

Income inequality and growth: A regime-switching approach.

Nektarios Aslanidis

University of Crete
Department of Economics
University Campus
74 100, Rethymno
Greece

n.aslanidis@econ.soc.uoc.gr

February 2, 2004

Abstract

This paper explores the methodology of regime-switching in the analysis of the income inequality-economic growth relationship. The underlying idea is that when some income determinant passes a certain threshold introduces a new relationship between inequality and income and/or income determinants. There are three implications of the estimated models. First, inequality decreases with economic growth when government consumption as share of GDP is 'low'. Second, in a 'low' inflation environment government consumption increases inequality. Third, in countries with 'strict' rule of law openness to international trade and government consumption are associated with lower inequality, while financial development implies higher inequality.

Keywords: Kuznets curve, regime-switching, growth determinants, thresholds.

JEL: O11, C23.

1. Introduction

According to the Kuznets hypothesis (1955) in the early stages of economic development, income distribution tends to worsen and does not improve until countries reach middle-income status. However, the empirical evidence suggests that economic growth does not have much of an impact on inequality as income distributions do not change significantly over time (Ravallion, 1995, Deininger and Squire, 1996, 1998, Schultz, 1998 and Bruno, Ravallion and Squire, 1998). In a recent paper, Dollar and Kraay (2002) claim that economic growth generally benefits the poor as much as everyone else, and they take account of several growth determinants in the relationship between poverty and growth.

The purpose of the present paper is to explore the idea of *regime-switching* as a new methodological approach in the empirical analysis of the relationship between income inequality and economic growth. The basic idea underlying regime-switching behaviour is that when some kind of threshold is passed the economy moves to another regime, with the inequality-growth relationship being different between the old and the new regime. This framework also allows for different growth determinants to have a *differential* impact on income inequality. That is, the variables that have been identified in the literature as growth determinants such as openness to international trade, macroeconomic environment, size of government, financial development and property rights may have opposing effects on income inequality depending on the prevailing regime. Likewise, these factors may magnify or offset the effects that growth itself has on income inequality.

2. Methodology

By regime-switching behaviour we mean that the regression functions are not identical across all observations in the sample or they fall into discrete classes. One of the most prominent among the regime-switching models in the macroeconomics area has been the threshold class of models (Tong, 1983, Tong and Lim, 1980) and its smooth transition generalization (STAR models) promoted by Teräsvirta and his co-authors (Teräsvirta and Anderson, 1992, Granger and Teräsvirta, 1993). Regime-switching models are flexible enough to allow several different types of effects that could be observed in the relationship between growth and inequality. The equation of interest is the one-threshold smooth transition regression (STR) static model given by

$$GINI_{it} = \mu_i + \beta_{11}GDP_{it} + \beta_{12}OPEN_{it} + \beta_{13}GC_{it} + \beta_{14}INF_{it} + \beta_{15}FD_{it} + \beta_{16}RL_{it} +$$

$$(\beta_{21}GDP_{it} + \beta_{22}OPEN_{it} + \beta_{23}GC_{it} + \beta_{24}INF_{it} + \beta_{25}FD_{it} + \beta_{26}RL_{it})F(\gamma, c; s_{it}) + u_{it}$$

$$i = 1, \dots, N; t = 1, \dots, T \quad (1)$$

where $GINI_{it}$ is the GINI index in country i in year t , GDP_{it} is per capita GDP, $OPEN_{it}$ is exports and imports relative to GDP, GC_{it} is government consumption as share of GDP, INF_{it} is inflation, FD_{it} is a measure of financial development and RL_{it} is a measure of rule of law in country i in year t ¹. The parameter vector is $\beta \equiv (\beta_{11}, \dots, \beta_{16}, \beta_{21}, \dots, \beta_{26})'$, μ_i denotes country-specific effects and u_{it} is an *IID* error term. The function $F(\gamma, c; s_{it})$ is the transition function, which is continuous and bounded by zero and unity and s_{it} is assumed to act as the transition (switching) variable. Values of zero by the transition function identify one regime and values of unity identify the alternative. In the growth and inequality literature, this property makes it possible, for example, to derive an inverted U-shaped curve by having inequality increasing with income ($\beta_{11} > 0$) until some threshold is passed, after which inequality is reduced ($\beta_{11} + \beta_{21} < 0$). However, why such relationship exists and what are the mechanisms by which economic development improves inequality are not well known. It is possible, for example, that growth from different sources has differential impact on income inequality. Therefore, the growth determinants in the STR specification are included as regressors as well as assumed to act in turn to be the transition variable. More interestingly, it is also possible that the growth determinants have different impact on income inequality depending on the prevailing regime.

The practical applicability of the above specification depends on how F is defined. One form of transition function used in the literature is the logistic function

$$F(s_{it}; \gamma, c) = (1 + \exp(-\gamma(s_{it} - c)))^{-1}, \quad \gamma > 0 \quad (2)$$

¹ See Dollar and Kraay (2002) for more details on the data.

where the parameter c is the threshold between the two regimes or the location of the transition function, and the parameter γ determines the smoothness of the change in the value of the logistic function and thus the speed of the transition from one regime to the other. When $\gamma \rightarrow \infty$, F becomes a step function ($F = 0$ if $s_{it} \leq c$ and $F = 1$ if $s_{it} > c$), and the transition between the regimes is abrupt. In that case, the model approaches a threshold model (Hansen, 1999). Hence, the STR model nests the threshold model as a special case.

One traditional method to eliminate the individual effect μ_i is to remove individual-specific means. While straightforward in linear models, the non-linear specification (1) calls for a more careful treatment. Once we have removed individual-specific means to estimate the STR model it is computationally convenient to first concentrate on the transition function parameters. Note that giving fixed values to the parameters in the transition function makes the STR model linear in parameters. That is, conditional on the transition function, the parameters of the STR can be estimated by OLS. We first carried out a two-dimensional grid search procedure using 40 values of γ (1 to 40) and 200 equally spaced values of c within the observed range of the transition variable. Essentially, the transition variable is ordered by value, extremes are ignored by omitting the most extreme 10 values at each end and the 200 values are specified over the range of the remaining values. This procedure attempts guarantee to that the values of the transition function contains enough sample variation for each choice of γ and c . The model with the minimum RSS value from the grid search is used to provide γ and c .

We have described an algorithm to estimate a STR static model with individual-specific fixed effects. As far as the consistency of the estimator vector β is concerned we argue the following: In linear static models with individual-specific fixed effects this estimator is consistent. If we assume that the dependence on γ and c is not of first-order asymptotic importance, then inference on β can proceed as if the estimates $\hat{\gamma}$ and \hat{c} were the true values. Hence, β is asymptotically normal and conventional standard errors can be reported.

3. Empirical results

This section provides an empirical analysis of the relationship between growth and income inequality. We use the data for the GINI index, income and growth determinants used in Dollar and Kraay (2002). The sample is restricted to a set of 277 observations covering 69 countries for which at least two spaced observations on all variables are available.

The estimated STR models are presented in Table 1. A total of 5 models were estimated although here we only report the results for 3 of them, the ones that resulted significant.² When openness to international trade and financial development were considered as the potential transition variables, the estimated threshold took very extreme value, which is an indication of STR models being inadequate or the data not exhibiting significant regime-switching behaviour. As to the slope or smoothness parameter, in all models the estimated value was $\hat{\gamma}=40$, implying abrupt regime-switch model and therefore threshold specifications. Finally, the variables reported in Table 1 are significant at the 10% significance level.

In the first panel, the model employs government consumption as the transition variable. It gives a threshold of 0.145, which is about a mid-point in the distribution of the government consumption variable. The implication of this model is that inequality decreases with economic growth when government consumption as share of GDP is low ('low' government consumption regime), whereas the relationship is positive for the 'high' government consumption regime.

The next model (panel 2) assumes inflation as the transition variable. The estimates show that in a 'low' inflation environment (threshold is estimated at 0.028) government consumption implies higher inequality, but in a 'normal-to-high' inflation environment government consumption is associated with an improvement in inequality.

Even more intuitive seems the model in the third panel with the rule of law as the switching variable. In countries with 'strict' rule of law openness to international trade and government consumption are associated with lower inequality, while financial development implies higher inequality in this class of countries. As to the countries where the rule of law is lax the results show that government consumption

² Results are available from the author upon request.

increases income inequality, whereas the other growth determinants do not result significant.

These findings constitute reasonable evidence in support of a two-regime specification in the analysis of the relationship between growth and income inequality. Thus this study re-addresses the Kuznets curve from a different angle. By using regime-switching models, not only are we able to test the Kuznets curve directly but we can also examine the mechanisms by which economic development improves inequality.

4. Concluding remarks

In this paper we explore a new methodological approach to testing the validity of the Kuznets curve: a regime-switching model. The underlying idea is that as some income determinant passes a certain threshold a new relationship between inequality and income and/or income determinants emerges. This econometric technique yields results that provide new insights on the mechanisms by which economic development affects inequality. In particular, our findings show that inequality decreases with economic growth when government consumption as share of GDP is 'low', whereas it increases when government consumption is 'high'. Second, in a 'low' inflation environment government consumption increases inequality, but in a 'normal-to-high' inflation environment government consumption is associated with an improvement in inequality. Third, in countries with 'strict' rule of law openness to international trade and government consumption are associated with lower inequality, while financial development implies higher inequality.

Table 1: Fixed-country effects STR models

<p>$GINI = -0.193*GDP + (0.222*GDP)*F(GC)$, the transition variable is government consumption (-2.275) (2.405)</p> <p><u>Classification of regimes</u></p> <p>$GINI = -0.193*GDP$, when $GC \leq 0.145$ 'low' government consumption (163 obs) $GINI = 0.029*GDP$, when $GC > 0.145$ 'high' government consumption (114 obs) $R-sq = 0.0538$</p>
<p>$GINI = 2.542*GC - (3.083*GC)*F(INF)$, the transition variable is inflation (-2.780) (-3.161)</p> <p><u>Classification of regimes</u></p> <p>$GINI = 2.542*GC$, when $INF \leq 0.028$ 'low' inflation (29 obs) $GINI = -0.541*GC$, when $INF > 0.028$ 'normal-to-high' inflation (248 obs) $R-sq = 0.0796$</p>
<p>$GINI = 0.680*GC + (-0.424*OPEN - 1.841*GC + 0.550*FD)*F(RL)$, the transition variable is rule of law (1.671) (-1.759) (-2.865) (3.059)</p> <p><u>Classification of regimes</u></p> <p>$GINI = 0.680*GC$, when $RL \leq 0.751$ 'lax' rule of law (161 obs) $GINI = -0.424*OPEN - 1.161*GC + 0.550*FD$, when $RL > 0.751$ 'strict' rule of law (116 obs) $R-sq = 0.1039$</p>

Notes: All the estimated slope parameters are large, implying threshold specifications; values in parentheses are *t*-ratios; all the variables estimated are significant at the 10% significance level.

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