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Privatization and growth: natural experiment of European economies in transition

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PRIVATIZATION AND GROWTH: QUASI-NATURAL EXPERIMENT WITH EUROPEAN ECONOMIES IN TRANSITION*

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Abstract

European ex-socialist countries' experience is exploited for two difference-in-differences analysis: effects of a) transition to a market economy, and b) accession to the European Union (EU) on oncome. Many countries adopting regime change simultaneously; and ten of them joining the EU mostly in 2004 provides a rich setting. Post-privatization growth varies by ex-ante institutional settings - whether they existed as separate countries before 1991 or came into being by break-up of a larger block - and by ex-post aspiration of (and then) joining the EU. We show starkly how unsuccessful was transition to a market economy - it increased income gap of most of them from the US for at least 13 years. The paper shows institutions are important/critical for growth in middle- or high-income countries of Europe also; and better institutions enhance the role of one (rather than all) proximate factor for growth. Using growth accounting, the growth effects are mostly driven by human capital (rather than by TFP). This paper a) presents a nuanced perspective on privatization's effect on growth, and b) identifies human capital to be the proximate factor through which the fundamental factor of institutions promotes growth.

JEL Codes: O47, O57

Key Words: Command economy and market economy; accession to the EU; income gaps and income ratios; institutions and middle/high income countries; growth accounting; fundamental versus proximate causes of growth; human capital versus TFP

Declaration of Competing Interests: None

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1. Introduction

North (1990) defines institutions as "rules of the game... or... humanly devised constraints . . . that structure incentives in human exchange, whether political, social, or economic." Rules of the game may either be codified in written laws, regulations, and instructions or they may be cultural traits, unwritten conventions and practices. Nunn (2014). If so, institutions overlap with cultural and legal traditions.

Jones and Romer (2010) refrain from modeling institutions; although they model other three of their four state variables, namely ideas, population, and human capital, they highlight as central to growth theory. Using institutional variables from World Bank's Doing Business database, Kant (2016) shows institutional quality is higher with a greater FDI presence in developing (but not in developed) countries Fuchs-Schundeln and Hassan (2016), defining institutions more precisely, separate them from i) social structure, and ii) culture. Institutions are "the broad set of rules, regulations, laws, and policies that affect economic incentives and thus the incentives to invest in technology, physical capital, and human capital" while i) social structure is the network of friendships, family ties, and socioeconomic stratification (e.g., the class structure) that affects spread of information and ability to enforce contracts; and ii) culture essentially means civic capital that overcomes free rider problem.

It is not feasible to conduct controlled experiments at the level of countries for any of the three aspects identified by Fuchs-Schundeln and Hassan (2016), viz institutions, social structure, and culture leaving quasi-natural experiments as the best means of drawing their causal relationships. Privatization of ownership and liberalization of markets in ex-socialist countries of Europe provide an excellent quasi-natural experiment to examine its effects in view of the sweep

of social and political forces that led to their fast, and all-encompassing introduction in almost such countries at the same time. See, Djankov and Murrell (2002)

Theoretical models generally predict a positive relationship of privatization/liberalization with growth. In general equilibrium framework, Gylfason (1998) employing a two-sector full employment model and Hansen (1997) with an imperfect competition model, predict that privatization and market (instead of administered) prices either act like removing a price distortion through price reform or enhance micro-economic efficiency through a broad distribution of ownership rights. These theoretical conclusions are supported by empirical studies by Berkowitz and DeJong (2003) for post-Soviet Russia. Estrin et al. (2009), using EBRD's Transition Reports 1998-2007 data, find privatization affected efficiency, profitability, and revenues of firms mostly positively in Central Europe, while its effects on Commonwealth of Independent States (CIS) are statistically insignificant. Summarizing empirical macro studies, they find privatization has a positive effect on growth – especially when accompanied by complementary reforms – but whether mass privatization (often largely to insiders) has a stronger effect is not clear. They suggest expected vast improvement from supposed poor performance during the centrally planned period has not occurred partly due to sharp recession immediately following the launch of privatization. Eicher and Schreiber (2010) exploit the relatively large changes during transition and construct a structural policy index by summing up EBRD's relevant privatization/liberalization indices from 1991-2001 for 26 transition countries. They find large short-term effects of structural policy on growth using a panel with fixed effects; or, alternatively, using "independence," (how politically free a country was) as instrument for economic institutions.

Our objective is to examine the relatively open questions of the mechanism of privatization (meaning regime change, that is, not just large and small-scale privatization, but governance and

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enterprise restructuring, price liberalization, openness of trade and foreign exchange system, and pro-competition policy also), leading to economic success - if any. See, Estrin et al. (2009) and the above literature review. As far as I can tell, none of the studies on transition have examined growth effects of privatization/regime change using the longer-term (i.e., pre-1991) comparable data that is available for Bulgaria, Hungary, Poland, and Romania (that have been separate countries since the Second World War) called hereinafter as BHPR. This data is eminently suitable to be employed for a quasi-natural experiment to examine the growth effects of a change in economic regime from Command to Market.

In addition, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia joined the EU on May 1, 2004; followed by Bulgaria and Romania on January 1, 2007. Simulating income growth by regional dynamic computable general equilibrium (CGE) models, Horridge and Rokicki (2018) find Visegrad group of countries would grow at a slower pace without EU membership primarily because of missing out of EU's structural policies. van Ees and Bachmann (2006), recognizing that transition economies suffer from weak institutional framework, conclude their EU accession may favorably induce institutional change by building trust and new economic exchange networks. On the other hand, Bluffstone et al. (2003) estimate that approximating its environmental protection legislation with fifteen environmental directives of EU will cost Lithuania roughly 3.5% of its GDP in 2015; and Hallett and Lewis (2007) expect Maastricht debt and deficit criteria will constrain the catch-up process of eight transition economies that joined EU in 2004.

The effects of privatization/regime change as well as of EU accession of European and ex-Soviet Union transition countries on growth can be examined by grouping them by their institutional antecedents or post-transition institutional aspirations. Comparable pre- privatization/

regime change data are not available for non-BHPR countries. These countries, called "new" ex-socialist countries here, can be grouped by ex-ante factors of whether they emerged from a civil war or from the breakup of a former bigger grouping, thereby exposing them to costs of separate statehood for the first time, or ex post factors of whether they aspired to join, and then joined, the EU as opposed to forming into CIS and turning away from the EU. Many countries joining the EU at the same time permits a difference-in-differences examination: of the effects of EU accession on growth. The treatment is joining the EU versus the counter-factual of no change in the EU membership status. We show below that positive effects on growth arise only for those ex-socialist countries (whether "old" or "new") that joined the EU and only after accession.

The paper contributes the following to the existing literature: It shows starkly how unsuccessful was privatization/regime change for income - it increased income gap of most of the ex-socialist countries of Europe from the US for at least 13 years following 1990-1991. It shows i) institutions are important and critical for growth even in middle- or high-income countries like these countries; and ii) better institutions enhance the role of one (rather than all) proximate factor for growth. Examining growth accounting by panel estimation, the growth effects are mostly driven by human capital (instead of TFP). This paper a) presents a nuanced perspective on privatization/regime change's effect on growth, and b) identifies human capital to be the proximate factor through which the fundamental factor of institutions promotes growth.

Section 2 below delineates the model and specifications used in the paper. Section 3 examines the effects of privatization/regime change and EU accession for countries that have existed as separate countries since at least the Second World War; Section 4 for countries that attained separate statehood for the first time in 1991/1993. Section 5 contains concluding observations.

2. Model and Specification

2.1 The Catch-up Index, R-Convergence, Divergence, Full Convergence

We use income normalized to a bench-mark country's income in our analysis. Income ratios are frequently used in growth and transition studies. For example, Peron and Rey (2012) use time series analysis to examine the distribution of Indian Ocean Zone (IOZ) countries' incomes ratio to the IOZ average, and to the world mean income, Cuberes and Jerzmanowski (2009) examine growth reversals using real output per worker relative to the US, Fuchs-Schundeln (2008) use German Reunification as a quasi-natural experiment to study its effect on East-West Germany saving-ratio, income-ratio, and wealth ratio, Jones and Olken (2008) find growth "miracles" and "failures, defined as growth relative to the US, are ubiquitous at ten-year periods, and Svejnar (2002) compares Soviet bloc's growth to a corresponding group of market economies. That country is chosen as the bench-mark country whose income growth is the least volatile. That makes the data of interest more granular. If the bench-mark country is a large country, taking its income as the numeraire dilutes the effects of global or world-wide factors on a country's income.

Let y_{J0} and y_{BM0} represent Country J's per-capita income for the base year and the benchmark country's per-capita income for Country J's base year, and R_{J0} Country J's base per capita income ratio. For each subsequent year, similar ratios of a country's annual per-capita income to that of the bench mark country are computed; and the index of these income ratios is called the catch-up index. [1] For Country J for year t, its catch-up index $I_{Jt,}$ is the ratio of its per capita income ratio for year t to its base per capita income ratio. That is,

$$I_{Jt} = (R_{Jt}/ R_{J0}) \tag{1}$$

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[1] See, Kant (2019) for this definition and related results.

By expressing all countries' income ratios to the same base (100), the catch-up index helps us identify the breaks/turning points. An increase (decrease) in the index (or in the income ratio) indicates Country J's income rises more than (less than) the bench-mark country's. Said increase is called relative convergence, r-convergence in this paper, that is not sufficient (although necessary) for absolute convergence, i.e., for income gap, $\Delta_{Jt} = (y_{BMt} - y_{Jt}) > 0$, to decrease. On the other hand, a decrease in the index is called divergence in this paper - both relative and absolute, since relative divergence is sufficient for absolute divergence.

We can show that:

$$r_I = r_J - r_{BM.} \tag{2}$$

and

$$n = \log (1/R_{J,0}) / \log(1 + r_I) \tag{3}.$$

where r_I is the catching-up rate (or the falling-behind rate, if negative) and r_J and r_{BM} are the country growth rates, and n is the number of years since the base year for Country J's income to become equal to the frontier's. This (absolute) income equality is called full convergence here.

2.2 Quasi-Natural Experiments and Difference-in-Differences

Quasi-natural experiments, like true randomized experiments, require that the manipulation of the treatment is not under the analyst's control; unlike the latter they arise from naturally occurring phenomena that are often the product of social and political forces that approximates the characteristics of a randomized experiment. Abandoning socialism and adopting a market economy due to the sweep of social and political forces in all ex-socialist countries of Europe at almost the same time eminently meets this requirement. Three econometric methods that have been prominently used to study quasi-natural experiments (but also used in non-quasi-natural experiment settings) are instrumental variables, regression discontinuity, and difference-

in-differences (DID). They are design-based estimators at the heart of credibility revolution in empirical economics. Of these, DID is probably the most widely used estimator. It also permits a simple explanation of the empirical method and a straightforward presentation of results. See, Angrist and Pischke (2010).[2]

To mimic random assignment, DID design uses time trend of untreated group as the "counterfactual." The assumption is that absent a treatment, the outcome in the treated countries should (counterfactually) have been the same as in the control countries. It compares the outcome in the treatment group before and after the treatment with the corresponding change in the non-treatment group during the same period. It thereby permits i) both pretreatment difference between the two groups and ii) factors other than the treatment that affected the outcome in both groups. To make the results compelling, the period must be long enough for underlying trends (in contrast from noise of yearly fluctuations) in both groups to emerge and manifest themselves.

The specification of the estimating equation is:

$$Y_{it} = \alpha_i + \beta\, Treat \times Post_t + \gamma_t + \varepsilon_{it} \qquad\qquad (4)^3$$

where Y_{it} is the outcome in, say, country i in year t; *Treat* indicates country i's treatment status in

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[2]For the use of DID to study macroeconomic relationships, see, e.g., Rodrik and Wacziarg (2005) and Papaioannou and Siourounis (2008).

[3]To make the counterfactual assumption more credible, DID literature often attempts to increase the similarity between treated and control countries by including a vector of covariates, X_{it}, such as initial per capita income and continental location (Africa, Asia, Europe, the Americas) indicators etc. We dispense with such specification because in our DID analysis both groups of countries belong to EU25.

the year of treatment, i.e., *Treat* = 1 if country *i* is a treatment country and = 0 if it is a not; *Postt*

indicates the post-treatment period, i.e., *Postt* = 1 ∀ *t* ≥ treatment year and = 0 otherwise; *β* gives

the effect of treatment, α_i and γ_t indicate time-invariant country effects (either pre-fixed or

randomly determined) and time effects, respectively, and ε_{it} is the error term.[4]

Before estimating (4), we also use directly compute DID in exponential growth rates as

non-econometrically indicating the effect of privatization/regime change and EU accession.[5]

2.3 Growth Factors

Based on Solow (1957), comparative standards of living have been explained either in

levels or in their growth. The former decomposes cross-section differences in output per worker

levels into differences in physical capital-labor ratios, quality of human capital, and productivity.

See, Caselli (2005) and Feenstra et al. (2015). The latter explains growth in output per worker by

growth in the right-hand side variables. The regressions are run for 100 or more countries, and

results averaged across countries and across each decade. Jorgenson and Vu (2010).

Our interest is in explaining changes in income ratios overtime. Let *kl* represent physical

capital per unit of employed labor, *hc* average human capital (that is based on years of schooling

and Mincerian returns to education), and *A* the efficiency with which the factors are used, i.e., TFP.

Let per capita income approximate output per worker, ignore the time sub-scripts and use the neo-

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[4]As noted by Torsten, and Tabellini (2008), this estimation allows for any correlation

between the treatment dummy and time-invariant country features since the outcome effects of the

latter are captured by α_i, the time-invariant country effects.

[5]An alternative would be to use least-squares growth rates. But, least-squares, being

essentially an arithmetic average, is greatly affected by squared deviations of extreme values.

classical production function as given in Caselli (2005) for Country J,

$$y_J = A_J \, kl_J{}^{\alpha} \, hc_J{}^{1-\alpha} \tag{5}$$

Then, Country J's income ratio to the US is,

$$(y_J/y_{US}) = (A_J/A_{US}) \, (kl_J/kl_{US})^{\alpha} \, (hc_J/hc_{US})^{1-\alpha} \tag{6}$$

(6) tells us Country J's income ratio depends on ratios of the two TFPs, the two capital-labor ratios and the two average human capital.[6]

The estimable version of (6) is:

$$(y_J/y_{US})_t = \mu + \beta_1 \, (A_J/A_{US})_t + \beta_2 \, (kl_J/kl_{US})_t + \beta_3 \, (hc_J/hc_{US})_t + \varepsilon_t \tag{7}$$

3. "Old" Ex-Socialist Countries

3.1 Data[7]

Two indices have been used to identify privatization/regime change in the literature on this subject: Heritage Foundation's index of economic freedom and EBRD's overall transition (or reform) indicators.[8] We prefer the latter since it is available from 1989 (as opposed to 1995 for the former). EBRD rates the following indicators on a score of 1 (little progress or lowest level)

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[6]As noted above, Peron and Rey (2012), Cuberes and Jerzmanowski (2009), Jones and Olken (2008), and Fuchs-Schundeln (2008), use income relative to the US as the dependent variable; but do not take explanatory variables as relative to the corresponding US/a bench mark country's numbers in their econometric investigation.

[7]What we say about data applies to both this and the next section.

[8]A description of these indicators and what a country must do to progress from the lowest to the maximum score in each, accessed from

https://www.ebrd.com/cs/Satellite?c=Content&cid=1395237866249&pagename=EBRD%2FContent%2FContentLayout on June 7, 2018, is given in Appendix 1.

to 4.33 (attainment of advanced industrial economy standards): Large-scale privatization, small-scale privatization, governance and enterprise restructuring, price liberalization, trade and foreign exchange system, and competition policy. For all the ex-socialist countries for which we have relevant data, sum of these indicators rose very rapidly from the lowest level (6 to 8.7) in 1989. We call the sum of these six indicators as privatization or regime change in this paper. Thus, privatization/regime change in this paper means not just large and small-scale privatization, but governance and enterprise restructuring, price liberalization, openness of trade and foreign exchange system, and pro-competition policy also. Although we do not have comparable pre1989 data, it is reasonable to assume these countries were at the same level of privatization (i.e., little) in the socialist period as they were in 1989-1990.

We use Penn World Tables (PWT) data for income (and other variables) since it gives purchasing power parity (PPP) values and goes back the farthest. Starting with version 8.0 (the new generation), PWT gives two versions of real GDP: CGDP that uses prices that are constant across countries but depend on the *current year*; and RGDP that uses prices that are constant across countries and are also *constant over time.* The R variables are well suited for comparisons across countries and over time (see, Feenstra, et al. (2015)). We use them; and the most recent PWT version, 9.0 (available at http://www.rug.nl/ggdc/productivity/pwt). It gives data to 2014 and goes back to 1950 for the US, EU15 countries and many countries in rest of the world.

For the ex-socialist countries, PWT 9.0 gives data on RGDP and other variables for Romania since 1960, for Bulgaria, Hungary, and Poland since 1970, and for most other ex-socialist countries since 1990. As indicated above, Bulgaria, Hungary, Poland, and Romania (BHPR) - that have been separate countries since the Second World War - are called "old" ex-socialist countries; other ex-socialist countries that emerged or re-emerged as separate countries in 1991/1993 are

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called "new" ex-socialist countries in this paper.

The other variables used from PWT 9.0 are population, number of employed persons, human capital measure based on years of schooling and returns to education, capital stock at current PPPs, and TFP level at current PPPs (USA = 1).[9] We use EU15 except Germany (EU15XG) as the control/comparison countries since the "counterfactual" from these countries would be most applicable for BHPR (and Slovenia, the Baltic countries, the Czech Republic and Slovakia discussed below); and the period since 1970.[10] Germany is excluded since data for it, whether pre or post 1991, is for unified Germany; that separately for the erstwhile East Germany are not available in PWT 9.0.

3.2 Estimation, DID for Privatization/Regime Change

Figure 1 shows three-year moving average of index of absolute PPP PCY with base-years 1971 for BHPR and the US. US income grew almost smoothly, was the least volatile, and exhibited no sharp change in or around 1991 - justifying normalizing all incomes by it.

The index of normalized incomes, or the catch-up index, for BHPR are depicted in Figure 2. BHPR show a break in the previous trend in 1991 (or, just around 1991), confirmed by cusum-

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[9]PWT 9.0 and 8.0 call their human capital measure an "index." See, Feenstra et al. (2015), Inklaar and Timmer (2013) and PWT 9.0. We prefer the nomenclature "human capital measure" or "average human capital" since the values in PWT 9.0/8.0 are not expressed as a ratio to a base year's values.

[10]It may be noted Denmark, Ireland and the United Kingdom joined the EU on 1-1-1973, Greece on 1-1-1981, Spain and Portugal on 1-1-1986 and Austria, Finland and Sweden on 1-1-1995. Nevertheless, they all had a market economy pre-1991.

of-squares test. Figure 3, that plots the sum of their six transition indicators for 1990-2014, shows all four countries adopted privatization/regime change with almost the same promptness. But only Poland experiences a change to catch-up growth in 1991 (from no r-convergence or divergence before 1991). Hungary and Romania end their divergence by 1992/1993 but start sustained catch-up growth only about eight years later.   On the other hand, Bulgaria starts on a downward trajectory in 1990; and even by 2013 it had not re-attained its 1990 relative income level. Taking the four countries together, the adoption of privatization and market economy in 1991 hardly led to a burst of catch-up growth.

<Insert Figures 1 to 3 here>

Now we directly compute DID in exponential growth rates as non-econometrically indicating the effect of privatization/regime change. We use index of three-year moving averages of normalized income relative to the US (catch-up index) for all 18 countries to both smooth out short-run fluctuations and to minimize the effects of initial and final year values. Table 1, Panel A gives the average (geometric mean) catching-up rates for BHPR and EU15XG countries for the treatment period (1991-2013), the pre-treatment period (1971-1990), and their difference. The average catching-up rate for the post- privatization/regime change period for BHPR is 0.58 points higher, that for EU15XG is 0.54 points higher. The difference of 0.04 (= 0.58 - 0.54) is the minuscule or negligible treatment effect. Panel B repeats the exercise when the treatment period is shortened to 1991-2003.[11]   The post-privatization/regime change but pre-EU accession

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[11]Growth rates for individual countries are given in Appendix 2A. Eicher and Schreiber (2010), using a panel for 1991-2001 of 26 ex-socialist countries, find a mere 10% change in quality of structural policies (measured by EBRD's TIs) raises annual growth by 2.7%. We find the

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performance of BHPR was 0.84 points annually worse than in the socialist period. This evidence

for BHPR does not support the conclusion of Estrin et al. (2009) that centrally planned economies

had poor economic performance pre-transition and were just waiting for privatization and market

economy to burst into rapid growth.

<Insert Table 1 here>

To perform econometric DID investigation, we estimate equation (4) by using annual data

(rather than three-year MA since initial and final values are not important for equation (4)) for

various periods by forming panels to accord with it. Following Kennedy (2008), we first test the

null that the intercepts are equal. If this null is not rejected, use the pooled OLS since it is efficient.

If it is rejected, use Hausman test to test the null that random effect estimator is unbiased. If this

null is not rejected, use the random effects estimator since it is more efficient; otherwise use the

fixed effects estimator.

For the effects of privatization/regime change, we consider two periods, 1970-2014 and

1970-2003 (i.e., ending before EU accession). The results when 1991 is considered as the

privatization/regime change year are stated in the first columns of Table 2's panels A and B. When

we consider the effects from 1991 to 2014, privatization/regime change increases relative income

by about 0.05 in a statistically significant way. On the other hand, for the period to 2003, there is

no statistically significant effect (and the whole equation is not significant), and the effect for this

sample is negative. BHPR did not self-select to privatization and shift to a private economy: the

latter occurred in all ex-socialist countries of Europe at almost the same time. Further, the results

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whole-scale privatization and structural change from command to market economy by BHPR

increased their average growth rate by only 0.58 points.

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are not just for large and small-scale privatization - they are with all economic confounders considered, namely governance and enterprise restructuring, price liberalization, openness of trade and foreign exchange system, and pro-competition policy. All these changes had a small positive effect on income if the 1991-2014 period is considered and none (or, negative) if we limit ourselves to the 1991-2003 period.[12]

<center><Insert Table 2 here></center>

Torsten, and Tabellini (2008) point out that DID estimation requires that heterogeneity in the effects of treatment should not be systematically related to the heterogeneity in (either the timing or the extent of) treatment itself. To allow for the possibility that complete and total privatization/regime change did not occur in all countries to the same extent in 1991 as well as that there may have been some privatization/market opening before 1991 also, we re-estimate the equation for alternative periods. First, we delete observations for all 18 countries for 1990 and 1991, then for 1989 to 1992, and lastly for 1988 to 1993. The first sub-period in each estimation then moves increasingly towards complete socialism, and the second increasingly towards complete privatization/regime change. First consider Table 2's Panel A. Each succeeding more complete privatization/regime change enhances its positive effect (from 0.0451 to 0.0476 to 0.0516 to 0.0564) justifying the study design. But, for the periods ending in 2003, there is no such effect. The privatization/regime change dummy remains statistically significant, the whole equation

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[12]We do not consider political confounders like almost simultaneous introduction of democracy in these countries. Rodrik and Wacziarg (2005) and Acemoglu, et al. (2019) find democracy causes growth. If so, the lack of any positive effect on growth of economic regime change in these countries is even more striking.

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becomes more and more not significant, and the effect for this sample remains negative.

3.3 Estimation, DID for EU Accession, BHPR

All four BHPR countries joined the EU - Hungary and Poland on May 1, 2004, and Bulgaria and Romania on the first day of 2007. We repeat the previous sub-section's DID estimation, now for the post-privatization/regime change period, namely 1991-2014. First, we examine the DID in exponential growth rates. Table 1, Panel C shows BHPR on average grew at 3.62 points higher annual growth rate after joining the EU than in the 1991-2003 period; while EU15XG countries grew only 0.19 faster in the 2004-2013 period as compared to the earlier period.[13] The difference of 3.43 (= 3.62 - 0.19) is remarkable. These results are confirmed by estimating equation (4) for 1991-2014. The results stated in column 1 of Table 2's panel C show the coefficient on the DID EU accession dummy, has a substantial positive magnitude and is statistically significant at 1% level.

EU accession comes after many years of country-EU inter-action with the latter requiring adherence to its norms and standards in all details and judging whether the candidate country had satisfied its concerns.[14] Further, many changes made may not have immediate effect on income. Thus, we re-estimate equation (4) for alternative periods. First, we delete observations for all 18 countries for 2001 to 2006. This deletes non-EU accession years of 2001 to 2003 for Hungary/Poland and 2001 to 2006 for Bulgaria/Romania, and EU accession years of 2004 to 2006

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[13]It also shows DID in exponential growth rates of SBCS, Slovenia, the Baltic countries, the Czech Republic and Slovakia, and EU15XG countries to be discussed below.

[14]We discuss this process below for ten ex-socialist countries that joined the EU - eight on May 1, 2004 and two on January 1, 2007.

for Hungary/Poland and none for Bulgaria/Romania. Then, we delete observations for 2000 and 2007 also. The results are stated in columns 2 and 3 of Table 2's panel C. Each succeeding fuller integration with the EU enhances its positive effect on income reinforcing the substantial positive treatment effect shown by the DID in exponential growth rates.

Further, comparing the BHPR numbers in Table 1's Panel C to those in Panel A, these countries grew at a lower rate (of 0.83%) in the post-privatization/regime change but pre-EU accession period (1991-2003) than they did (at 1.67% rate) in the command economy period (1971-1990). Rather than boosting growth, privatization/adoption of a market economy worsened BHPR's average economic performance for 12 years as compared to their command economy period for which we have comparable data for both periods.

What is the explanation for this worse performance after a complete and total change to a market economy? Our results suggest that any post-privatization/regime change economic rationalization was neutralized even in the "old" ex-socialist countries by an institutional collapse from which these countries recovered only with joining the EU. For example, Kowalewski and Rybinski (2011) find the Polish state malfunctioned on numerous fronts to the EU accession period due to an unchecked growth of the government and weakening of political and legal institutions. We explain below the institutional changes accompanying adopting the EU norms and standards for each country that joined it.

3.4 Growth Factors, BHPR

3.4.1 Post-Privatization/Regime Change versus Pre-Privatization/Regime Change

Now we examine whether the relative importance of growth factors for BHPR are different from those for EU15XG countries; or whether they are different post-privatization/regime change from pre-privatization/regime change, by undertaking panel estimations of (7). We take annual

data rather than that averaged over five or ten non-overlapping years since the latter throws away too much information. See, Attanasio et al. (2000).

Table 3 presents panel estimation results for normalized income for the two groups of countries separately for 1970-1990 and 1991-2014 periods. All four panels are strongly balanced. The BHPR panels are estimated by pooled OLS since they do not reject Breusch-Pagan Lagrange multiplier test of equal intercepts.[15] Surprisingly, TFP's contribution to income is slightly lower post-privatization/regime change. Estrin et al. (2009) find the effect of privatization of state-owned enterprises on efficiency and TFP is mostly positive in Central Europe. We do not find privatization-boosted-TFP contributed more to income in BHPR countries after privatization/regime change than it did before privatization/regime change. The only reason for income growth boost is the almost quadruple contribution of human capital. It more than makes up for the almost halving of physical capital's contribution in that period.

<Insert Table 3 here>

EU15XG countries' panels are estimated by the fixed effects estimator. Comparing the two periods' results yields the same qualitative conclusions as for BHPR. As compared to 1970-1990, in the 1991-2014 period physical capital's and TFP's contributions are lower and that of human capital is higher. Human capital entirely explains the higher growth by both BHPR and EU15XG countries in the post-1990 periods.

3.4.2 Post-EU Accession versus Pre-EU Accession

We perform an analysis like sub-section 3.4.1 now comparing post-EU accession

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[15]As noted by Kennedy (2008), we do find the pooled OLS estimates to be equal to the corresponding random effect estimates for these and other cases of equal intercepts.

growth factors for normalized income for BHPR to those in their pre-accession period. Table 4

presents the said panel estimation results.[16] The two panels are unbalanced and are estimated by

pooled OLS. Human capital is not statistically significant in the pre-EU accession period; all

other coefficients in the two periods are significant at 1% level. TFP's contribution to income is

about 70% higher post-EU accession and that of physical capital is less than one-half. The main

reason for sharp income growth boost post-EU accession is the high and statistically significant

(at 1% level) contribution of human capital.

<center><Insert Table 4 here></center>

<center>**4. "New" ex-socialist countries**</center>

4.1 Post-Privatization/Regime Change Growth

This sub-section compares the growth experience of all "new" ex-socialist countries

grouped by their institutional settings. "New" ex-socialist countries are entities that came into

being or re-emerged as separate independent countries in 1991/1993 by i) the break-up of the

former Soviet Union, ii) the dissolution of the former Yugoslavia, and iii) the splitting of

Czechoslovakia into its two parts. Limiting ourselves to countries for which explanatory variables

data are available, we divide them into three groups based on the following institutional factors:

whether they joined the EU (on May 1, 2004), whether they emerged from the ruins of internecine

war for many years, and whether they formed into CIS (thereby distancing them from the EU).

Countries that joined the EU in 2004 consist of Slovenia, the Baltic countries, the Czech

Republic and Slovakia, called hereinafter as SBCS countries - they were under the Soviet system

for about five decades. The second group consists of ex-Yugoslavia countries Croatia and Serbia

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[16]The growth accounting results for SBCS countries reported therein are discussed below.

- they were under the Soviet system for about four decades.; and the third of ex-Soviet Union countries, Armenia, Kazakhstan, Kyrgyz Republic, Moldova, Russian Federation, Tajikistan and Ukraine - they were under the Soviet system for about seven decades).

Table 5 presents average growth/catching-up experience of all three groups of "new" ex-socialist countries for the 1991-2013 period. Although no quasi-natural experiment to analyze the treatment effect of the shift to a market economy cannot be undertaken for any of these countries (since comparable data for the pre-privatization/regime change period is not available for them). different growth experience of groups of countries illustrates the importance of institutional antecedents and ex-post aspirations. We also show (in the next sub-section) that examining growth factors separately by groups of countries is illuminating.

<Insert Table 5 here>

The "new" ex-socialist countries have experienced significantly worse economic performance than "old" ex-socialist (BHPR) countries over the same period. The three groups of "new" ex-Socialist countries have caught-up/fallen-behind the US during 1991-2013 at 1.36%, 1.33%, and -1.46 % rate, respectively - versus 2.25 % catching-up for the "old" socialist countries. See, Tables 1 and 5.[17] Megginson (2005) found that mass privatization did not yield the expected positive results. We find the results varied greatly among the four groups of ex-socialist countries - even though all four groups had almost the same trajectory of privatization and transition to a market economy. See, Figure 4.

<Insert Figure 4 here>

Figure 5 shows the dynamics of the average (GM) catch-up index for the four groups of

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[17]Growth rates for individual "new" ex-socialist countries are given in Appendix 3.

ex-socialist countries for the 1991-2013 period. [18]   Roland (2000) finds no transition country avoided a serious and major output fall at the beginning of transition. We find the BHPR's income did not fall - it kept growing up at almost the US rate right from the beginning of transition for about ten years - and then grew faster. Croatia and Serbia recover their initial level of income relative to the US (that undoubtedly fell due to their internecine war from 1991) within about three years of end of that war (in December 1993). SBCS start recovery and catching-up after just about two years of falling-behind. CIS is the only group of countries that continue to fall-behind sharply for about ten years and their income relative to the US was about 30% lower in 2013 than what it was in 1991. Roland (2000) explains the initial fall to credit crunch, snapping of network externalities and freedom to engage in monopoly behavior by enterprises. Yet, he does not explain why these factors had no effect on BHPR countries and such strong effect in CIS countries (that their income gap from the US is much higher in 2013 than it was in 1991 - since relative divergence is sufficient for absolute divergence).

<center><Insert Figure 5 here></center>

4.2 Estimation, DID for EU Accession, SBCS

We can perform DID analysis for EU accession for SBCS countries also. First, consider

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[18]We also find that, in contrast to Svejnar (2002), i) Balkan and Baltic countries, Romania, Estonia, Lithuania, Latvia, and Bulgaria, on average have performed better than the Central European countries, Poland, Hungary, Slovakia, Slovenia, and the Czech Republic, in the post-privatization/regime change period, indicating that geography-related initial conditions have not held the former group back; and ii) Slovenia and the BHPR countries (other than Bulgaria) did not have a larger relative income gap with advanced economies in 2001 than in 1990/91.

the DID in exponential growth rates. Table 1, Panel C shows SBCS fell behind the US from 1991

to 2003 at 0.73% annual rate, and then caught -up at 1.76% rate after joining the EU. That is, they

grew at 2.49 points higher annual growth rate after joining the EU; while (as before) EU15XG

countries grew only 0.19 faster in the 2004-2013 period. The difference of 2.30 (= 2.49 - 0.19) is

also remarkable. These results are confirmed by estimating equation (4) for 1991-2014 for

EU15XG (control) and SBCS (treatment) countries with the results presented in Table 6. Like

Table 2's panel C, the random effects estimator is used since Hausman test finds it unbiased. The

results show the coefficient on the DID EU accession dummy, has a substantial positive

magnitude, is statistically significant at 1% level, and its magnitude steadily increases as an

increasing number of EU accession transition years are deleted for all 20 countries from estimation.

<Insert Table 6 here>

The shift to privatization and market economy increased SBCS countries' income gaps

from the US. But they were able to stop their declining living standards vis a vis the US, and

started catching-up to it, after they joined the EU. Both the i) higher catching-up of BHPR

countries after privatization/regime change in 1991 (as compared to the period before that) and ii)

all positive catching-up of SBCS countries since 1991, are entirely explained by the spurt in

catching-up after they joined the EU. Some of the treatment-effect may have been bolstered by

their latent motivation, initiative and self-selection to join the EU. But, the *homo economicus*

economic agents in these countries were not successful on their own in the 1991-2003 period.

They needed the externally imposed EU norms and standards, discipline, network effects, and

virtuous circle of the EU brand to succeed.

We have stated above that all these countries had not just introduced large and small-scale

privatization and all economic confounders (namely governance and enterprise restructuring, price

liberalization, openness of trade and foreign exchange system, and pro-competition policy) and political confounders (like democracy) in the early 1990s, but also almost attained the maximum "standards and performance typical of advanced industrial economies" by late 1990s. See, Figure 4. BHPR, ex-Yugoslavia, and ex-Soviet Union rather than hermitically sealed off, were well-integrated in the world economy pre-1991 and were members of all international economic organizations. Specifically referring to openness, collapse of socialism led them to rapidly deepen their integration with the world economy - by 1994 all BHPR and SBCS countries had already reached the next-to-the maximum 4.00 value of trade and foreign exchange system openness indicator by 1994 and reached the maximum value of 4.33 in different years from 1994 to 2001.[19] See, Figure 6.   A spurt in openness in 2004 was not the reason for spurt in growth after joining the EU. We have discussed above four routes, two positives and two negatives, through which accession to the EU may have affected growth. The positive factors are: i) adopting EU's structural policies, and ii) building trust and new economic networks. The negative, whether long-term or short-term, are i) aligning with EU's environmental directives, and ii) constraints of Maastricht treaty's debt and deficit criteria. Clearly, the positive factors dominate. We discuss below some of these factors in these countries in the few years before and after they joined the EU.

<Insert Figure 6 here>

Bulgaria's accession was delayed because the EU had especial concern about vast amount of corruption in high positions. The EU demanded Bulgaria needed to reestablish its legal codes; especially the system for prosecuting and investigating criminal networks, and enforcing laws

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[19]EBRD gives the 4.33 value to transition countries that attain standards and performance norms of advanced economies, remove most tariff barriers and achieve membership in WTO.

surrounding money laundering and fraud. (Phinnemore, 2006). In January 2006, the Bulgarian legislature adopted reforms generated by the public-private initiative, Coalition 2000, in the areas of "political level corruption, VAT fraud, a stricter system of implementation monitoring, a stronger mandate for the oversight government commission, and in limiting/lifting the immunity of parliament members and magistrates under specified conditions." (Pond, 2006). Romania had to increase legal force to deal with its corruption, consolidate judicial and police reform and tackle issues on human rights, freedom of the press, and minority protection before being allowed into the EU. (Phinnemore, 2006 and Lusman, 2014).

Estonia had to revise many parts of its tax law, including its entire set of corporate income tax laws. (Streimann, 2007). Latvia agreed to limit licensing requirements to a narrower scale of business activities, to raise the savings guarantees in the national banks as well as to introduce an Investment Compensation System by 2008. (Kesteris and Plamse, 2007). The Czech Republic agreed to closure of most of its banks by the European Commission that the EC had deemed corrupt. These banks were rebuilt using foreign involvement. (Telicka and Bartak, 2007). Slovakia had to change its whole political structure in 1999 - with its first-ever presidential elections in May 1999 - to even be considered by the EU as a candidate for negotiations. It also had to adopt new laws into its constitution to align it with the needs of the European Commission and the Council of Europe and to increase transparency of governmental decisions; and had to restructure its entire banking structure, and to tighten tax-discipline of its business sector. (Figel' and Adamiš, 2007).

Clearly, privatization or economic regime change, rapidly adopted in the early 1990s, was not sufficient for growth. It also needed legal, judicial and police reforms, restructuring of banking, adopting EU standards and practices in every detail, and increased transparency and

control of political level corruption. Berkowitz, Hoekstra, and Schoor (2014) find privatizing state-owned banks in Russia did not have any impact on economic growth if the banks still retained political connections. We find a stronger result: mass privatization across all industries in ten countries (BHPR and SBCS) did not boost growth if the problems listed above were present.

To summarize the growth experience of all ex-socialist countries of Europe (see, Tables 1 and 5), assuming all these countries were catching-up to the US before 1991 at the BHPR's 1.67% annual rate, only BHPR countries show a slightly better post-socialist economic performance (at about one-half point higher). Post-socialist income gaps from the US of SBCS and CIS countries increased that SBCS countries may have ended (since r-convergence is not sufficient for absolute convergence) after they joined the EU.

4.3 Growth Factors, "New" Ex-socialist countries

4.3.1 Croatia & Serbia and CIS countries

Now we examine the growth factors for Croatia & Serbia and CIS countries to understand what caused CIS countries to fall behind so sharply after privatization/regime change. Table 7 presents panel estimation results for normalized income for these two groups of countries for 1991-2014. Both panels are strongly balanced. Based on the above considerations, the Croatia & Serbia panel is estimated by pooled OLS and the CIS by the fixed effects estimator. For the former group, human capital does not have a statistically significant effect; the other two factors do. It is the positive and statistically significant (at 1% level) effects of physical capital and TFP that explains the catch-up of these countries. For the CIS group, all three factors are statistically significant with the contribution of TFP slightly higher and that of physical capital substantially weaker. The only reason for their falling back is the negative contribution of human capital that more than negates the positive contribution of the other two factors.

<Insert Table 7 here>

4.3.2 Post-EU Accession versus Pre-EU Accession, SBCS countries

Discussing now the post-EU accession and pre-accession growth factors for SBCS countries presented in Table 4, the two panels are strongly balanced and are estimated by fixed effects estimator. Physical capital is not statistically significant in the pre-EU accession period; all other coefficients in the two periods are significant at 1% level. TFP's contribution to income is about 50% higher post-EU accession and physical capital is now statistically significant. Nevertheless, the primary reason for sharp income growth boost post-EU accession is the change in human capital's coefficient's sign from a negative value to a positive high value.

Thus, a) privatization/regime change, rapidly adopted in the early 1990s, was not sufficient for growth/faster growth; b) it also needed legal, judicial and police reforms, restructuring of banking, adopting EU standards and norms, increased transparency and control of political level corruption; c) adopting EU standards and norms make human capital the most important factor explaining both the i) higher catching-up of BHPR countries after privatization/regime change in 1991, ii) all positive catching-up of SBCS, iii) and falling back of CIS countries since 1991.

Table 8 collects results from panel estimation of growth factors of EU-15XGe countries for 1991-2014 (from Table 3) and for BHPR and SBCS countries since their accession to the EU (from Table 4). For all three groups of countries, TFP is not the most important factor; human capital is. This is in accordance with the importance Lucas (1988) and Erosa et al. (2010), give to human capital. Erosa et al. (2010) find human capital amplifies the effect of TFP differences about four-fold. To explain rich country's absolute PPP income level that is 20 times a poor country's, TFP needs to be five times when human capital can vary but 18 times when it is fixed. Our focus is on relative income and changes in it (rather than differences in levels). We find

human capital is always more significant than TFP in explaining changes in relative income, and its relative importance varies from two to 17-fold (see, Table 8).

<Insert Table 8 here>

Fernald et al. (2017) and Hanushek et al. (2017) adopt growth accounting framework like what we use. Fully accounting for the cyclical effects that should have implied faster recovery, Fernald et al. (2017) report it is the slower growth of TFP (and decline in labor force participation rate) that account for slower recovery in the US since the Great Recession. They do not find human capital played any role in it. On the other hand, Hanushek et al. (2017) while finding results to be insensitive to differences in price levels across states (available since 2008), show differences in human capital account for 20 to 30% of differences in per-capita GDP of states within the US. We find a far greater role of human capital than either of these two studies.

5. Conclusions

We use quasi-natural experiment and difference-in-differences estimation to examine the growth effects of i) privatization/regime change from command to market economy and ii) joining the EU, using the ex-socialist countries in Europe. As far as I can tell, none of the empirical studies of this question have used data for both the post-1990 and the pre-1991 periods. We use such data, income ratios, and ratios of explanatory variables in our analysis. We group countries into four depending on institutional considerations: a) countries that have existed as separate countries since at least the Second World War, called BHPR (Bulgaria, Hungary, Poland, and Romania - "old" ex-socialist), that did not bear the institutional burden of separate statehood for the first time; and three groups of "new" ex-socialist countries: b) Slovenia, Baltic, the Czech republic and Slovakia (SBCS) that aspired to and joined the EU in 2014, c) Croatia and Serbia - that emerged from ruins of civil war, and d) ex-Soviet Union countries that turned away from the EU and formed into CIS,

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a new block.

Estrin et al. (2009) state the widely held expectation that centrally planned economies, who were presumed to have poor economic performance pre-transition, would vastly improve it post-transition. They conclude privatization mostly affected TFP positively, implying the enhanced-TFP boosted growth. Using difference-in-differences exponential growth rates, we show a shift to a market economy in 1991 for BHPR was only 0.04 points higher than a similar 1991-2013 versus 1971-1990 comparison for EU15 countries except Germany. Even this better performance entirely occurred after they joined EU 13 years later and adopted its norms and standards. Similarly, SBCS countries stopped their declining income relative to the US, and (hopefully) the widening income gap with the US, after they joined the EU; while CIS countries (that turned away from the EU) fell-behind so sharply that they still are at about 70% of the income level relative to the US they had in 1991. Privatization/shift to a market economy itself widened the income gap of most of the "new" socialist countries from the US, but countries that joined EU and its institutions were able to stop at least the relative divergence (declining income ratio) from the year of accession. Institutions are critical for growth in middle- or high-income countries of Europe also

In contrast to Estrin et al. (2009), we find TFP's contribution to output of BHPR was slightly lower in the post-transition as compared to pre-transition. Considering only the post-transition period, the "new" ex-socialist countries have done worse than "old" ex-socialist countries and reforms did not impose any short run costs on BHPR. Panel estimation shows post-accession institutional improvement manifests itself in greater contribution of human capital: It entirely explains the post-transition higher catching-up of BHPR; just like it entirely explains post-transition falling-behind of CIS countries. While TFP is behind the growth/catching-up of both

post-EU SBCS countries and Croatia and Serbia, the additional factor in the former is human capital while in the latter it is physical capital. Human capital, not TFP, is the dominant factor for faster catch-up, or any catch-up, of all three of the following groups of countries: BHPR and SBCS countries since their accession to EU, and EU-15XG countries.

The paper emphasizes the role of institutions in economic growth. See, Helpman (2008) and Ogikvie and Carus (2014) for recent surveys. The weaker growth effects of transition in "new" ex-socialist countries might also be due to the burden of governance as a sovereign country for the first time and undertaking regime change while grappling simultaneously with costs and burdens of separate statehood. Standard scale effects (increasing returns in the provision of public goods and non-rivalrous technology) raise the administrative costs both in the main unit in the former united country/empire (e.g., Russia in the former Soviet Union and Serbia in the former Yugoslavia) as well as in the new units that are spun off.

It may be noted de jure privatization and introduction of a market economy is not de facto introduction in view of ingrained habits and customs of people. As noted above, Fuchs-Schundeln and Hassan (2016) identify three aspects of fundamental causes of growth: institutions, social structure, and culture. Even if institutions change, old social structure, and culture may persist. E.g., Alesina and Fuchs-Schundeln (2007) and Okulicz-Kozaryn (2014) find that after 45 years under communism, ex-socialist countries' residents were favorably disposed to redistribution by the state (and, if anything, increased their preference for redistribution) and were not ready for unbridled privatization, market economy and competition.

In addition, political integration does not mean economic integration. Nitsch and Wolf (2013) find that although administrative barriers to trade between East and West Germany were

rapidly eliminated with the fall of the Berlin Wall, the intra-German trade pattern has persisted along the former East-West border. The persistence of old trade patterns and economic relationships among CIS countries is likely to be even greater.

Lastly, even though its growth effects may be mixed, as noted by Shleifer and Vishny (1994), massive privatization/regime change may have been necessary to root out the command economic system based on communist ideology. It may also have been necessary to root out tentacles of the communist party reaching almost all sections of the society, and to eliminate the fear of the secret police, arbitrary detention and may be execution. But, giving free reins to animal spirits of capitalism is no guarantee of honest new production and innovation. Animal spirits can also be used as freedom for predation, diversion, and rent accumulation. Prevention of diversion and pocketing of gains from investments and technology by bureaucrats, politicians, insiders, controlled shareholders, and lawyers/judges is essential. As noted by Wade (1990), markets cannot be given a completely free reign, but countries/markets need to be "governed" by wise politicians and technocrats or constrained by proper institutions to ensure a positive outcome.

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Tab. 1: DID in Average Exponential Gorwth Rates
A. Privatization/Regime Change; Period 1971-2013

	1991-2013 Catch-Up Index		1971-1990 Catch-Up Index		
	2013	Gr. Rate	1990	Gr. Rate	Difference
BHPR	163.1	2.25	136.9	1.67	0.58
EU15XG	121.5	0.89	106.6	0.34	0.54
DID					0.04

B. Privatization/Regime Change; Period 1971-2003

	1991-2003 Catch-Up Index		1971-1990 Catch-Up Index		
	2003	Gr. Rate	1990	Gr. Rate	Difference
BHPR	111.7	0.83	136.9	1.67	-0.84
EU15XG	111.7	0.93	106.6	0.34	0.59
DID					-1.43

C. EU Accession

	2004-2013 Catch-Up Index		1991-2003 Catch-Up Index		
	2013	Gr. Rate	2003	Gr. Rate	Difference
BHPR	137.7	4.45	111.7	0.83	3.62
SBCS	117	1.76	91.6	-0.73	2.49
EU15XG	110.5	1.12	111.7	0.93	0.19
DID, BHPR					3.43
DID, SBCS					2.30

Notes: BHPR stands for Bulgaria, Hungary, Poland, and Romania, SBCS for
Slovenia, the Baltic countries, the Czech Republic and Slovakia and EU15XG
for EU15 countries except Germany. The above results are derved from PWT9.0
data and are for catch-up (PCY relative to US) index. The average is geometric
mean. Three year MA data are used.

Table 2: DID estimation of Effect on (relative) income with BHPR
as the treatment group and EU15XG as the control group

A) Treatment = Privatization/Regime Change; Period to 2014

Period	1970-2014	1970-1989, 1992-2014	1970-1988, 1993-2014	1970-1987, 1994-2014
Prvc × Postt	0.0451[a]	0.0476[a]	0.0516[a]	0.0564[a]
	(0.0150)	(0.0156)	(0.0163)	(0.0169)
Constant	0.6099[a]	0.6106[a]	0.6119[a]	0.6136[a]
	(0.0039)	(0.0041)	(0.0043)	(0.0044)
No. of obs.	810	774	738	702
R-sq	0.1828	0.1815	0.1796	0.1780

B) Treatment = Privatization/Regime Change; Period to 2003

Period	1970-2003	1970-1989, 1992-2003	1970-1988, 1993-2003	1970-1987, 1994-2003
Prvc × Postt	-0.0039	-0.0042	-0.0024	-0.0001
	(0.0126)	(0.0134)	(0.0142)	(0.0151)
Constant	0.5840[a]	0.5834[a]	0.5834[a]	0.5840[a]
	(0.0411)	(0.0410)	(0.0409)	(0.0409)
No. of obs.	612	576	540	504
Wald X^2	0.10	0.10	0.03	0.00
prob > X^2	0.7532	0.7518	0.8629	0.9929
R-sq	0.1628	0.1595	0.1546	0.1494

C) Treatment = EU Accession; Period from 1991

Period	1991-2014	1991-2000, 2007-2014	1991-1999, 2008-2014
EUAcc× Postt	0.1116[a]	0.1285[a]	0.1365[a]
	(0.0153)	(0.0193)	(0.0213)
Constant	0.6541[a]	0.6542[a]	0.6523[a]
	(0.0543)	(0.0535)	(0.0534)
No. of obs.	432	324	288
R-sq	0.0921	0.1011	0.0929

Notes: See above. The numbers in parenthesis are the standard errors of the estimated coefficients in the row directly above. [a] and [b] indicate significance at 1% and 5% levels, respectively. All panels are strongly balanced. Annual data is used. All periods in Panel A are estimated by fixed effects estimator, and in B and C by the random effects estimator. The results when 1991 is considered as the only privatization/regime change year are stated in the first columns of Panels A and B. The other columns of these panels give results when obs.for all 18 countries for 1990 and 1991, then for 1989 to 1992, and lastly for 1988 to 1993 are deleted. The first sub-period in each estimation then moves increasingly towards complete socialism, and the second increasingly towards complete privatization/regime change. Panel C's first column is with EU accession for Hungary/Poland from 2004 and for Bulgaria/Romania from 2007. its next column deletes obs. for all 18 countries for 2001 to 2006, deleting non-EU accession years of 2001 to 2003 for Hungary/Poland and 2001 to 2006 for Bulgaria/Romania and and EU accession years of 2004 to 2006 for Hungary/Poland and none for Bulgaria/Romania. Its last column deletes observations for 2000 and 2007 also. These columns represent succeedingly fuller integration with the EU.

Table 3: Growth factors for BHPR & EU15XG countries

	BHPR		EU15XG countries	
	1970-1990	**1991-2014**	**1970-1990**	**1991-2014**
K/L ratio	0.6112[a]	0.3710[a]	0.1482[a]	0.0639[a]
	(0.0505)	(0.0292)	(0.0273)	(0.0225)
Human capital	0.3252[b]	1.1622[a]	-0.2671[b]	2.9538[a]
	(0.1355)	(0.1847)	(0.1293)	(0.2008)
TFP	0.2509[a]	0.2395[a]	0.3364[a]	0.1721[a]
	(0.0172)	(0.0216)	(0.0392)	(0.0405)
No. of obs.	84	96	294	336
Est. method	Pooled OLS (= RE Estimates)	Pooled OLS (= RE Estimates)	Fixed effects	Fixed effects
R-sq	0.8723	0.9016	0.1919	0.1521

Notes: See above. All four panels are strongly balanced.

Tab 4: Growth Factors For EU Accession Countries

	BHPR		SBCS	
	1991 to 2003	2004 To 2014	1991 to 2003	2004 To 2014
K/L Ratio	0.5996[a]	0.2653[a]	0.0815	0.2488[a]
	(0.0251)	(0.0352)	(0.0483)	(0.0327)
Human Capital	0.0045	1.5087[a]	-0.6470[a]	1.7683[a]
	(0.1730)	(0.2529)	(0.0988)	(0.5675)
TFP	0.2378[a]	0.4008[a]	0.5756[a]	0.8304[a]
	(0.0132)	(0.0580)	(0.0419)	(0.1374)
No. of Obs.	58	38	78	66
Method	Pooled OLS (= RE Estimates)	Pooled OLS (= RE Estimates)	Fixed effects	Fixed effects
R-sq	0.9436	0.9513	0.0279	0.6390

Notes: As above.

Tab. 5: Average Exp. Growth Rates
New Ex-Soc. Countries

	Catch-Up Index	
	2013	Gr. Rate
SBCS countries	134.6	1.36
Croatia and Serbia	133.8	1.33
CIS countries	72.3	-1.46

Notes: See above. Catch-up index is the index of PCY relative to the US income . The base year for all countries is 1991.

Tab 6: DID estimation of Effect on (relative) income with SBCS
as the treatment group and EU15XG as the control group
Treatment = EU Accession (in 2004)

Period	1991-2014	1991-2002, 2005-2014	1991-2001, 2006-2014	1991-2000, 2007-2014
EUAcc× Postt	0.1229[a]	0.1336[a]	0.1450[a]	0.1545[a]
	(0.0121)	(0.0129)	(0.0140)	(0.0153)
Constant	0.6414[a]	0.6414[a]	0.6415[a]	0.6410[a]
	(0.0478)	(0.0481)	(0.0484)	(0.0487)
No. of obs.	480	440	400	360
R-sq	0.0761	0.0690	0.0613	0.0543

Notes: See above. All panels are strongly balanced. All periods are estimated by the random effects estimator. The second column deletes obs. for all 20 countries for 2003 and 2004, the next for 2002 to 2005, and the last from 2001 to 2006. These columns represent succeedingly fuller integration with the EU.

Tab 7: Growth Factors For CS & CIS Countries

	Crotia & Serbia	CIS countries
K/L Ratio	0.3669^{a}	0.0801^{b}
	(.1286)	(.0430)
Human Capital	-0.1884	$0\text{-}.2174^{b}$
	(0.4125)	(0.0867)
TFP	0.3390^{a}	0.4350^{a}
	(0.0619)	(0.0159)
No. of Obs.	48	168
Est. Method	Pooled OLS (= RE Estimates)	Fixed effects
R-sq	0.8100	0.7654

Notes: See above. Both panels are stongly balanced. The estimaton period for both panels is 1991-2014.

Table 8: Growth Factors For "New" And "Old" EU Countries

	BHPR 2004-2014	SBCS 2004-2014	"Old" EU Countries 1991-2014
K/L Ratio	0.2653[a]	0.2488[a]	0.0639[a]
	(0.0352)	(0.0327)	(0.0225)
Human Capital	1.5087[a]	1.7683[a]	2.9538[a]
	(0.2529)	(0.5675)	(0.2008)
TFP	0.4008[a]	0.8304[a]	0.1721[a]
	(0.0580)	(0.1374)	(0.0405)
No. of obs.	38	66	336
Estimation Method	Pooled OLS (= RE Estimates)	Fixed effects	Fixed effects
R-sq	0.9513	0.6390	0.1521

Notes: See above. BHPR and SBCS panels are unbalanced while "old" EU panel is stongly balanced.

"Old EU" stands for EU-15 countries except Germany.
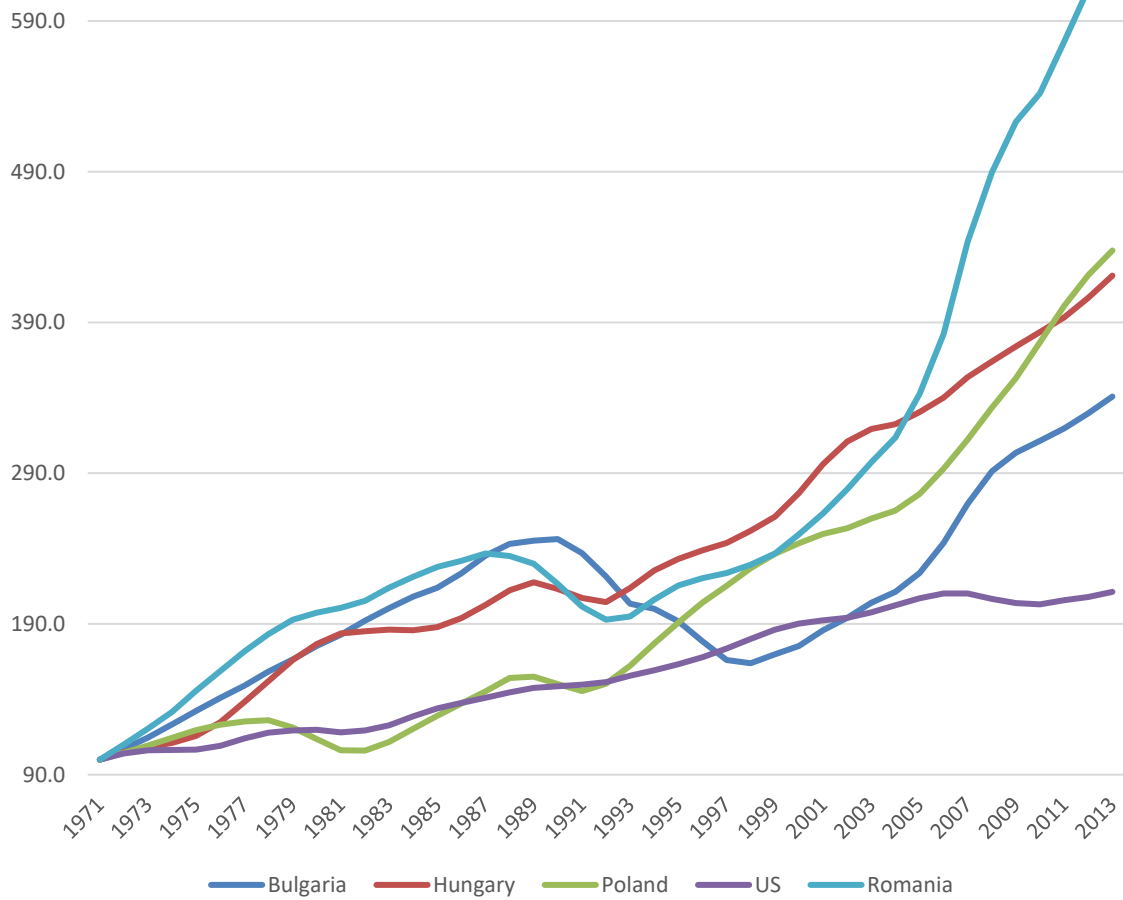
Figure 1: (Absolute) PCY Index 1971-2013

Legend: Bulgaria, Hungary, Poland, US, Romania

Figure 2: Catch-up (or PCY Relative to US)
Index 1971-2013, BHPR

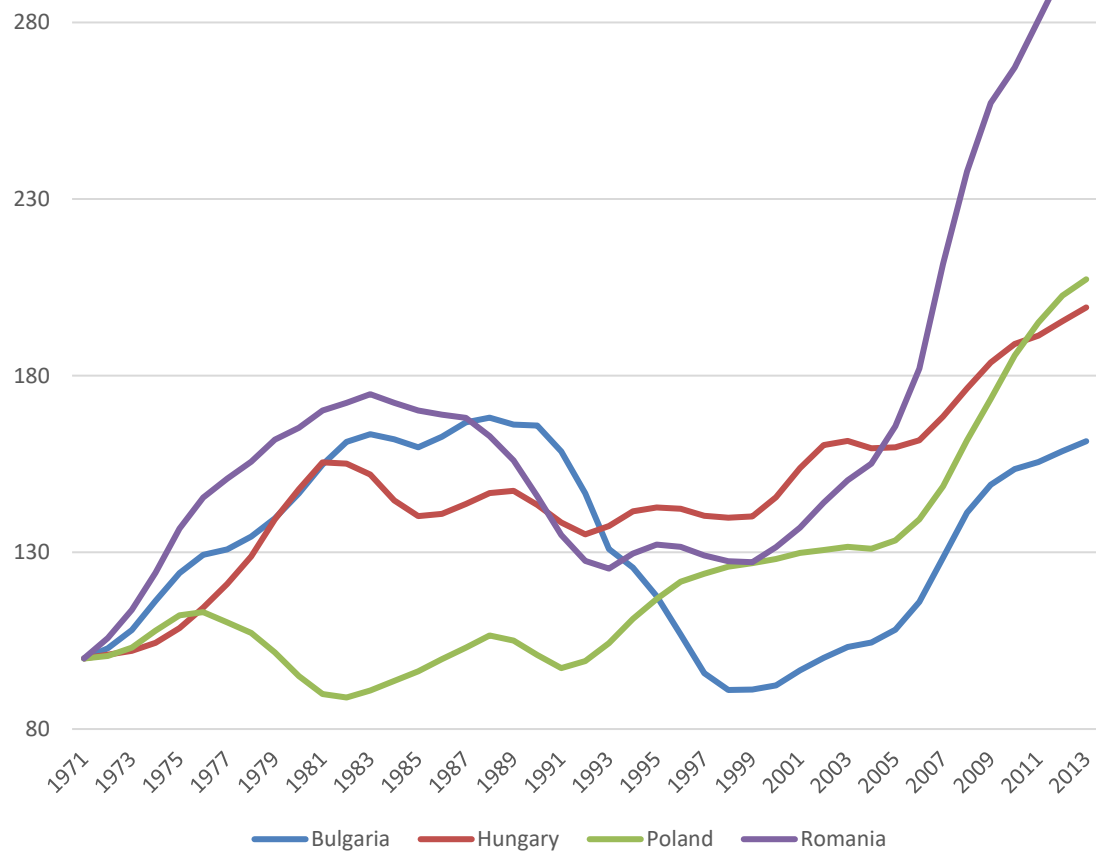Legend: Bulgaria, Hungary, Poland, Romania

Figure 3: Transition Indicators
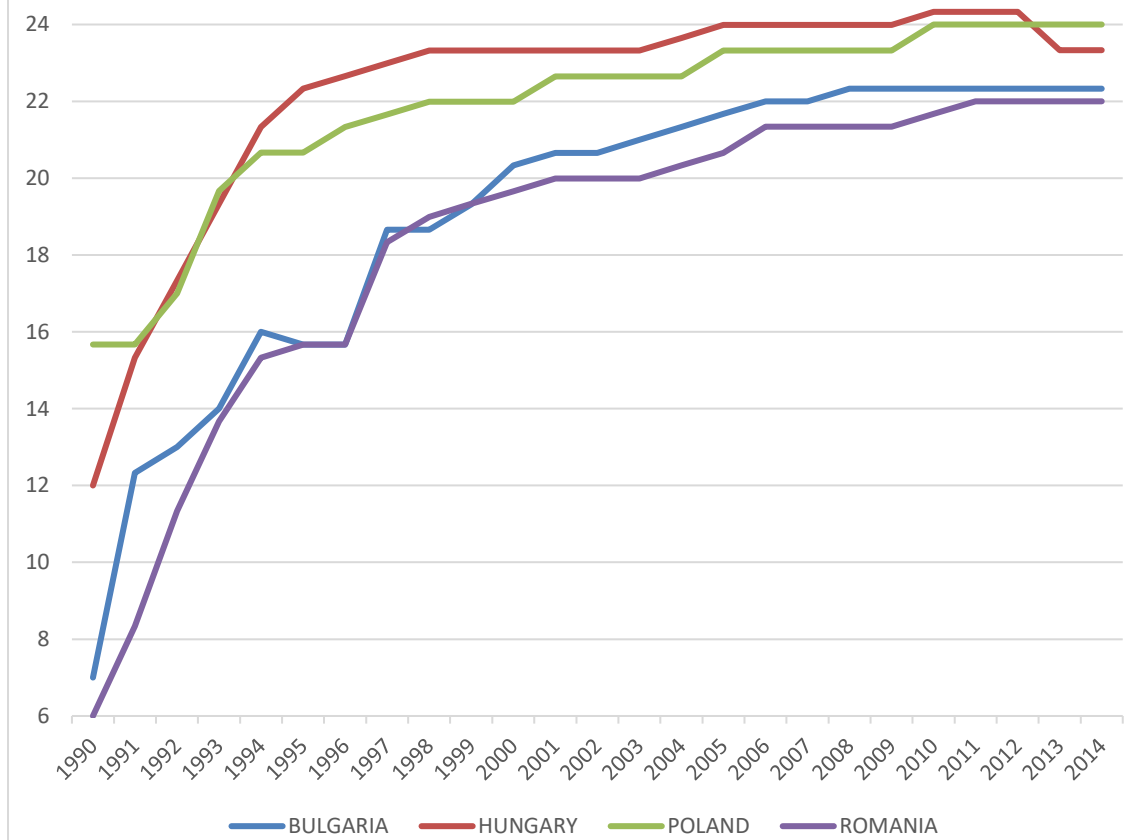1990-2014; BHPR

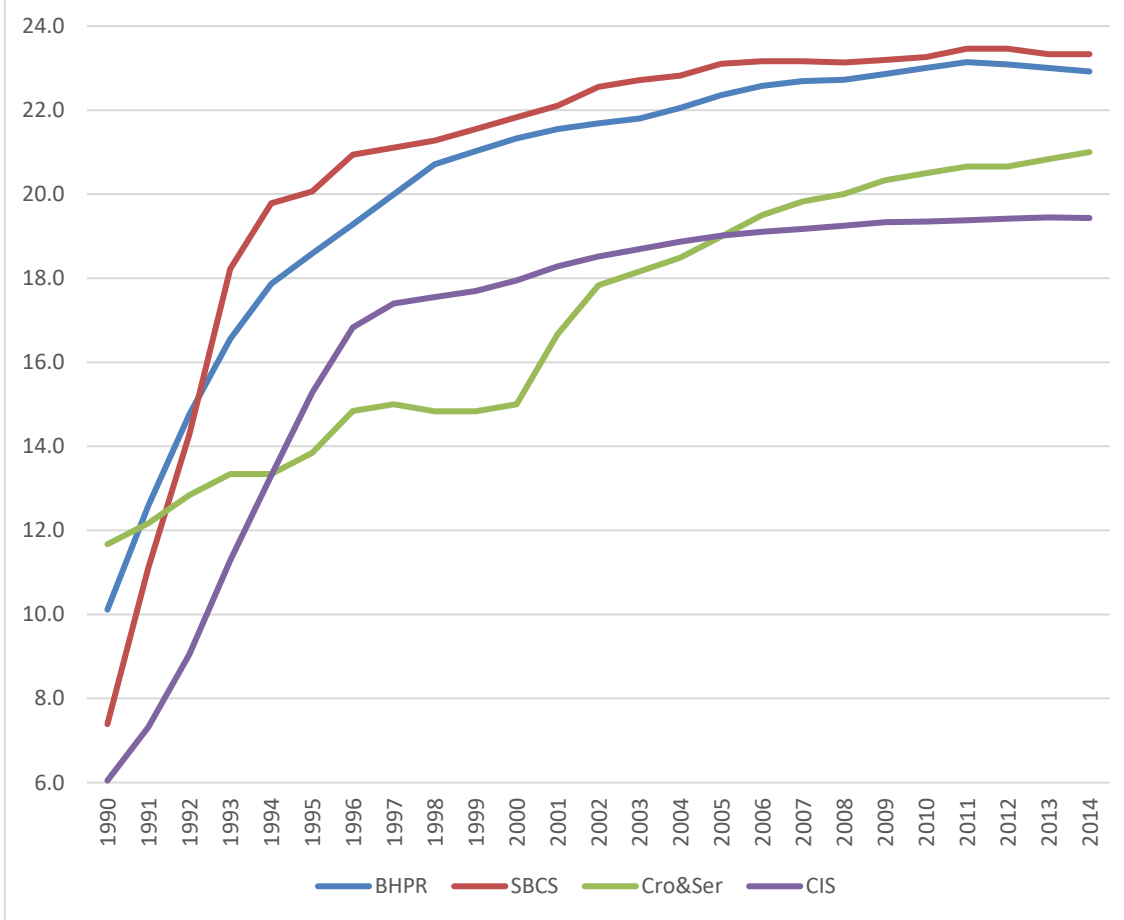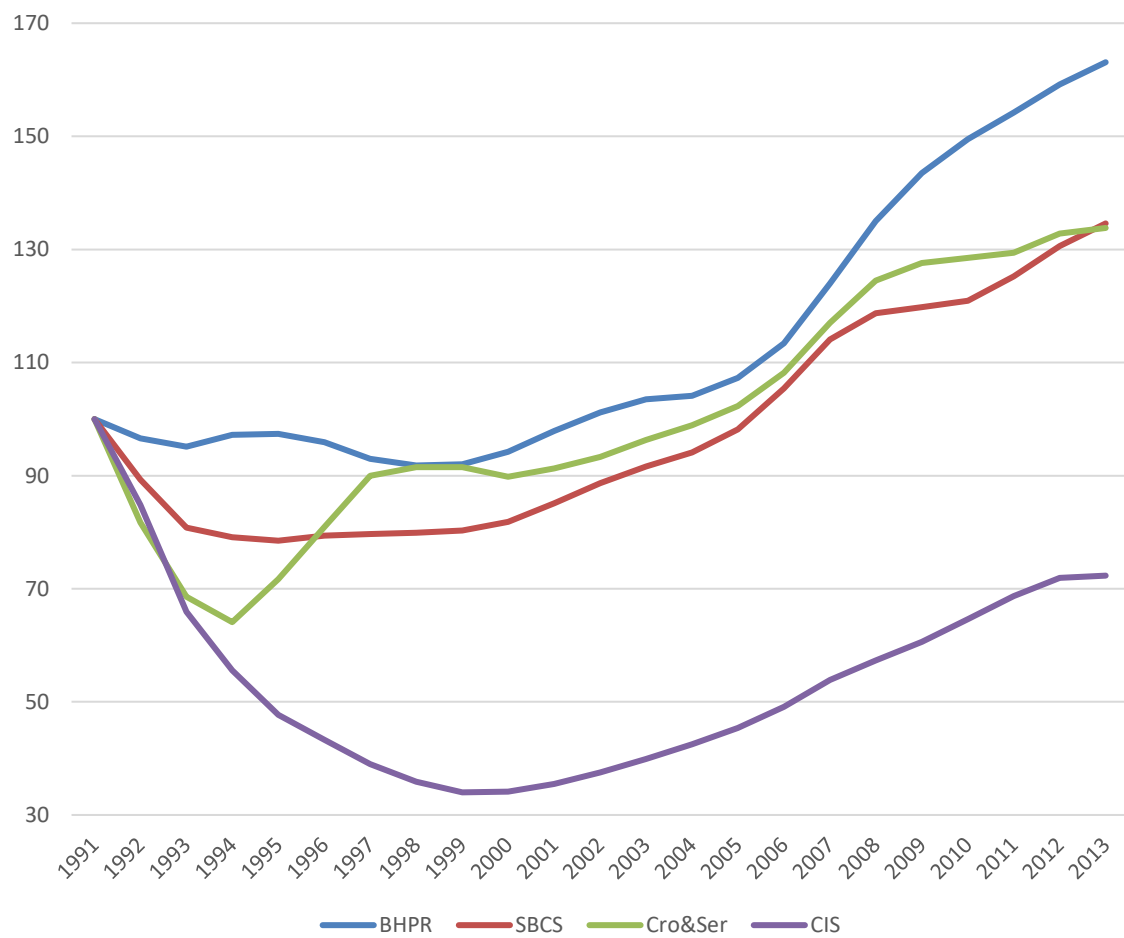Figure 4: Transition Indicators 1990-2014;
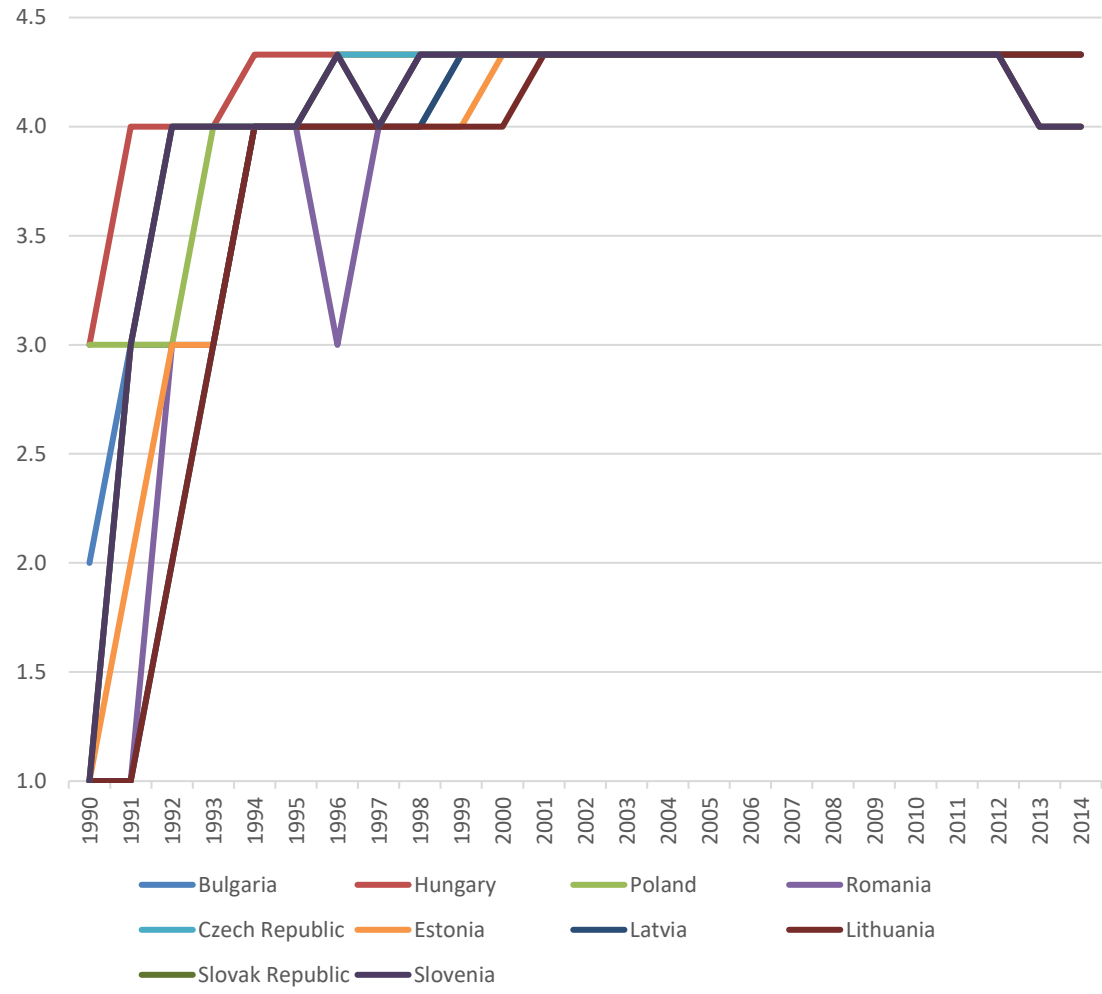Four Groups of Ex-Socialist Countries

Figure 5: Catch-up Index 1991-2013
Four Groups of Ex-Socialist Countries

Fig. 6: Trade & FE TI 1990-2014;
BHPR and SBCS Countries

Appendix 1

Transition indicators methodology

The transition indicator scores reflect the judgment of the EBRD's Office of the Chief Economist about country-specific progress in transition. The scores are based on the following classification system, which was originally developed in the 1994 Transition Report, but has been refined and amended in subsequent reports.

"+" and "-" ratings are treated by adding 0.33 and subtracting 0.33 from the full value. Averages are obtained by rounding down, for example. a score of 2.6 is treated as 2+, but a score of 2.8 is treated as 3-.

Overall transition indicators

Large-scale privatisation

1 Little private ownership.

2 Comprehensive scheme almost ready for implementation; some sales completed.

3 More than 25 per cent of large-scale enterprise assets in private hands or in the process of being privatised (with the process having reached a stage at which the state has effectively ceded its ownership rights), but possibly with major unresolved issues regarding corporate governance.

4 More than 50 per cent of state-owned enterprise and farm assets in private ownership and significant progress with corporate governance of these enterprises.

4+ Standards and performance typical of advanced industrial economies: more than 75 per cent of enterprise assets in private ownership with effective corporate governance.

Small-scale privatisation

1Little progress.

2 Substantial share privatised.

3 Comprehensive programme almost ready for implementation.

4 Complete privatisation of small companies with tradable ownership rights.

4+ Standards and performance typical of advanced industrial economies: no state ownership of small enterprises; effective tradability of land.

Governance and enterprise restructuring

1 Soft budget constraints (lax credit and subsidy policies weakening financial discipline at the enterprise level); few other reforms to promote corporate governance.

2 Moderately tight credit and subsidy policy, but weak enforcement of bankruptcy legislation and little action taken to strengthen competition and corporate governance.

3 Significant and sustained actions to harden budget constraints and to promote corporate governance effectively (for example, privatisation combined with tight credit and subsidy policies and/or enforcement of bankruptcy legislation).

4 Substantial improvement in corporate governance and significant new investment at the enterprise level, including minority holdings by financial investors.

4+ Standards and performance typical of advanced industrial economies: effective corporate control exercised through domestic financial institutions and markets, fostering market-driven restructuring.

Price liberalisation

1 Most prices formally controlled by the government.

2 Some lifting of price administration; state procurement at non-market prices for the majority of product categories.

3 Significant progress on price liberalisation, but state procurement at non-market prices remains substantial.

4 Comprehensive price liberalisation; state procurement at non-market prices largely phased out; only a small number of administered prices remain.

4+ Standards and performance typical of advanced industrial economies: complete price liberalisation with no price control outside housing, transport and natural monopolies.

Trade and foreign exchange system

1 Widespread import and/or export controls or very limited legitimate access to foreign exchange.

2 Some liberalisation of import and/or export controls; almost full current account convertibility in principle, but with a foreign exchange regime that is not fully transparent (possibly with multiple exchange rates).

3 Removal of almost all quantitative and administrative import and export restrictions; almost full current account convertibility.

4 Removal of all quantitative and administrative import and export restrictions (apart from agriculture) and all significant export tariffs; insignificant direct involvement in exports and imports by ministries and state-owned trading companies; no major non-uniformity of customs duties for non-agricultural goods and services; full and current account convertibility.

4+ Standards and performance norms of advanced industrial economies: removal of most tariff barriers; membership in WTO.

Competition policy

1 No competition legislation and institutions.

2 Competition policy legislation and institutions set up; some reduction of entry restrictions or enforcement action on dominant firms.

3 Some enforcement actions to reduce abuse of market power and to promote a competitive environment, including break-ups of dominant conglomerates; substantial reduction of entry restrictions.

4 Significant enforcement actions to reduce abuse of market power and to promote a competitive environment.

4+ Standards and performance typical of advanced industrial economies: effective enforcement of competition policy; unrestricted entry to most markets.

Appendix 2A. Exponential Gorwth Rates, 1971-1990 & 1991-2013

Country	1991-2013 Catch-Up Index 2013	Gr. Rate	1971-1990 Catch-Up Index 1990	Gr. Rate
	1991-2013		**1971-1990**	
	Catch-Up Index		**Catch-Up Index**	
Country	**2013**	**Gr. Rate**	**1990**	**Gr. Rate**
A) EU15XG				
Austria	126.2	1.06	117.0	0.83
Belgium	115.4	0.65	104.2	0.22
Denmark	116.5	0.7	89.9	-0.56
Finland	122.7	0.93	106.9	0.35
France	108.0	0.35	97.9	-0.11
Greece	104.7	0.21	102.3	0.12
Ireland	181.9	2.76	120.2	0.97
Italy	97.2	-0.13	131.1	1.44
Luxembourg	142.2	1.61	116.5	0.81
Netherlands	123.1	0.95	95.1	-0.26
Portugal	128.9	1.16	115.5	0.76
Spain	127.4	1.11	103.6	0.19
Sweden	113.8	0.59	94.1	-0.32
UK	112.0	0.52	106.7	0.34
B) BHPR				
Bulgaria	101.8	0.08	145.9	2.01
Hungary	143.9	1.67	165.9	2.70
Poland	213.2	3.50	143.5	1.92
Romania	226.8	3.79	101.0	0.05

Notes: BHPR stands for Bulgaria, Hungary, Poland, and Romania and
EU15XG for EU15 countries except Germany. The above results are der-
ived from PWT 9.0 data and are for catch-up (PCY relative to US) index

Appendix 2B. Exponential Gorwth Rates, 1991-2003 & 2004-2013

Country	2004-2013 Catch-Up Index		1991-2003 Catch-Up Index	
	2013	Gr. Rate	2003	Gr. Rate
A) EU15XG				
Austria	120.4	2.08	106.3	0.51
Belgium	116.4	1.7	101.9	0.16
Denmark	116.5	1.71	102.7	0.22
Finland	113.1	1.38	109.4	0.75
France	113.4	1.41	98.2	-0.15
Greece	89.3	-1.25	118.8	1.45
Ireland	109.8	1.04	165.4	4.28
Italy	105.5	0.6	94.9	-0.44
Luxembourg	121.5	2.19	117.8	1.37
Netherlands	112.6	1.33	112.4	0.98
Portugal	113.5	1.42	114.5	1.13
Spain	108	0.86	118.8	1.45
Sweden	113.3	1.4	102.8	0.23
UK	98.5	-0.17	114.5	1.13
B) BHPR				
Bulgaria	125.7	3.88	73.1	-2.07
Hungary	125.0	2.51	116.6	1.29
Poland	158.2	5.23	135.3	2.55
Romania	144.6	6.34	134.9	2.01
C) SBCS countries				
Czech Rep.	123.5	2.38	89.1	-0.95
Estonia	123.5	2.38	103.0	0.24
Latvia	110.8	1.15	71.9	-2.71
Lithuania	123.5	2.38	94.5	-0.47
Slovakia	110.8	1.15	87.4	-1.12
Slovenia	110.8	1.15	108.6	0.69

Notes: See above. SBCS stands for Slovenia, the Baltic countries, the
Czech Republic and Slovakia.

App. 3: Exp. Growth Rates
New Ex-Soc. Countries

Country	Catch-Up Index 2013	Gr. Rate
A) SBCS countries		
Czech Rep.	111.0	0.48
Estonia	175.0	2.58
Latvia	115.0	0.64
Lithuania	161.5	2.20
Slovakia	136.2	1.41
Slovenia	121.0	0.87
B) Croatia and Serbia		
Croatia	128.0	1.13
Serbia	139.8	1.53
C) CIS countries		
Armenia	125.1	1.02
Kazakhstan	142.9	1.64
Kyrgyz Rep.	33.9	-4.80
Moldova	73.1	-1.41
Russian Fed.	88.8	-0.54
Tajikistan	35.8	-4.56
Ukraine	73.6	-1.38

Notes: See above. Catch-up index is the index of PCY relative to the US income . The base year for all countries is 1991.