# INSTABILITY OF ECONOMIC GROWTH IN THE COURSE OF TRANSITION

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**Abstract**

In the conventional growth literature, long - run economic growth is usually described as a relatively steady pattern (single long –run trend) characterized by business cycles (short-run variations) around it. However, in this paper, we argue that this growth description that fits well developed countries' growth paths does not accommodate well the economic growth paths observed in transition economies. Namely, the hypothesis tested in this paper is that the economic growth in the course of transition is characterized by breaks in the growth pattern. These breaks create a specific broken growth line instead of a single long-run growth trend.

In order to test this assumption, the real data on GDP growth rates for 28 transition countries are observed. In addition, the univariate analysis for identifying structural breaks that is Perron's version of the Augmented Dickey Fuller (ADF) test is applied in order to capture huge shifts in macroeconomic growth paths during transition, mainly related to the huge structural changes. Indeed, the empirical results confirm the suspicion of the broken GDP growth paths in the course of transition for most of the tested countries. This finding could alter the complete understanding of the growth process in the course of transition, not only when applying growth theory to, but also when undertaking growth empiric in the course of transition.

**Keywords:** Economic growth, transition economies, univariate analysis, ADF test

## Introduction

In general, until recently, the macro phenomenon of growth path was divided only into "trend" and "cycle" movements (Pritchett, 2000). While on one side are the business cycle studies exploring business cycle fluctuations, which involve voluntary reallocations

of factors, including labor supply that have little or no welfare consequences in the long run; on the other side are growth studies focused on long-run growth trend displaying itself as gradual changes and adjustments in the economy with major implications on the standards of living in the long run. Only lately growth literature started to look in between those two components, searching for more appropriate explanations and methods of investigation for the real growth patterns observed in developing and transition economies in that matter.

In particular, when developing/transition countries growth paths are observed several questions arise– what happens if one economy is hit by huge shocks, different from the one occurring in a business cycle that eventually changes not only the growth rate, but also its steady-state GDP level? Are these transitional shocks significant? It appears that once the world of highly developed countries is left, these shocks are rather the rule than the exception. Namely, Pritchett (2000) noticed that almost nothing that is true about per capita GDP for the developed countries is true for developing or transition countries. Namely, he argued that in developing (or transition countries) growth is characterized by great instability (or breaks) over time, relative to both average levels of growth and to cross-sectional variance. Hence, he argued that growth in the latter groups can be better depicted by shifts in growth regimes instead of variation around a single trend.

Even earlier, in the early nineties, Easterly et al. (1993) discussed the instability of growth and its causal relation with sudden shocks, which they believed are ignored in growth theoretical and empirical literature. They found out that the country specific shocks are hugely important for the medium-term growth of each country and hence they proposed growth studies to be focused on the analysis of growth within individual countries. Namely, Easterly et al. (1993) showed that correlation of growth across decades (1960-70 and 1970-80) *within* countries is very low – averaging from 0.1 to 0.3 in a worldwide sample of 115 countries. The possible explanation for the *low persistence of growth rates* is *the role of shocks* in growth shifts, such as the terms of trade, external transfers, war related causalities and the presence of a debt crisis. More precisely, they argued that shocks are important over decade-long periods, since they influence "policy" variables and thus estimates of the impact of policies. The main implication of their study was that most of the variation in growth comes *within* individual countries, rather than across countries.

In a similar manner, stressing the instability of growth in developing countries, Aquiar and Gopinath (2004) claim that the "cycle" is a trend for emerging economies. They analyzed the business cycle in emerging markets, validating its uniqueness in the sense that shocks to trend are the primary source of fluctuations in these markets rather than transitory fluctuations around a stable trend. Along the similar lines, Ben-David and Papell (1998) identify a statistically significant single structural break in the growth series for 54 countries out of a set of 74 countries from 1955 to 1990. Beginning with the scan of output (in levels) defined as the logarithm of real GDP per capita they used Perron's (1994) technique to identify structural breaks in the data series. The algorithm actually identified structural break on purely statistical grounds and the unit root null was rejected in 20 countries in their sample. Additionally, they applied the test in first differences in the series in which unit root could not be rejected. Finally they found 54 countries in total in which structural break was statistically significant either in levels or rate analysis. In most of the cases they found that the brakes were followed by growth slowdowns.

All these studies in fact convey the idea that growth might have another dimension or component, which is not extensively discussed in the literature and which is mostly related to the stylized facts of growth observed in developing/emerging/or transition countries. Hence, the main goal in the next section is to offer consideration of the stylized facts of growth in the course of transition. The data used are the annual real GDP growth rates for 28[1] transition countries borrowed by the World Development Indicators. In addition, the countries under analysis are grouped in the familiar regional groups: Central Eastern European Countries (CEECs) and Baltic Countries that entered the EU in 2004, "Three CEECs" that accessed EU in 2007 such as Bulgaria and Romania, Croatia included; South Eastern European Countries (SEECs) and Commonwealth of Independent States (CISs[2]).

[1] For some countries the data series are too short for the empirical analysis, such as B&H, Kosovo, Serbia and Montenegro. Hence, these countries will be partially included in the analysis.

[2] For better visibility, group of CISs is divided into two groups in the graphs.

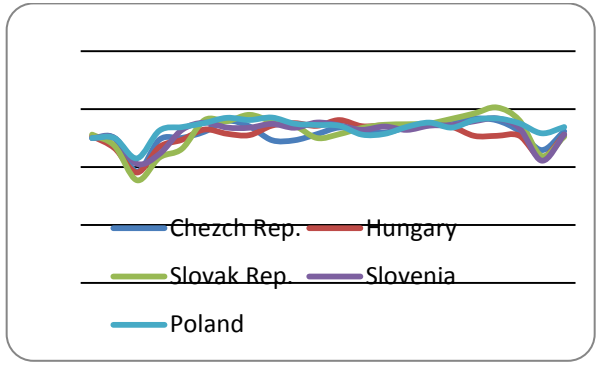
**Stylized facts of GDP growth rates in transition**

The Figure 1 below gives the GDP growth paths of the transition countries. When the GDP growth paths for transition countries are observed several observations can be made:

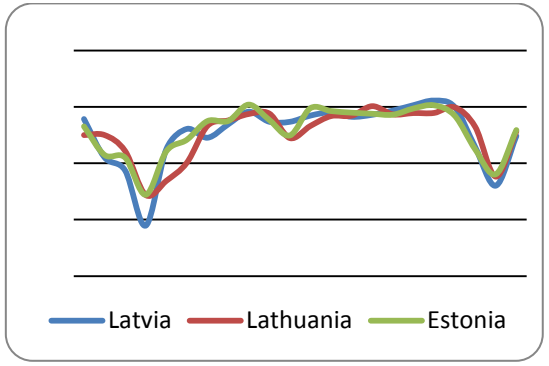
- All transition countries have experienced breaks in the GDP growth patterns. Namely,
    - CEECs experienced mainly 2 big breaks: at the beginning of transition and as a result of the Global Financial Crisis (Figure 1.a));
    - Baltic Countries and the "Three CEECs" experienced mainly three breaks (all except Latvia): at the beginning of transition, in middle transition and at the end of the research period as a result of the Global Financial Crisis (Figure 1.b) and c))
    - Rest three groups are also characterized by breaking GDP growth paths. However, their growth paths are falling into negative values several times, such as in the cases of Serbia, Kyrgyz Republic, Russia, and Moldova; or rising up significantly such as in the case of Azerbaijan and Turkmenistan.
- The breaks are less pronounced in the first three groups (Figure 1 a), b), and c)) with falls being smaller and shorter as compared to the falls experienced in the last three groups (Figure 1 d), e) and f)).
- Finally, it should be noted that there is much less diversity among the countries within the first three groups (Figure 1. a), b), and c)) with respect to the patterns and the size of changes in GDP growth rates. In opposite, the diversity is much more pronounced in the last three groups of transition countries (Figure 1.d), e) and f)).

**Figure 1.** GDP Growth rate patterns in various transition countries (grouped in various groups) (1990- 2010, in percent)

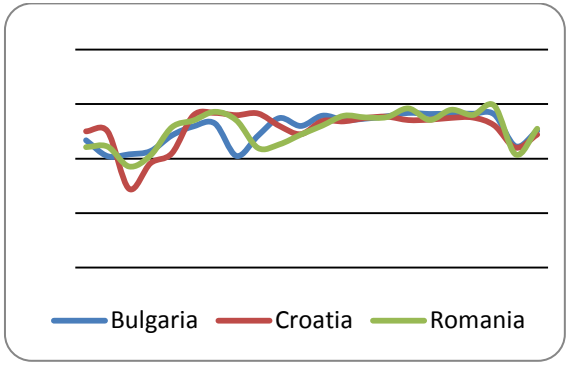
*a) CEECs*



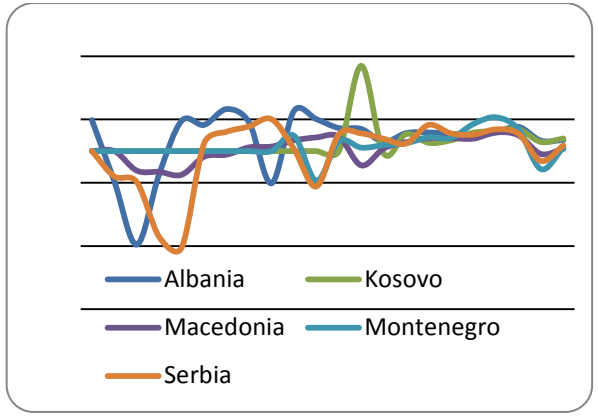

*b) Baltic Countries*



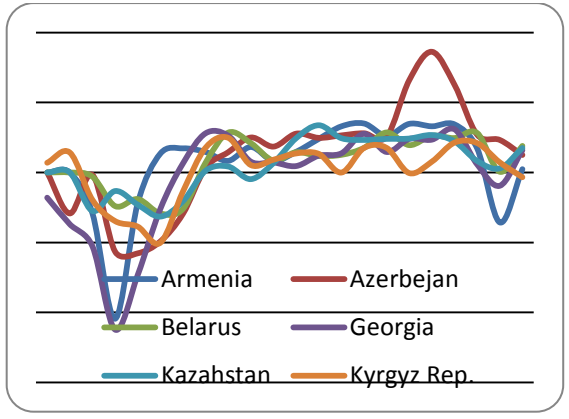

*c) Three CEECs – Romania, Bulgaria Croatia*



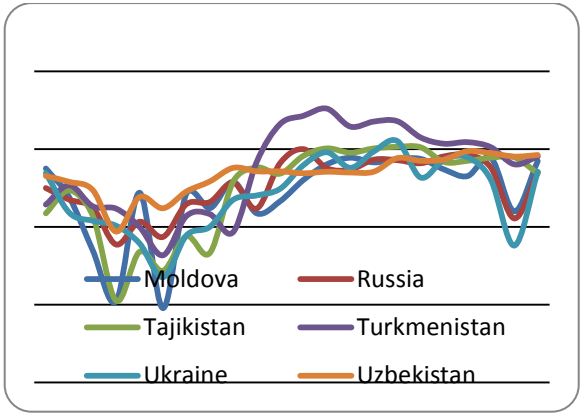

*d) SEECs*




*e) CISs (part I)*




*f) CISs (part II)*



The figures accompanied by the observations shed some new light on the transition process itself. They suggest that transition is not a simple linear growth process, but a process characterized by strong switches in the main growth indicator. In turn, this needs special attention when applying growth theory to, or undertaking growth empiric on, the course of transition. Hence, the main goal of the next section is to provide a set of non-standard statistics characterizing the evolution of GDP for transition countries, with particular emphasis on going beyond average growth rates to instability in growth rates. To motivate the use of the univariate analysis of structural breaks, firstly the simple test for fitting a single time trend through the GDP annual growth rates over the period 1990-2010 is performed.

**Assessment of instability of growth in transition countries**

The definition of instability is borrowed from Pritchett (2000) where it is defined as shifts in growth trend. In order to analyze it in the case of transition countries two main procedures are applied.

- Testing for a single time trend through GDP Growth rate; and
- Identifying the possible shifts in growth rates using Perron's version of the augmented ADF test.

The annual data on GDP growth rates[3] or GDP (in constant 2000 U.S. dollars) used in the analyses are taken from the World Bank (2012) data series. The former is used for conducting the first test, while the latter data series are used for the second test.

**Testing for a single time trend through GDP Growth Rate**

Following Pritchett's example (2000) the main goal of this section is to test how much of the series behavior of the growth rates in transition countries is "just a trend". Hence, the following equation is used.

$$\overset{*}{y}_t = \hat{\alpha}_0 + \hat{\beta}_t + \hat{e}_t \qquad \text{Equation 1}$$

Where $\overset{*}{y}$ is the dependent variable (GDP growth rate), $\hat{\alpha}_0$ is the constant, $\hat{\beta}_t$ is a deterministic time trend and $\hat{e}_t$ is the error term. In economic terms, the variables from the equation take different meanings: a significant constant in this model indicates the average

[3]The long deffinition of the data series is given in World Development Indicators.

growth rate at the beginning of transition, while a significant positive trend indicates a continuous increase in the growth rate.

As mentioned, the idea is to see how much of the behavior of the growth rates fits the trend line. Due to space limitation, the full regression results on every individual country are not present, however they are available from the author on demand. The following Table 1 summarizes the results of each individual country, together with the aggregated averaged results for the five identified groups of transition countries: the CEECs; Three CEESs (Romania+Bulgaria+Croatia); Baltic Countries; SEECs and CISs. In the columns various estimated coefficients are presented, accompanied by the p-value in parentheses. While significant constant coefficient (column 1) presents the growth rate at the beginning of transition, a significant trend coefficient (column 2) should represent a constant change in the growth rate. Columns (3) and (4) give the mean value of the growth rate in each country and its standard error, while column (5) gives the R-squared i.e. the measure of goodness of fit of the regression.

**Table 1.** Fitting a single trend through GDP growth rates

| Country | Constant term (in percent, $\alpha_0$)(p-value) (1) | Trend Coefficient (in percent, $\beta_t$) (p-value) (2) | Mean (in percent)($\overset{*}{y}_t$) (3) | SE(Y) (in percent) (4) | R2 (5) |
|---|---|---|---|---|---|
| Czech Rep. | -4.70(0.1980) | 0.32 (0.0728)*** | 1.77 | 4.33 | 0.18 |
| Hungary | -2.84(0.3803) | 0.20(0.2011) | 1.17 | 4.28 | 0.08 |
| Poland | 0.79(0.7877) | 0.15(0.2836) | 3.89 | 3.30 | 0.07 |
| Slovak Rep. | -4.90(0.2938) | 0.35(0.1255) | 2.06 | 6.26 | 0.12 |
| Slovenia | -0.35(0.8893) | 0.16(0.4364) | 1.37 | 5.42 | 0.03 |
| CEECs | -2.40 | 0.24 | 2.05 | 4.72 | 0.10 |
| Bulgaria | -11.98(0.0041)* | 0.65(0.0019)* | 0.77 | 5.94 | 0.42 |
| Croatia | -5.34(0.1529) | 0.57(0.0665)*** | 0.93 | 7.47 | 0.18 |
| Romania | -9.65(0.0445)** | 0.55(0.0219)** | 1.10 | 6.41 | 0.26 |
| Three CEECs | -8.99 | 0.59 | 0.93 | 6.61 | 0.29 |
| Latvia | -14.12(0.1075) | 0.76(0.0815)*** | 0.63 | 11.22 | 0.16 |
| Lithuania | -8.33(0.3396) | 0.40(0.3296) | -0.14 | 10.29 | 0.05 |
| Estonia | -4.70(0.5190) | 0.28(0.4260) | 0.87 | 9.42 | 0.03 |
| Baltic Countries | -9.05 | 0.48 | 0.45 | 10.31 | 0.08 |
| Macedonia | -9.70(0.0026)* | 0.52(0.0011)* | 0.69 | 4.25 | 0.47 |
| Albania | -8.67(0.2347) | 0.59(0.0998)*** | 3.03 | 9.84 | 0.14 |
| Serbia | -11.32(0.0242)** | 1.01(0.0167)** | -0.68 | 11.35 | 0.28 |
| SEECs4 | -9.90 | 0.71 | 1.01 | 8.48 | 0.30 |
| Azerbaijan | -35.08(0.0001)* | 2.15(0.0001)* | 4.70 | 15.79 | 0.65 |
| Armenia | -9.20(0.1969) | 1.07(0.0712)*** | 2.60 | 14.28 | 0.18 |
| Belarus | -7.49(0.0199)** | 0.97(0.0008)* | 3.18 | 7.76 | 0.50 |

[4] Kosovo and Montenegro are not included due to the short length of their data series.

| | | | | | |
|---|---|---|---|---|---|
| Georgia | -33.73(0.0023)* | 1.65(0.0024)* | -1.57 | 15.26 | 0.41 |
| Moldova | -25.05(0.0029)* | 1.16(0.0044)* | -2.39 | 11.30 | 0.37 |
| Kyrgyz | -15.23(0.0180)** | 0.81(0.0112)** | 0.64 | 8.68 | 0.31 |
| Kazakhstan | -22.00(0.0007)* | 1.10(0.0002)* | 2.24 | 8.27 | 0.56 |
| Russian Fed. | -17.25(0.0039)* | 0.82(0.0027)* | 0.28 | 7.61 | 0.40 |
| Ukraine | -13.81(0.0074)* | 0.93(0.0121)** | -2.21 | 9.99 | 0.30 |
| Tajikistan | -29.12(0.0005)* | 1.46(0.0004)* | -0.58 | 12.11 | 0.51 |
| Uzbekistan | -4.35(0.0066)* | 0.71(0.0000)* | 3.09 | 5.14 | 0.67 |
| Turkmenistan | -9.18(0.0374)** | 1.38(0.0008)* | 5.26 | 11.81 | 0.47 |
| CISs | -18.46 | 1.18 | 1.27 | 10.67 | 0.44 |

Notes: * - indicates significant at the 1% level, ** - indicates significant at the 5% level, and ***-indicates significant at the 10% level of significance.

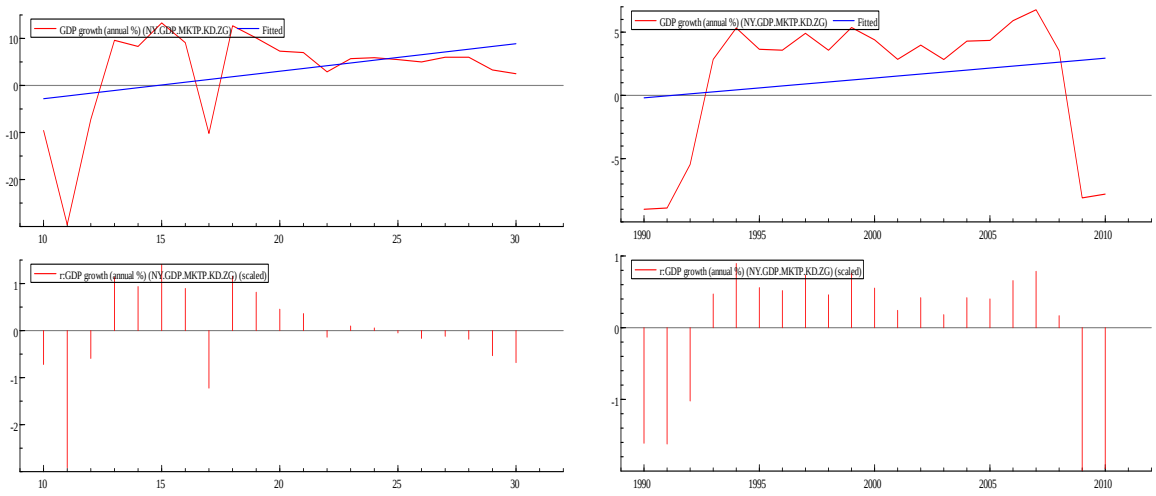
Column (5) is of interest as it shows the R-squared of fitting a single time trend through growth rates ($\overset{*}{y}_t$) or it shows how mucbehaviortime series behaviour of GDP growth rates is "just the trend". For most of the countries, the R-squared is very low. In fact, only two countries - Azerbaijan and Uzbekistan - have an R-squared above 0.65[5], suggesting that for transition countries, “growth” is not just the trend. However, the interpretation of the low R-squared is complicated, as it involves both the deviations from the trend and their magnitude, which represents the volatility of growth and possible structural breaks in the data or the instability of growth. Hence, the possible instability in the series is mixed with the potential volatility of the data series. Finally, a glance at the results in column 5 (with all the successful transition countries recording the lowest R-squared), indicates that “successful” countries with rather stable growth rates in latter transition tend to record a bad fit onto the tested trend line. In addition, the constant and trend coefficients in the case of these countries mainly are not statistically significant, suggesting that this regression is a weak representation of the data generating process of GDP growth of these countries. [6]

In general, the results offered in Table 1 are inconclusive. The interpretations of the R-squared are ambiguous, suggesting that this basic starting regression trial has weak statistical relevance. In addition, the estimated regressions do not allow for differentiating between the possible instability and volatility in the growth rate series. For example, in the following graphs (top ones) annual GDP growth rate dynamics for Albania and Slovenia are presented. On y-axis GDP growth rates are given for the whole course of transition. It can be easily observed that

[5] Even this value of R- squared of 0.65 that is taken arbitrary means relatively low fit of the trend line.
[6] Some interesting observations emerge from the estimated coefficients for the countries, as well as for the countries’ groups. However, these are not the focus of the analysis and are left for some future analysis.

there are three breaks in the data series in the course of transition in Albania: at the beginning, in the middle and at the end of the research period. This situation is observable for most of the countries. In Slovenia, two main breaks can be noticed: at the beginning of transition and the end of the research period.

**Figure 2** Annual GDP growth rate dynamics for Albania (left) and Slovenia (right)




Note: Since the graphs are from the original software printouts, the second graph that gives the scaled residuals could not be excluded. In addition, the scale on the y-axis is different; hence the note of caution should be preserved when comparing the top two graphs.

For example, Albania's average annual growth rate from 1990-2008 is 3.03 per cent; which includes both its high positive annual growth rate from 1993 to 2008 as well as the sudden drops of -30 per cent from 1990-1992 and of -10 per cent in 1997.Is Albania's experience similar to that of Slovenia, for example, that recorded a sudden drop of -7.14 per cent annually at the start of transition till 1993 and afterwards experienced a more modest average annual growth of 4.11 per cent as compared to 6.56 per cent in Albania? Ignoring this break, the average annual growth rate of Slovenia for the whole period was only 1.37 per cent, lower than the average annual growth rate of Albania of 3.03 per cent. Additionally, Slovenia recorded much lower variability in the growth rates of 5.42 percentage points while Albania's standard error is 9.84 percentage points.

Similar comparisons suggest that the average annual growth rates can mask the real processes in the course of transition and so disguise the instability recorded in each country.

Hence, in the following section, the focus will be on the further appraisal of the instability of growth rates.

**Univariate analysis**

This section gives the statistics on the instability of growth, i.e. on shift changes in the level of the growth rates within a country. The idea in this section is to identify if there are some structural breaks in the data series. Perron's version of the Augmented Dickey Fuller test was used in order to test for the presence or absence of unit roots in macroeconomic time series, conditional on the presence of a deterministic trend and trend breaks, which should help to identify some features of the underlying data-generating process of each series. For the testing procedure the dependent variable is the first difference of log GDP that approximates the growth rate[7], while the data used is GDP (in constant US dollars) as mentioned above.

**The method used – Perron's modified augmented Dickey-Fuller Unit Root Test**

The theme of univariate analysis of time series has gained an increasing amount of attention in terms of theoretical and applied research over the last three decades, starting with the seminal work by Perron (1989). Following his argument that most macroeconomic time series are characterized by deterministic trends broken by large shocks that determine one country long-run growth, this section aims to identify similar structural breaks in data series in transition countries by using a univariate analysis approach and the Equation 2 given below[8].

In the case of transition countries, for each growth regime shift there is usually an easily identifiable turning point after which growth behaves differently. Moreover, many of the turning points for various transition countries can be easily related to the changes undertaken in the countries or to recent historical facts, which are well known.[9] These informed the choice of structural break points to be investigated. The question to follow is whether the shocks observed in historical facts can be classified as major, thereby affecting subsequent growth in transition countries. Accordingly, the strategy is to use Perron's modified augmented Dickey- Fuller Tests to test for a unit root in data series conditional on the presence of trends and structural breaks.

[7] In equation, the equivalence can be written as: $y_t^* = \Delta(\ln y_t)$.

[8] Due to space limitations, the results for each country are not included, though can be obtained from the author.

[9] The hystorical facts can be checked from CIA fact.

However, before interpreting the results, it should be noted again that the results are only indicative, for several reasons.

- Firstly, this test is asymptotic and so requires a large sample for implementation; hence, the results will be considered as suggestive only.
- Secondly, the break points are assumed in advance, based on the historical facts and knowledge, however this may not represent the reality the best.
- Additionally, the countries for which the unit root could not be rejected are not taken into consideration when drawing general conclusions, for the reason that in those cases the critical values on the coefficients change and are not relevant anymore (the relevant countries are marked in light gray in Table 2).

Following Pritchett (2000) and Perron (1989), Perron's model C is estimated to test for a unit root. The equation tested is:

$$\Delta(\ln y)_t = \hat{u} + \hat{\theta}DU_t + \hat{\beta}_t + \hat{\gamma}DT_t + \hat{d}D(TB)_t + \hat{\beta}_1 y_{t-1} + \sum_{i=1}^{k} \hat{c}_i \Delta y_{t-i} + \hat{e}_t \quad \textbf{Equation 2}$$

where $\hat{u}$ is the constant or estimated drift term, $\hat{\beta}_t$ is a deterministic time trend, $y_{t-1}$the first lag of the level of the left-hand side variable and $\Delta y_{t-1}$lagged differences to ensure that the residual $e_t$ is free of autocorrelation. The equation take into account the existence of three kinds of structural breaks, where *TB* is the break date: a "crash" effect, which allows for a break in the level (or intercept) of the series, such that the crash dummy *(DTB)* = 1 if *t = TB* +1, and zero otherwise; the intercept dummy *DUt* allows for a once-and-for-all change in the level, such that *DUt =1* if (*t >TB)* and zero otherwise; the slope dummy *DTt* represents a trend "shift", which allows for a once-and-for-all break in the slope (or the rate of growth) of the trend function, such that *DT = t-TB* (or *DTt= t* if *t > TB*) and zero otherwise. The model has a unit root with a break under the null hypothesis, as the dummy variables are incorporated in the regression under the null. The alternative hypothesis is a broken trend stationary process. The results with respect to the presence of a unit root in the data are given in Table 2. The coefficients are estimated by OLS regression using Microfit. For the coefficient $\beta_1$(column 7 in the table), for which T-Ratio and p-value are reported, the t-statistic is compared to the critical values given in Perron's tables (Perron, 1989, p.1377), having deciding first the size of the test, which is taken to be the 10% level of significance, and the time break relative to the total sample size. If t-statistic < critical value, the unit root can be rejected. In the table non-significant coefficients are marked with

darker gray, while the coefficients for the cases where the unit root was not rejected are not marked for significance at all, since they are not valid (in those cases the countries are marked in light gray, as for example Estonia, Armenia, Azerbaijan, Belarus and Kazakhstan). Given that, critical values are non-standard in the presence of a unit root, these countries and their results are not included in the further analysis. However, in cases where the unit root null is rejected, then the usual (standard) critical values are used. Hence, in these cases the estimated coefficients and their appropriate p-values in parentheses are presented for further comment.

In Table 2 each row presents one country. The columns (2-7) give the appropriate estimated coefficients with the p-values in parentheses, with the first column (1) giving the turning points tested, column (8) the R-squared of the estimated regression, column (9) the diagnostic test brief description, and final column (10) the judgment as to whether the assumption of unit root is/or is not rejected.

**The results**

Generally speaking, three main conclusions can be made:

- Namely, when implementing Perron's modified augmented Dickey-Fuller Test on the real growth rate data, 21 broken trend stationary processes can be detected in 26 countries that have at least 19 years of World Bank (2011) data. Examination of the test results given in the tables above reveals large shifts in growth rates[10]. These large shifts in growth rates in all countries suggest that the GDP growth rate path is not, in general, well characterized by a single deterministic trend.
- In addition, thirteen out of 21 countries, for which the unit root null was rejected, is characterized by statistically insignificant "crash" effects. This implies that the GDP growth rate changes were much more profound than single-period effects, playing out mainly through a more persistent level and/or trend changes in economic activity.
- Finally, growth rate effects after the break point in those 21 countries for which unit root was rejected are dually-combined, consisting of significant estimated coefficients measuring level (constant) and trend, accompanied by the appropriate significant interactive terms, such as level break dummy and trend break dummy. While the sum of the estimated coefficient on constant plus level break dummy represents the combined level change effect

[10]Below, a more extensive comparison of the plots and test results for three representative countries is given explaining how the analysis has been conducted (see Figure 3 and Table 3).

after the break, the sum of the estimated coefficient on trend plus trend break dummy represents the combined trend change effect after the break in the data series. Depending on the sign and the size of the estimated coefficients and their appropriate interactive terms, the combined effects in level and trend after the break can be described as mainly positive or negative. We shall return to this point later when different groups of countries are discussed.

**Table 2 -** Testing for the break in the data series

| Country | Dependent variable is the first difference of ln GDP per capita (growth rate) $\Delta y_t = \hat{u} + \hat{\theta} DU_t + \hat{\beta}_t + \hat{\gamma} DT_t + \hat{d} D(TB)_t + \hat{\beta}_1 y_{t-1} + \sum_{i=1}^{k} \hat{c}_i \Delta y_{t-i} + \hat{e}_t$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Turning point tested (1) | Constant (2) | Trend (3) | $\hat{\theta}$( $DU_t$ level effect) (4) | $\hat{\gamma}$( $DT_t$ trend effect) (5) | $\hat{d}(D(TB)_t$ crash effect) (6) | $\hat{\beta}_1 y_{t-1}$ (T-ratio, p-value) (7) | R2 (8) | Diag. tests (9) | Hypothesis: Unit root rejected/not rejected (10) |
| Czech Rep. | 1997 | 4.65[.000]* | .03[.000]* | -.05[.179] | -.00[.380] | .03[.098]** | -5.5607[.000]* | .93 | All fine. | Unit root can be rejected |
| Hungary (2 lags) | 1995 | 6.25[.005]* | -.06[.073]*** | -.39[.037]** | .08[.037]** | .04[.053]*** | -3.5464[.005]* | .83 | Func. form | Unit root can be rejected |
| Poland | 2001 | 6.22[.000]* | .039[.000]* | -.05 [.061]*** | -.001[.361] | .031[.018]** | -11.7351[.000]* | .95 | All fine | Unit root can be rejected |
| Slovak Rep. | 1999 | 3.67[.000]* | .030[.000]* | -.09 [.072]*** | -.50[.914] | .023[.307] | -6.5435[.000]* | .95 | All fine | Unit root can be rejected |
| Slovenia | 1993 | 4.84[.078]*** | -.006[.808] | -.036[.787] | .027[.474] | .003[.759] | -1.99[.069]*** | .96 | All fine | Unit root can be rejected (border line) |
| Bulgaria | 1996 | 4.73[.000]* | .013[.030]** | -.29[.002]* | .02 [.035]** | .02[.318] | -5.7109[.000]* | .96 | Fun. form | Unit root can be rejected |
| Croatia | 2000 | 3.12[.003]* | .03[.000]* | .10[.207] | -.02[.078]*** | -.054[.178] | -3.9549[.002]* | .88 | | Unit root can be rejected |
| Romania | 1999 (93-08) | 5.40[.000]* | -.001[.727] | -.43[.001]* | .039[.000]* | .047[.196] | -5.4638[.000]* | .85 | All fine | Unit root can be rejected |
| Estonia | 1999 | -.36[.010] | .057[.008] | -.063[.004] | .547[.004] | -.108[.134] | -.83402[.422] | .73 | Func. form | Unit root can NOT be rejected |
| Latvia | 1993 | 5.05[.017]** | -.31[.000]* | -.94 [.005]* | .35[.000]* | .018[.751] | -2.59[.024]** | .94 | All fine | Unit root can be rejected |
| Lithuania | 1994 | 5.11[.024]** | -.13[.004]* | -.67[.034]** | .17[.005]* | -.035[.540] | -2.57[.025]** | .92 | Func. form | Unit root can be rejected |

| Country | | Dependent variable is the first difference of ln GDP per capita (growth rate) $\Delta y_t = \hat{u} + \hat{\theta} DU_t + \hat{\beta}_t + \hat{\gamma} DT_t + \hat{d} D(TB)_t + \hat{\beta}_1 y_{t-1} + \sum_{i=1}^{k} \hat{c}_i \Delta y_{t-i} + \hat{e}_t$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Turning point tested (1) | Constant (2) | Trend (3) | $\hat{\theta}$( $DU_t$ level effect) (4) | $\hat{\gamma}$( $DT_t$ trend effect) (5) | $\hat{d}(D(TB)_t$ crash effect) (6) | $\hat{\beta}_1 y_{t-1}$ (T-ratio, p-value) (7) | $R^2$ (8) | Diag. tests (9) | Hypothesis: Unit root rejected/not rejected (10) |
| Armenia | 1993 | 1.58[.131] | -.42[.000] | -.81 [.002] | .43[.000] | -.11 [.025] | -.90728[.382] | .98 | Fun. form | Unit root can NOT be rejected |
| Azerbaijan | 1995 | 2.12[.114] | -.11[.016] | -.65 [.087] | .15 [.013] | -.05[.617] | -1.6925[.116] | .89 | All fine | Unit root can NOT be rejected |
| Belarus | 1996 | 2.53[.189] | -.044[.035] | -.28[.267] | .067[.062] | -.02[.476] | -1.3954[.188] | .93 | Fun. form | Unit root can NOT be rejected |
| Kazakhstan | 2000 | .44[.801] | .015[.262] | .266[.364] | -.017[.582] | -.08[.055] | -.35037[.732] | .89 | All fine | Unit root can NOT be rejected |
| Macedonia | 2000 | 1.275[.134] | .011[.004]* | -.12[.077]*** | .003[.498] | .075[.003]* | -1.75[.105]*** | .91 | Fun. form | Unit root can be rejected (border) |
| Serbia | 1999 (93-08) | 7.21[.000]* | .06[.000]* | -.14[.039]** | -.014[.029]** | -.002[.921] | -16.228[.000]* | .99 | All fine | Unit root can be rejected |
| Albania | 1997 | 5.03[.000]* | .07[.000]* | .26 [.000]* | -.04[.000]* | -.14[.000]* | -15.5541[.000]* | .98 | All fine. | Unit root can be rejected |
| Russian Federation | 1998 | 8.65[.003]* | -.08 [.007]* | -1.13 [.005]* | .15[.003]* | .11[.032]** | -3.8413[.002]* | .91 | All fine | Unit root can be rejected |
| Turkmenistan | 1997 | 3.40[.003]* | -.05[.013]** | -.69[.023]** | .094[.006]* | -.099[.111] | -3.9278[.002]* | .96 | All fine | Unit root can be rejected |
| Uzbekistan | 1995 (2lags) | .393[.422] | .09[.000]* | .33[.001]* | -.08[.000]* | -.04[.045]** | -1.7607[.106] *** | .97 | All fine | Unit root can be rejected(border) |
| Georgia | 1995 | 2.12[.232] | .17[.021]** | .53[.265] | -.14[.069]*** | .033[.742] | -2.073[.062]*** | .98 | All fine | Unit root can be rejected |
| Kyrgyz Rep. | 1995 | 6.80[.013]** | -.16[.003]* | -.96[.018]** | .18[.004]* | -.047[.178] | -2.933[.013] ** | .95 | All fine | Unit root can be rejected |
| Moldova | 1993 | 3.96[.000]* | -.25[.005]* | -.99[.001]* | .27[.002]* | .32[.000]* | -5.5668[.000]* | .91 | Func. form | Unit root can be rejected |
| Tajikistan | 1997 (92-08) | 6.43[.001]* | -.15[.003]* | -1.5[.004]* | .21[.002]* | .033[.310] | -4.8451[.001]* | .98 | All fine | Unit root can be rejected |
| Ukraine | 1995 | 3.74[.001]* | -.10[.000]* | -.75[.000]* | .13[.000]* | .060[.258] | -4.2800[.001]* | .94 | All fine | Unit root can be rejected |

Notes: * - indicates significant at the 1% level, ** - indicates significant at 5%level, and ***-indicates significant at the 10% level of significance. In addition, column 9 in each table gives short description of diagnostic tests: “All fine” is used to mark estimations for which all diagnostic tests were fine, while “Func.form” marks the cases where problems with Functional form test were identified. (Estonia, Armenia, Azerbaijan, Belarus and Kazakhstan are the countries for which the unit root null was not rejected).

**Discussion on instability of growth**

When various regional transition groups are observed separately, some additional assertions can be made. In the following example, one representative country for three transition groups (CEEC, SEEC and CIS group) is presented, comparing the plots of the GDP growth rates and the test results of the Perron (1989) modified augmented Dickey-Fuller Test.

**Figure 3.** Comparison of results and plots of the GDP growth rates in three countries

**a) Czech Republic (CEE country)** **b) Macedonia (SEE country)** **c) Tajikistan (CIS country)**

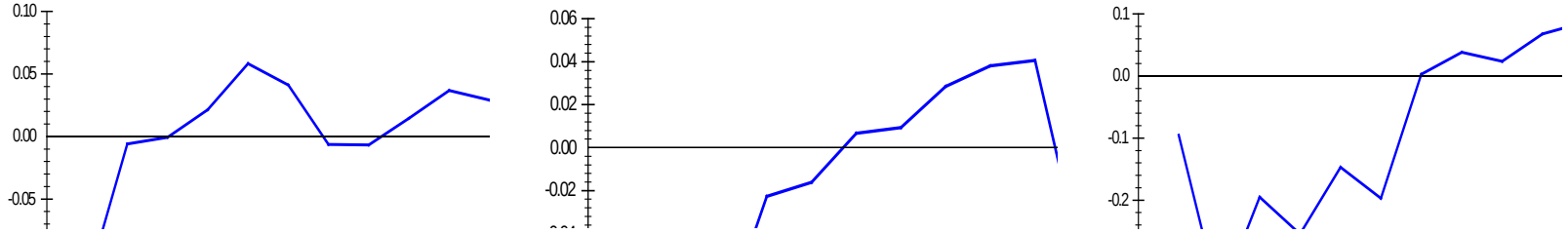



**Table 3.** Test results of the Perron's modified augmented Dickey-Fuller Test for three groups' representative countries

| Country | Dependent variable is the first difference of ln GDP per capita (growth rate) $\Delta y_t = \hat{u} + \hat{\theta} DU_t + \hat{\beta}_t + \hat{\gamma} DT_t + \hat{d} D(TB)_t + \hat{\beta}_1 y_{t-1} + \sum_{i=1}^{k} \hat{c}_i \Delta y_{t-i} + \hat{e}_t$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Turning point (1) | Constant (2) | Trend (3) | $\hat{\theta}$( $DU_t$ level effect) (4) | $\hat{\gamma}$( $DT_t$ trend effect) (5) | $\hat{d}(D(TB)_t$ crash effect) (6) | $\hat{\beta}_1 y_{t-1}$ (T-ratio, p-value) (7) | R2 (8) |
| Czech Rep. | 1997 | 4.65[.000]* | .03[.000]* | -.05[.179] | -.00[.380] | .03[.098]** | -5.5607[.000]* | .93 |
| Macedonia | 2001 | 1.275[.134] | .011[.004]* | -.12[.077]*** | .003[.498] | .075[.003]* | -1.75[.105]*** | .91 |
| Tajikistan | 1997(92-08) | 6.43[.001]* | -1.5[.004]* | -.15[.003]* | .21[.002]* | .033[.310] | -4.8451[.001]* | .98 |

Notes: * - indicates significant at the 1% level, ** - indicates significant at 5%level, and ***-indicates significant at the 10% level of significance.

The results in Table 3 support the picture of GDP growth rates depicted in the plots above. According to the combined picture,

- In the Czech Republic, a CEE successful transition country, growth was characterized by statistically significant "crash" effect in 1997 (0.03 per cent), which did not result in a change of the level or trend line of the series. This is some extent confirmed in the plot in which not major change is observed. The constant coefficient (4.65 per cent) and the trend coefficient (0.03 per cent) are both positive and significant.

- Conversely, in the case of Macedonia, a SEE country or lagging transition country, not only the "crash" (0.075 per cent) but also negative "level" changing effect (-0.12 per cent) is confirmed as statistically significant in the test and also observed in the plot. The constant term (1.28 per cent) is statistically insignificant, though accompanied by very small positive significant trend coefficient (0.01 per cent).

- Lastly, in the case of Tajikistan (CIS country) the "crash" effect is not significant (0.033 per cent), in contrast to the more profound negative "level" braking effect (-0.15 per cent) and a small, positive "trend" braking effect (0.21 percent) that are statistically significant. In addition, in the case of Tajikistan the trend coefficient is large and statistically significant but negative (-1.5 per cent), which would suggest that the overall trend effect after the break will remain negative, though less negative[11].This story is also supported by the plot. In addition, the positive intercept term of 6.43 per cent, after the break decreases due to the negative level breaking dummy of -0.15 per cent.

When the plots and test results of all countries in all groups are compared in a similar manner, several conclusions can be derived.

1. Namely, the firsts three groups, the CEEC, Baltic countries and "Three CEECs" countries, consist of countries for which the unit root null could be rejected for all countries, except Estonia. Estimated constant term is positive and significant in all countries, while estimated trend coefficient is positive and significant in most of the countries. The distinctive characteristic of this group of countries is the insignificant " crash "coefficient (variable *DTU*), which implies that the GDP growth in this group of countries mainly recorded "level" (variable

[11] The combined growth rate trend effect after the break is -1.5 per cent summed with 0.21 per cent of the estimated significant trend dummy.

*DU*) or "trend" (variable *DT*) effects. However, in most of the cases the overall effect is mainly positive.

In general, the stylized growth path of these groups of countries can be described as relatively continuous and steady, which is suggested by the significant positive constant and trend coefficients. Namely, as the results suggest, after the first drop in the economic activity, later transition is characterized by short trend adjustments or small level adjustments.

2. The second two groups of lagging transition countries such as SEEC and CIS countries are rather heterogeneous, with four countries for which the unit root null could not be rejected; two countries - Macedonia and Uzbekistan - for which rejection was on the borderline; and, for all the rest, the unit root null could be rejected. If the coefficients are observed, one general conclusion emerges: the changes of the economic activity in mid-transition in these countries resulted mainly in "level" and "trend" break effects, while the "crash" effect (variable *DTU)* seem to be insignificant in several cases. On the other hand, the "level" effect (variable *DU)* is statistically significant and negative in most cases. This would imply that the events in mid transition affected economic activity mainly in a negative manner, lowering the average growth rates. In addition, in most countries, the "trend" break effect (variable *DT)* is significant, suggesting not only the level but also the trend line switching after the turning points in the countries. When the trend effect dummy coefficient is jointly observed with the trend coefficient, which in negative and significant in most cases, the combined trend effect on growth rates after the break point mostly is negative. In addition, constant terms are positive in most cases, though accompanied by interactive terms-level "effect" dummies that are usually negative and sizable, suggesting an overall decreasing turn in growth rate levels in these countries after the break points.

The abundance of various combinations of significant coefficients makes it difficult to draw general conclusions. However, if this group is observed in general, it can be noticed that the economic activity in the countries was mainly interrupted by events that had a negative impact, by lowering the average growth rates though improving slightly their trend.

In sum, the results in this section suggest possible breaks in the data series. While in some cases these breaks mean only a transient crash effect, in most cases the breaks are characterized by long-lasting "level" and "trend" effects. Beside the above mentioned limitations, the testing procedure was useful in the sense that it directed interest towards further

search for more effective and appropriate method of analysis that can take into account for instability and volatility at the same time.

**Conclusion**

In sum, the univariate analysis has enabled closer assessment of the peculiar characteristic of growth - instability - in the course of transition. In addition, it raised the question of how growth pattern has developed in the course of transition in a way that have never been addressed before and showed possible answer to this question. It showed that growth in the course of transition can be viewed from different perspectives – as a non – linear switching process characterized by tectonic structural changes and reforms, instead of a smooth linear process as it is described in the conventional growth theory. Hence, the main output of this research was not to give straight answers or policy recommendations of how to increase or sustain growth, but rather to introduce the new notion of transition that can be described as bold non-linear changes that require adequate valiant measures, not only at the beginning of transition but all the way through it. This new concept does not prescribe the exact measures but helps policy makers as to what and where they should look for the answers.

In fact, by putting the accent on structural changes in the course of transition this approach completely abandons the convention of studying growth by using a linear approach, which makes it different from previous studies of growth in transition. However, this pioneering work initiates some further questions as to whether this framework can be extended to investigate what actually occurs in the various regimes and what are the main driving forces behind different transition stages or regimes?

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