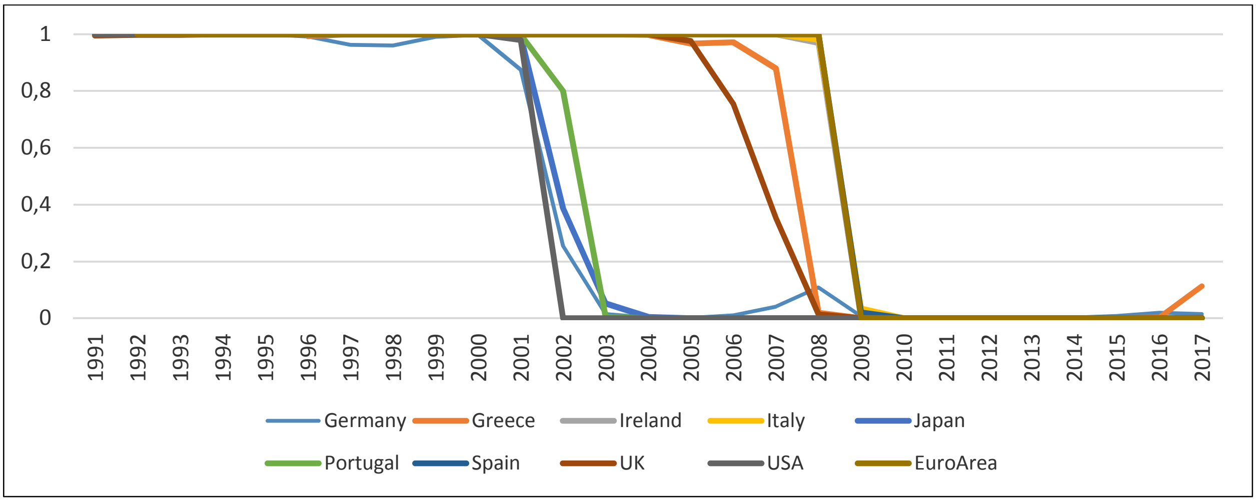
	μ_1	μ_2	p_{11}	p_{22}	σ_1^2	σ_2^2	L^*
Germany	1.957 (0.1452)	1.152 (0.0581)	0.949 (0.0648)	0.963 (0.0432)	0.180 (0.0850)	0.0583 (0.0192)	-15.51
Greece	3.142 (0.2286)	-0.548 (0.3492)	0.949 (0.0618)	0.955 (0.0535)	0.341 (0.2257)	1.093 (0.5556)	10.20
Ireland	5.696 (0.1791)	2.119 (0.1791)	0.966 (0.0384)	0.951 (0.0624)	0.569 (0.1922)	0.273 (0.1480)	7.34
Italy	1.292 (0.1151)	-0.341 (0.0606)	0.966 (0.0384)	0.951 (0.0627)	0.233 (0.0798)	0.031 (0.0164)	-10.53
Japan	1.944 (0.2588)	0.422 (0.0398)	0.958 (0.0524)	0.964 (0.0424)	0.689 (0.2936)	0.021 (0.008)	-14.51
Portugal	2.847 (0.0859)	0.565 (0.1871)	0.959 (0.0510)	0.964 (0.0427)	0.078 (0.0355)	0.481 (0.1918)	-2.74
Spain	2.888 (0.0947)	0.634 (0.1173)	0.966 (0.0384)	0.951 (0.0627)	0.159 (0.0553)	0.122 (0.0584)	-7.73
UK	2.445 (0.0972)	1.379 (0.1162)	0.964 (0.0420)	0.956 (0.0550)	0.131 (0.0477)	0.112 (0.0528)	-11.10
USA	3.124 (0.0324)	1.935 (0.0873)	0.957 (0.0538)	0.965 (0.0413)	0.012 (0.0049)	0.121 (0.0434)	-23.15
Euro area	1.950 (0.0742)	0.776 (0.0416)	0.965 (0.0403)	0.951 (0.0632)	0.094 (0.0322)	0.016 (0.0073)	-21.03

Notes: Standard errors in parentheses. L^* is the computed local maximum of the logarithm of the likelihood function.

TABLE 2 - *Wald Tests of Potential GDP Switching Dynamics*

	$H_o: \mu_1 = \mu_2$		$H_o: p_{11} = 1 - p_{22}$	
	Statistic [$\chi^2(1)$]	p-value	Statistic [$\chi^2(1)$]	p-value
Germany	27.38	0.000	104.23	0.000
Greece	106.82	0.000	92.86	0.000
Ireland	204.84	0.000	121.98	0.000
Italy	161.73	0.000	121.35	0.000
Japan	34.97	0.000	142.13	0.000
Portugal	132.85	0.000	145.63	0.000
Spain	226.86	0.000	121.38	0.000
UK	59.84	0.000	134.40	0.000
USA	163.88	0.000	140.73	0.000
Euro area	190.46	0.000	115.30	0.000

FIGURE 1 - *Smoothed Probability of State 1*



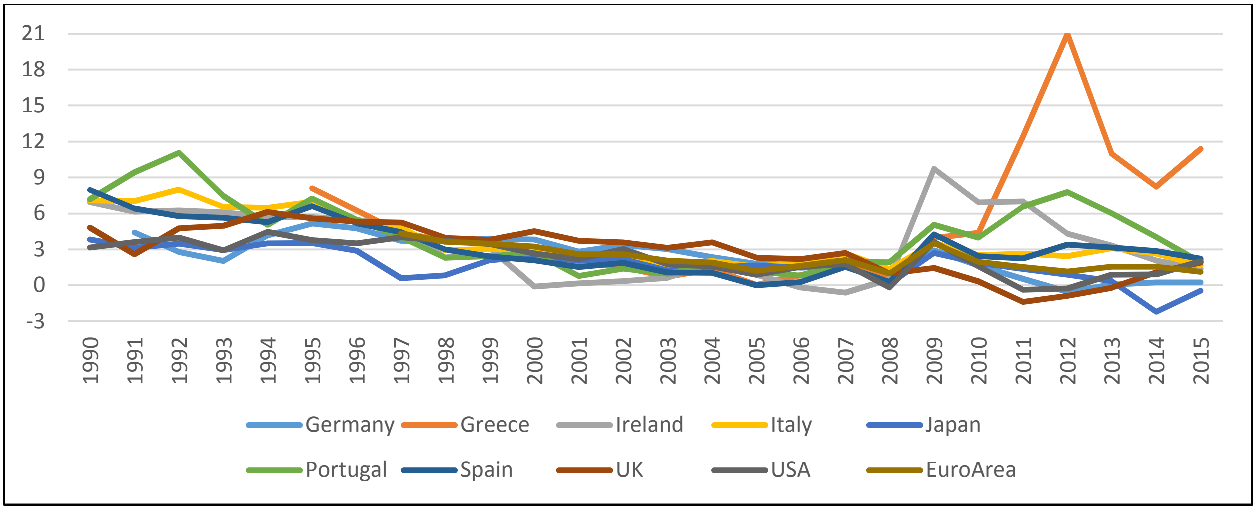
4. CONCLUDING REMARKS

Our findings show that the long-run growth rate has persistently shifted to a lower mean value and the turning points appear around 2002 and 2008 for all economies considered. This evidence suggests that secular stagnation cannot be empirically excluded, but it does not provide conclusive proof of secular effects.

Rogoff has advanced an alternative interpretation that may fit data dynamics and is based on debt overhangs (see Lo and Rogoff, 2015). In short, the deleveraging that follows financial crises has historically had extremely adverse effects on economies with high sovereign debt due to sharp declines in aggregate demand. Such severe slumps may produce debt supercycles before the deleveraging recedes and the economy reverts to its long-run trend. However, the debt overhang approach works mostly through higher interest rates which are observed only in the cases of Greece, Ireland, and Portugal after 2008 (see Figure 2).

Thus, combining the results on regime shifts shown in Figure 1 with the evolution of long-term real interest rates of Figure 2, we obtain firm signs that a debt supercycle may be relevant for Greece and Ireland only under hysteresis effects. All other countries seem to have been affected by adverse secular trends[2].

FIGURE 2 - *Long-Term Real Interest Rate on (10-year) Government Bonds*[3]



[2] For Portugal, the financial crisis rather exacerbated the secular effects that seem to have been at work since 2003.
[3] Data on nominal rates and inflation are drawn from the OECD database.

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