



Estimates of the steady state growth rates for some European countries

Paolo Casadio ^a, Antonio Paradiso ^{b,*}, B. Bhaskara Rao ^c

^a Intesa Sanpaolo Bank Group, Risk Management, Rome Italy

^b National Institute for Statistics (ISTAT), Rome, Italy

^c School of Economics and Finance, University of Western Sydney, Sydney, Australia

ARTICLE INFO

Article history:

Accepted 16 March 2012

JEL classification:

C22

O52

O40

Keywords:

Extended Solow growth model

Trade openness

Human capital

Investment ratio

Steady state growth rate

European countries

ABSTRACT

This paper estimates the steady state growth rates for the main European countries with an extended version of the Solow (1956) growth model. Total factor productivity is assumed a function of human capital, trade openness and investment ratio. We show that these factors, with some differences, have played an important role to improve the long run growth rates of Italy, Spain, France, UK, and Ireland. A few policies to improve the long-run growth rates for these countries are suggested.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

In the Solow (1956) growth model the long-run equilibrium growth of output (expressed in per worker terms) is determined by total factor productivity (TFP). TFP is usually estimated as a residual from the growth accounting framework of Solow (1957) and for this reason is also known as the Solow Residual (SR). Endogenous Growth Models (ENGs) identify factors on which the TFP/SR may depend. Although there is a large number of cross-country empirical works based ENGs, empirical work with country-specific time series data is limited.¹ In addition, the major part of these studies is on the developing countries² and very few on the matured industrial economies.³ Therefore, it is not known what are the long run growth rates of such industrialized countries and what are the important factors on which their TFPs depend. This paper aims to fill this gap but uses an extended Solow (1956) growth model for this purpose. We estimate the long run growth rates for a selected group of European

countries: Italy, France, UK, Spain, and Ireland and our methodology can also be used to estimate the long run growth rates for other countries.

In the empirical work on the ENGs many potential determinants of the long-run growth have been used although it is difficult to develop theoretical frameworks to justify each and every potential determinant. For example, Durlauf et al. (2005) make a list of more than 100 potential growth determinants in the empirical works. However, Jones (1995) cited no more than 10 potential determinants of the long-run growth such as physical investment rate, human capital, export share, government consumption etc.⁴ Due to limited sample size (50 observations) in the country specific time series data, only a few such potential explanatory variables can be considered. Although we experimented with several variables, we found that trade openness⁵ (TRADE), an index of human capital (HKI) and investment ratio (IRAT) are adequate to explain TFP in our selected countries. After having estimated our extended growth model, we estimate the steady state growth rate (SSGR) defined as a situation in which the rate of growth of physical capital (expressed in per capita

* Corresponding author.

E-mail addresses: paolo.casadio@yahoo.it (P. Casadio), anto_paradiso@hotmail.com (A. Paradiso), raob123@bigpond.com (B.B. Rao).

¹ Greiner et al. (2005) is one of the few attempts to estimate endogenous ENGs with country-specific time series data. More recent studies are Rao (2010a) and Rao (2010b) for example.

² See Rao and Cooray (2011).

³ See for example Paradiso and Rao (2011) for a study on Italy.

⁴ Levine and Renelt (1992), using the extreme bounds analysis, have found that only the investment ratio is a robust explanatory variable of growth.

⁵ Trade openness (or short: openness) measure is based on the share of nominal exports and imports in GDP. Several measures of openness have been used in the empirical growth literature. The ratio between exports and imports and GDP has increasingly become the variable of choice in empirical growth analysis. See for example Bergheim (2008) on this point.

worker terms) goes to zero and output per worker grows at the same rate of TFP ($\Delta \ln y^* = g$). This permits us to make a sensitivity analysis to understand which variables have to be stimulated to favor growth.

The paper is organized as follows. In [Section 2](#) we discuss the extended Solow model and develop our specification used in estimations. [Section 3](#) presents a description of the countries' characteristics. [Section 4](#) shows the estimation results for Italy, Spain, France, UK, and Ireland. [Section 5](#) concludes.

2. Specification

The starting point is the steady state solution for the level of output in the [Solow \(1956\)](#) growth model and this is:

$$y^* = \left(\frac{s}{d+g+n} \right)^{\frac{\alpha}{1-\alpha}} A \quad (1)$$

where $y^*(=Y/L)$ is the steady state level of income per worker, s = the ratio of investment to income, d = depreciation rate of capital, g = the rate of technical progress, n = the rate of growth of labour, A = the stock of knowledge and α = the exponent of capital in the Cobb–Douglas production function with constant returns (see below). This implies that the steady state rate of growth of per worker output (SSGR), assuming that all other ratios and parameters are constant, is simply TFP because:

$$\Delta \ln y^* = \text{SSGR} = \Delta \ln A = \text{TFP} \quad (2)$$

However, since the determinants of TFP are not known and are exogenous in the [Solow \(1956\)](#) growth model, the Solow model is also known as the exogenous growth model. The new growth theories based on ENGM use optimization framework and suggest several potential determinants of TFP. However, to the best of our knowledge there is no ENGM which rationalizes that TFP depends on more than one or two selected variables. We take the view that the Solow model can be extended by making TFP a function of a few of the determinants identified by the ENGMs. For example, if the findings of [Levine and Renelt \(1992, see footnote 4\)](#) are valid, then TFP depends only on the investment ratio in spite of the findings by [Durlauf et al. \(2005\)](#) and [Jones \(1995\)](#).

We extend the Solow model as follows. Note that the SSGR can be estimated by estimating the production function. The production function can also be extended by assuming that the stock of knowledge (A) depends on some important variables identified by the ENGMs. We start with the well-known Cobb–Douglas production function with constant returns:

$$Y_t = A_t K_t^{\alpha} L_t^{(1-\alpha)} \quad (3)$$

Following [Rao \(2010b\)](#) and [Paradiso and Rao \(2011\)](#) we assume the following general evolution for the stock of knowledge A is as follows⁶:

$$A_t = A_0 e^{(a + \varpi R_t \cdot T + \gamma_1 Z_t + \gamma_2 Z_t^2 + \varphi W_t + \vartheta \ln S_t \cdot T) X_t^{\delta}} \quad (4)$$

where T is time and R, Z, W , and S are variables on which TFP depends in different ways. This can be explained by taking the logs of Eq. (4) with lower case letters denoting the logs as:

$$a_t = a_0 + a \cdot T + \varpi R_t \cdot T + \gamma_1 Z_t + \gamma_2 Z_t^2 + \varphi W_t + \vartheta \ln S_t \cdot T + \delta \ln X_t \quad (5)$$

Taking the first difference gives:

$$\Delta a_t = \text{TFP} = a + \varpi \Delta R_t \cdot T + \varpi R_{t-1} + \gamma_1 \Delta Z_t + \gamma_2 \Delta Z_t^2 + \varphi \Delta W_t + \vartheta \Delta \ln S_t \cdot T + \vartheta \ln S_{t-1} + \delta \Delta \ln X_t \quad (6)$$

Eq. (6) captures the actual growth rate of output due to changes in variables, other than factor accumulation. The effects of these other variables may be trended and linear, some of which are transitory and some permanent ($a + \varpi \Delta R_t \cdot T + \varpi R_{t-1}$) but nonlinear ($\gamma_1 \Delta Z_t + \gamma_2 \Delta Z_t^2$ and $\delta \Delta \ln X_t$) or transitory and linear (ΔW) or nonlinear but with some transitory and some permanent ($\vartheta \Delta \ln S_t \cdot T + \vartheta \ln S_{t-1}$). Our choice of the variables is made on the basis of empirical considerations.

The steady state growth rate (SSGR) is defined as the situation when all differences go to zero:

$$\therefore \text{SSGR} = a + \varpi R_{t-1} + \vartheta \ln S_{t-1} \quad (7)$$

The higher are R and S levels, and higher is the SSGR.

3. Countries' characteristics

In [Table 1](#) we present the country characteristics of the key variables used in this study and we have divided the sample into two parts 1960–1985 and 1986–2010. The first period was in general characterized by high growth for all countries, whereas in the second there are some differences in their growth performance. In the second sample the growth rates in Italy, France, and Spain have decreased. This decline is particularly accentuated for Italy. For UK the growth remains somewhat stable and in Ireland growth has increased. In describing the main macroeconomic characteristics of these countries we also report some country specific events to justify later the use of dummy variables in their estimation.

The prolonged period of sustained growth in Italy comprised between the end of World War II and the late of 1960s was called the “Italian economic miracle” (“Il miracolo economico italiano”). The last years of 1960s and the beginning of 1970s were characterized by a working-class struggle. The events of these years and the wage bargaining agreements that went into effect in 1970 determine the beginning of a new regime in the wage determination process ([Modigliani et al., 1986](#)). The investment ratio slightly decreased in the second sample, even if it is above 20% despite of the recent recession of 2008–2009. Employment accelerated in the second sample, in particular after the mid-1990s due to significant labour market reforms in the 1990s ([Schindler, 2009](#)). Trade openness grew sharply in the second sample, in particular after the 1990s. The average years of education is the lowest among the countries considered, even if the average value in the period 1960–1985 was larger than in France and Spain.

Spain's economy was characterized by huge growth in the period 1960–1985, and in the second sample growth slowed down even though it was above the growth rates in Italy, UK, and France. To illustrate this performance we have to consider two important changes in the Spanish economy. The first is in 1978 with the introduction of the Constitution and the beginning of the de-facto democracy in Spain. The second is in 1994 when labour market reforms were introduced. These reforms allowed private employment agencies to operate freely, and introduced flexibility into firing costs and bargaining process ([Dolado et al., 2002](#)). According to [Boldrin et al. \(2010\)](#), the period after the reforms was characterized by a spectacular increase in employment and a small gain in the productivity. The investment ratio is well above 20% and grew in the second sample. Employment has also increased after the labour market reforms. Trade openness tripled from 17% to 51% and Spain became more opened than France and Italy. Spain's education performance is the result of the political

⁶ This approach and specification are based on empirical considerations and our specification (5) gave the best empirical results. We are not aware of any ENGM in which the functional form of the determinants of TFP is well established with theoretical insights.

Download English Version:

<https://daneshyari.com/en/article/5055283>

Download Persian Version:

<https://daneshyari.com/article/5055283>

[Daneshyari.com](https://daneshyari.com)