How to offset the negative trend growth rate in the Italian economy?

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How to Offset the Negative Trend Growth Rate in the Italian Economy?

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Abstract

The trend growth rate of the Italian economy has been declining since the 1980s. To examine how to offset this trend, we estimate a simple specification of an endogenous growth model. Cointegrating equations for the long-run output growth and its determinants are estimated with alternative time series methods. Our results imply that policies to double trade openness are necessary.

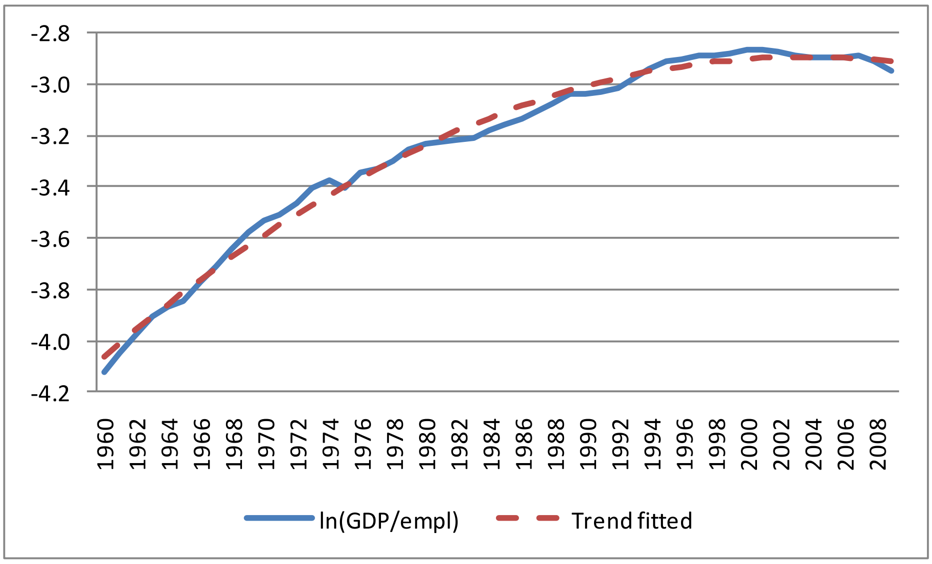
Keywords: Economic Growth, Trade Openness, Italy.

JEL: C22, O52, O40

1. Introduction

Italian economy is growing at decreasing rates especially since the mid 1980s. A quadratic trend, implying the trend growth of GDP per worker (growth rate hereafter) has been declining, fits the data well and is shown in Figure 1. Table 1 compares growth rates of Italy with a few advanced economies. Italy's growth rate since 2001 is the lowest among these countries. Therefore, how its growth rate can be improved is important to examine. We use three time series methods to estimate the long-run relationship between the growth rate and its determinants with a specification in Rao (2010). We examine the role of trade openness and education to offset the negative trend in Italy's growth rate. Section 2 specifies our model. Empirical results and policy implications are in Section 3. Section 4 concludes.

Figure 1: Per worker GDP



$$\ln \frac{GDP}{EMPLOYMENT} = -4.06 + 0.053 TREND - 0.001 TREND^2$$

Table 1: Average growth rate

Period	1971-1980	1981-1990	1991-2000	2001-2009
Italy	3.64	2.42	1.6	0.16
USA	3.21	3.27	3.41	1.56
Germany	2.91	2.32	2.1	0.59
Greece	4.70	0.71	2.36	3.28
France	3.71	2.41	1.99	1.17
Spain	3.57	2.95	2.81	2.35

2. Specification

Rao (2010) extended the following Cobb-Douglas production function to capture the permanent growth effects of variables in endogenous growth models.

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

Here $Y =$ output, $K =$capital, $L =$employment and $A =$stock of knowledge. Error term is ignored for convenience. Greiner et al. (2004) suggest that a trend component may be augmented to capture the effect of other excluded and trended variables that affect the stock of knowledge. In the case of Italy a second order nonlinear trend appears satisfactory. Following Rao (2010) we assume the following evolution for A, where T is time and Z is a vector of growth effecting variable. We use two growth-affecting variables, which differ in their effects as shown below.

$$A_t = A_0 e^{(aT + bT^2 + \gamma_1 Z_{1t})} Z_{2t}^{\gamma_2} \qquad (2)$$

Transforming (1) into the intensive form, substituting (2) for the stock of knowledge and taking logs gives:

$$\ln y_t = \ln A_0 + aT + bT^2 + \gamma_1 Z_{1t} + \gamma_2 \ln Z_{2t} + \alpha \ln k_t \qquad (3)$$

where $y = (Y/L)$ and $k = (K/L)$. Equation (3) implies that in the steady state, when $\Delta \ln k \to 0$, the steady state rate of growth of output (*SSGR*) equals the rate of growth of the stock of knowledge (ΔA), and this is $a + 2bT + \gamma_1 \Delta Z_1 + \gamma_2 \Delta \ln Z_2$.[1]

3. Empirical Results

Three estimation techniques are implemented viz., FMOLS (Fully modified OLS), CCR (Canonical cointegration regression), DOLS (Dynamic ordinary least squares). These estimators deal with the problem of second-order asymptotic bias arising from serial correlation and endogeneity and they are asymptotically equivalent and efficient. The p-values of the coefficients are reported in the square brackets below the coefficients. Two dummy variables added are: a dummy in the last years of 1960, which captures the important changes, occurred in that period in the Italian labour market (Modigliani et al., 1986); a dummy for the years 1988 and 1989 for capturing the progress in the financial markets with the introduction of new structures and instruments.

Six different models are estimated. Table 2 has the estimates of the baseline specification. In Tables 3 to 7, estimates with additional determinants of A viz., trade openness and human capital (average years of education) are given. We check if nonlinear effects for the added variables explain the downward trend in growth. In particular, we check if the nonlinear effect for education may have a role. The results confirm that the nonlinear pattern of GDP per worker is well captured by the nonlinear effects of education.

[1] This is derived by taking the total differential of equation (2). Note that $dT = 1$, and in the steady state $(dk/dT) \to 0$.

$$(dA/dT) = a(dT) + 2bT(dT) + \gamma_1 (dZ_1/dT) + \gamma_2 (d\ln Z_2/dT)$$

Table 2: Model 1

	FMOLS	CCR	DOLS
Intercept	-0.869 [0.04]	-0.886 [0.03]	-0.982 [0.01]
ln k	1.105 [0.00]	1.099 [0.00]	1.060 [0.00]
Trend	0.014 [0.01]	0.014 [0.00]	0.015 [0.00]
Trend^2	-3E-04 [0.00]	-3E-04 [0.00]	-3E-04 [0.00]
DUM60	0.047 [0.00]	0.048 [0.00]	0.048 [0.00]
DUM80	-	-	-
EG residual test	-3.465 [0.29]		
λ	-		
DW test	-		
JB Test	-		
BPG Test	-		

Notes: Regressand = ln(Y/L). Time period 1960 – 2009. P-values are in squares brackets. FMOLS = Fully modified OLS; CCR = Canonical cointegrating regression; DOLS = Dynamic OLS; EG = Engle-Granger t-test for cointegration; λ = factor loading in the ECM; DW = Durbin Watson test for serial correlation; JB = Jarque-Bera Normality test; BPG = Breusch-Pagan-Godfrey test. FMOLS and CCR use Newey-West automatic bandwidth selection in computing the long-run variance matrix. In the DOLS estimation leads and lags are selected according to HQ criteria. Newey-West adjusted t-statistics are reported in parentheses for DOLS estimation.

Table 3: Model 2

	FMOLS	CCR	DOLS
Intercept	-1.820 [0.00]	-1.857 [0.00]	-1.993 [0.00]
ln k	0.584 [0.00]	0.567 [0.00]	0.507 [0.00]
Trend	0.023 [0.00]	0.023 [0.00]	0.024 [0.00]
$Trend^2$	-4E-04 [0.00]	-4E-04 [0.00]	-4E-04 [0.00]
ln Trade	0.315 [0.00]	0.322 [0.00]	0.342 [0.00]
DUM60	0.047 [0.00]	0.048 [0.00]	0.048 [0.00]
DUM80	0.027 [0.00]	0.028 [0.00]	0.028 [0.00]
EG residual test	-6.144 [0.01]		
λ	-1.336 [0.00]		
DW test	2.03		
JB Test	1.563 [0.46]		
BPG Test	0.242 [0.91]		
See notes for Table 2.			

Table 4: Model 3

	FMOLS	CCR	DOLS
Intercept	-0.858 [0.09]	-0.815 [0.12]	-0.585 [0.07]
ln k	1.195 [0.00]	1.221 [0.00]	1.039 [0.00]
Trend	0.006 [0.59]	0.004 [0.72]	0.023 [0.00]
Trend^2	-2E-04 [0.00]	-2E-04 [0.00]	-2E-04 [0.00]
Schooling	0.053 [0.59]	0.060 [0.58]	-0.097 [0.07]
DUM60	0.051 [0.00]	0.052 [0.00]	0.043 [0.00]
DUM80	0.037 [0.01]	0.041 [0.01]	0.019 [0.00]
EG residual test	-3.850 [0.27]		
λ	-		
DW test	-		
JB Test	-		
BPG Test	-		
See notes for Table 2.			

Table 5: Model 4

	FMOLS	CCR	DOLS
Intercept	-1.955 [0.00]	-2.125 [0.00]	-2.545 [0.00]
ln k	0.602 [0.00]	0.588 [0.00]	0.531 [0.00]
Trend	0.019 [0.00]	0.016 [0.03]	0.009 [0.12]
Trend^2	-4E-04 [0.00]	-4E-04 [0.00]	-4E-04 [0.00]
ln Trade	0.311 [0.00]	0.327 [0.00]	0.400 [0.00]
Schooling	0.038 [0.42]	0.070 [0.29]	0.158 [0.01]
DUM60	0.031 [0.00]	0.031 [0.00]	0.030 [0.00]
DUM80	0.028 [0.00]	0.029 [0.00]	0.027 [0.00]
EG residual test	-6.194 [0.02]		
λ	-1.345 [0.00]		
DW test	2.07		
JB Test	3.432 [0.18]		
BPG Test	0.172 [0.95]		
See notes for Table 2.			

Table 6: Model 5

	FMOLS	CCR	DOLS
Intercept	-2.606 [0.00]	-2.838 [0.00]	-3.109 [0.00]
ln k	0.572 [0.00]	0.567 [0.00]	0.530 [0.00]
Trend	0.015 [0.04]	0.012 [0.08]	0.007 [0.42]
$Trend^2$	-2E-04 [0.08]	-2E-04 [0.15]	-1E-04 [0.30]
ln Trade	0.335 [0.00]	0.339 [0.00]	0.422 [0.00]
Schooling	0.249 [0.18]	0.315 [0.07]	0.458 [0.02]
$Schooling^2$	-0.018 [0.19]	-0.021 [0.11]	-0.033 [0.01]
DUM60	0.033 [0.00]	0.034 [0.00]	0.030 [0.00]
DUM80	0.025 [0.00]	0.025 [0.00]	0.023 [0.00]
EG residual test	-6.440 [0.02]		
λ	-1.315 [0.00]		
DW test	2.04		
JB Test	3.013 [0.12]		
BPG Test	0.120 [0.97]		
See notes for Table 2.			

Table 7: Model 6

	FMOLS	CCR	DOLS
Intercept	-3.651 [0.00]	-3.733 [0.00]	-3.660 [0.00]
ln k	0.589 [0.00]	0.557 [0.00]	0.533 [0.00]
ln Trade	0.370 [0.00]	0.385 [0.00]	0.438 [0.00]
Schooling	0.603 [0.00]	0.619 [0.00]	0.637 [0.00]
Schooling^2	-0.041 [0.00]	-0.042 [0.00]	-0.045 [0.00]
DUM60	0.034 [0.00]	0.034 [0.00]	0.032 [0.00]
DUM80	0.027 [0.00]	0.027 [0.00]	0.024 [0.00]
EG residual test	-6.425 [0.01]		
λ	-1.198 [0.00]		
DW test	2.00		
JB Test	2.398 [0.30]		
BPG Test	0.109 [0.98]		
See notes for Table 2.			

Our strategy is the following: we firstly estimate the long-run-relationship with the three methods. Only if all these techniques show plausible and similar results, we pass to verify the existence of the cointegrating relationship via the Engle-Granger residual test. If the test confirms its existence, we construct an ECM with the long-run relationship and we study the factor loading and the tests for correct specification (normality, absence of autocorrelation, and no heteroskedasticity in the residuals). Only if all these conditions are satisfied, we conclude that there is a cointegrating relationship.

Model 1 the coefficient for capital is above unity and is implausible. This suggests that other variables have to be added to capture the trend of output. In Model 2 we add trade openness and the results are encouraging. The three cointegrating methods show very similar results with a coefficient for the capital now plausible. The Engle-Granger cointegration test confirms the presence of this long-run relationship. The ECM shows a factor loading significance and with the expected negative sign.

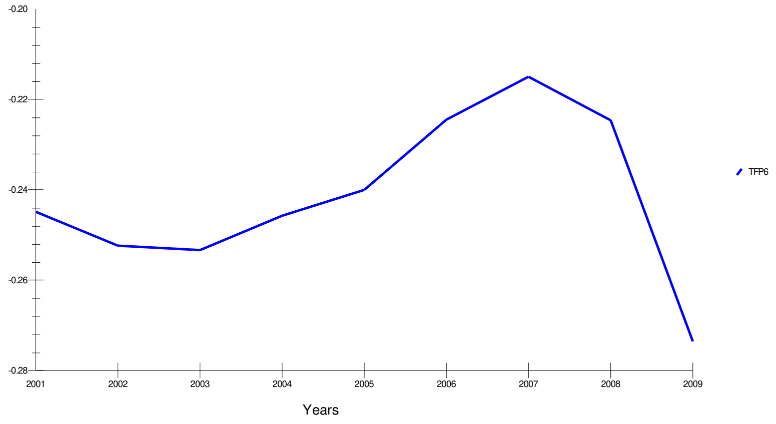
Model 3 considers the average years of education (schooling) instead of openness and the results are somewhat unsatisfactory. Model 4 considers both openness and schooling and the results are more plausible. An interesting aspect to note is that the schooling and the exogenous linear trend component seem to share some statistical properties. In CCR and FMOLS, while trend is significant, schooling is insignificant. In DOLS the opposite occurs. This means that the exogenous linear trend information could be "endogenised" by schooling. In Model 5 we check if schooling also has nonlinear effects and the results confirm this. While the coefficients of $SCHOOL^2$ and $TREND^2$ have the expected sign, they are not very statistically significant. The last experiment is to drop the two trend components and consider only SCHOOL and $SCHOOL^2$. The results are impressive. All the coefficients are statistically significant, the EG test confirms the presence of a long-run relationship and ECM is satisfactory. This is our preferred estimate and it implies that that the unobservable steady state growth rate is:

$$\Delta A = 0.603\Delta SCHOOL - 0.082\Delta SCHOOL \times SCHOOL + 0.370\Delta \ln TRADE \qquad (5)$$

Using the actual data, the unobservable SSGR of Italy is plotted in Figure 2 for the period 2001-2009. It can be seen that it has declined until 2003, then steadily increased up to 2007 and then declined again until 2009. During this period, SSGR has been negative and this explains the low growth rate of Italy. The average SSGR during this period is -0.242. To make this slightly positive at about 0.03 percent, it is necessary to double the openness of the economy from its 2001-2009 average of 0.54 to slightly more than one. It is difficult to achieve this by increasing education because of its strong and negative nonlinear effects. It is likely that SCHOOL may be capturing some nonlinear effects of other variables. Only further analysis can throw more light on the growth effects of this variable and this is beyond the scope of our paper.

Figure 2

Steady State Growth Rate of Italy 2001-2009



4. Conclusions

In this paper, we used alternative methods of estimating the long-run relationship between the growth rate and its determinants in Italy. We found that education with nonlinear effects and trade openness can adequately explain the declining trend rate of growth in Italy. However, this negative trend can be offset if trade openness of the economy is almost doubled.

Data Appendix

Y = real gross domestic product.

L = total employment.

Schooling = average years of education.

Trade = ratio of exports plus imports to GDP.

K = capital stock computed with the perpetual inventory method.

Source of data

Sample period: 1960 to 2009. Output, imports, exports, and investment data are from the database of the World Bank. Average years of education are from Barro and Lee (2010). Employment data are from OECD statistics database.

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