



THE WILLIAM DAVIDSON INSTITUTE
AT THE UNIVERSITY OF MICHIGAN BUSINESS SCHOOL

*Returns to Skills and the Speed of Reforms:
Evidence from Central and Eastern Europe, China, and Russia*

By: Belton M. Fleisher, Klara Sabirianova and Xiaojun Wang

William Davidson Institute Working Paper Number 703
June 2004

**Returns to Skills and the Speed of Reforms:
Evidence from Central and Eastern Europe, China, and Russia¹**

by

Belton M. Fleisher+

Klara Sabirianova++

Xiaojun Wang+++

+Contact Author. Professor, Department of Economics, Ohio State University,
Columbus, OH, 43210; 614 292 6429; Email: FLEISHER@ECONOMICS.SBS.OHIO-STATE.EDU

++Assistant Professor, William Davidson Institute at the University of Michigan Business
School

+++Assistant Professor, Department of Economics, University of Hawaii.

¹ We acknowledge helpful communications with Oleksiy Ivaschenko, Daniel Munich, Dana Sapatoru, and Yaohui Zhao. Comments by Peter Orazem have been particularly helpful. We thank Charlie Pengvanich and Ruchir Agarwal for excellent research assistance in data collection and Yuriy Gorodnichenko and Janos Kollo for providing their estimates on returns to schooling in Ukraine and Hungary. We thank Carsten Holz, Gary Jefferson, and Xianchun Xu for commenting on our indexes of liberalization and privatization for China, but we absolve them of any blame for errors in these series.

**Returns to Skills and the Speed of Reforms:
Evidence from Central and Eastern Europe, China, and Russia**

We dedicate this paper to the memory of Mark C. Berger, who died in 2003 at the peak of his career. Mark Berger was the Ph.D. student of Belton Fleisher and the Ph.D. advisor of Klara Sabirianova. He will long be remembered as a noted contributor to our understanding of labor economics, as a devoted teacher and advisor, and as an outstanding member of his community.

Abstract

We explore the pace of increase in returns to schooling during the transition from planning to market over time across a number of Central and Eastern European countries, Russia, and China. We use metadata from 33 studies of 10 transition economies covering a period from 1975 through 2002. Our empirical model is an attempt to account for cross-section and over-time variation in rates of return as a function of the timing, speed, and volatility of reform processes as well as estimation methods used and sample characteristics. Our principal aim is to investigate the relative strength of two hypotheses: (1) the speed of economic transformation from planning to market represent the relaxation of legal, regulatory, and institutional constraints on wage-setting behavior, leading directly to adjustment returns to schooling to market rates; 2) the rapid increase in returns to schooling during the early reform period reflects the ability of highly-educated individuals to respond to changing opportunities in a disequilibrium situation. We find that both the speed of reforms and the degree of economic disequilibrium as reflected in macroeconomic volatility help to explain cross-country differences in the time paths of the returns to schooling. We report the systematic effects of sample characteristics, estimation methods, and model specifications on estimated returns to schooling.

JEL Classification: J31, J24, O15, P2, P3, P5.

Keywords: returns to schooling, skills, speed of reforms, meta-analysis, transition, Central and Eastern Europe, China, Russia.

1. Introduction

One of the defining characteristics of economies operating under the Soviet, Central and Eastern European, and Chinese planning schemes in the post-World War II era was the imposition of wage “grids,” introduced to effect income leveling policies that were, at least officially, favored by the communist government of the Soviet Union and which were adopted in various forms in the Soviet satellites and by China as well. (Meng, 2000; Munich, Terrell, and Svejnar, 2003). The wage compression imposed by the grids effectively reduced private returns to schooling as conventionally measured. Estimated returns prior to reform were less than 5% in all countries except Hungary, which operated under a considerably less rigid economic regime than did most of the rest of Central and Eastern Europe and the former Soviet Union. In China, returns to schooling, which were in the 5-6% range in the early 1950s, fell to nearly zero by the end of the Cultural Revolution (Fleisher and Wang, 2003).

With economic reforms, enterprises began to operate under fewer constraints, rapidly in most cases, but slower in China and in some of the countries that had been in the Soviet Union sphere of influence. In the absence of the wage-grid structure, it is natural to expect that returns to schooling would increase. While this expectation has to a large extent been fulfilled, the time path of returns to schooling has by no means been uniform. Studies of the returns to schooling in much of Central and Eastern Europe and Russia (CEER) indicate they tended to rise almost immediately following reform, albeit at different speeds. However, most studies of returns to schooling in China in the period covering approximately the first 15 years of its economic transition report low rates of return when compared not only to industrialized and industrializing countries but also to almost all of CEER.² This paper seeks an explanation of variation in the growth of returns to schooling within the CEER group as well as the larger variation between CEER and China.

The path of returns to schooling in transition economies has generally evolved in two phases (Sabirianova Peter, 2003). The early phase encompassed the period in

² For summaries of the estimated returns to schooling in China, see Zhang and Zhao (2002) and Fleisher and Wang (2003). The reviews of the estimated rates of return in CEER countries are provided in numerous studies, including Boeri and Terrell (2002), Brainerd (1998), Munich, Svejnar, and Terrell (1999), and Rutkowski (2001).

which the transition economies moved from wage setting under the wage grids toward one that reflected the relative marginal products of skilled and unskilled workers. In the second phase the path of relative wages is expected to match more closely the path of relative marginal products of skilled and unskilled (or highly educated and less educated) workers. This paper deals primarily with wage adjustments during the initial, disequilibrium phase of economic transition in CEER and China.

One obvious hypothesis explaining wage adjustments during the first phase is that the speed of relative wage adjustment to the ratio of the marginal products simply reflects the speed of relaxation of legal, regulatory, and institutional constraints on wage-setting behavior. Thus, the higher the speed of reforms the faster should returns to schooling be adjusted to the market rates. Another hypothesis explaining the relatively rapid increase in returns to schooling in CEER is that the structural transformations, disruptions, and economic disequilibrium are important factors, and the rapid increase in returns to schooling during the first phase reflects the ability of highly-educated individuals to respond to changing opportunities in a disequilibrium situation (Schultz, 1975). The two hypotheses – “the speed of reforms” and “disequilibrium” – are not mutually exclusive, and we compare their relative importance with metadata from 33 studies of 10 transition economies, linking these data to a rich set of measures on reform progress and macroeconomic volatility.

Throughout the paper, we define the beginning of reform on the basis of political, legislative, and administrative changes that indicate a departure from the intent to control the economy according to an official plan, allowing or encouraging evolution toward a market economy. These dates are closely associated with the beginning of comprehensive price and trade liberalization programs in CEER and the year following the end of the Cultural Revolution in China.³

The rest of the paper proceeds as follows. In the next section we describe metadata on returns to schooling in transition economies. In section 3 we discuss various measures of the speed of reforms and macroeconomic volatility. In section 4 we present an empirical model with which we attempt to account for cross-section and

³ The start of reforms is determined as follows: 1979 for China, 1990 for Hungary and Poland, 1991 for the Czech and Slovak Republics and Slovenia, and 1992 for Estonia, Romania, Russia and Ukraine.

over-time variation in rates of return as a function of reform processes (timing, speed, and volatility), estimation methods used, and sample characteristics. Section 5 reports empirical findings and section 6 provides the summary of results.

2. Metadata on Returns to Schooling in Transition Economies

In this paper, we use meta-analysis that integrates the results of several studies of the returns to schooling in transition economies.⁴ We have created a unique data set of 470 different returns to schooling obtained from 33 studies in 10 transition economies.⁵

Table 1 shows the descriptive statistics for this sample of studies. The full listing of 33 studies is reported in Appendix 1. Returns to schooling in our sample of studies are mainly estimated by the OLS method. Only 12.3 percent of the estimates are obtained by IV/2SLS or GMM methods, which is likely due to the lack of valid instruments in many data sets on transition economies. Most estimates are obtained directly from the coefficients on the years of schooling; only 5.3 percent of the estimates are imputed on the base of specifications with the level of education. Imputations are performed for countries with no direct estimates of the returns to the year of schooling, such as Estonia, Poland, and Slovenia. 72.7 percent of all studies report standard errors or t-statistics of the coefficient on the years of schooling.

Besides traditional covariates such as years of schooling and linear and quadratic terms of experience, many earnings functions include additional individual characteristics that might affect the estimated returns to schooling. In our sample, the industry of employment is included as a regressor in 39.8 percent of the estimates. Firm characteristics, such as size, age, and ownership, are included in 24 percent of the estimates. Having occupational dummies in the earnings functions is less common

⁴ For a meta-analysis of returns to schooling in a large sample of countries, see Ashenfelter, Harmon, and Oosterbeek (1999) and Denny, Harmon, and Lydon (2002). Only the latter study includes transition countries, but the estimates of the returns to schooling are not time-varying.

⁵ The original number of estimates exceeds 500 but for the purpose of our analysis, we had to exclude countries with no time trend in returns to schooling. Among excluded countries are Bulgaria, Macedonia, Vietnam, and countries of Central Asia. We also excluded three outliers: Li and Zhang (1998) reported (-0.067) in 1977 for a very small sample of 668 workers from one China village; Li and Luo (2002) reported extremely high estimates of 0.326 and 0.356 for China in 1995 also for a very small sample of 590 Chinese women.

(14.5 percent). Only a few estimates control for hours of work (14.3 percent) using either hourly wage rate on the left-hand side or including log of hours on the right-hand side of the earnings function. No hourly data have been used in the pre-reform period, but over time these data are increasingly becoming more available in the transition countries. Occasionally, earnings functions control for ethnicity, party membership, school quality, language, marital status, parental income, health, and family background. Compared to the common use of the ability controls in many U.S. studies, we did not find any study in transition economies that explicitly control for ability measures (see Ashenfelter, Harmon, and Oosterbeek, 1999).

Sample size varies significantly, with the largest samples coming from administrative data and the smallest samples being drawn in the pre-reform period in China and Russia. The samples are mainly based on household surveys, with 7 percent derived from surveys of employers or from administrative data. Roughly half of the estimates are based on combined samples of men and women, with the other half based on gender-specific samples.

Table 2 reports average returns to schooling for 10 countries by year from 1975 through 2002. Between 1 and 8 countries are represented in each year. A substantial number of estimates come from the early 90s. The overall trend of returns to schooling is positive, with a noticeable increase in the mean and variance of the returns to schooling over time. Although the time path of returns to schooling has generally been upward as expected, it has not been uniform across countries or steady within countries over time. This heterogeneity of levels and time paths is revealed in Table 3. Initial reform years are indicated in column 1. In the countries' respective pre-reform periods, schooling rates ranged from a low of 1.5 percent in China to a high of 6.7 percent in Hungary, a country which did not adhere to the strict model of Soviet planning. The estimated returns to schooling under communist wage grids were much below typical estimates for a market economy.⁶ During the early reform period, defined as the first five years in Table 3, schooling returns barely budged in China, but rose sharply in the other countries for which comparisons can be made. The only exception in CEER is

⁶ For instance, Card (1999) reviews a range of studies in which most of the estimated schooling effects using recent U.S. data are well above the estimates we report for the pre-transition period.

Hungary, where the returns were much higher prior to reform than in the other planned economies. Some variation is noticeable in the time paths of rates of return among the CEER countries, particularly between low-return countries (such as Romania and Ukraine) and other CEER countries. However, the biggest gap in the first phase is between the CEER group on one hand and China on the other.⁷

3. Returns to Schooling, the Speed of Reforms, and Macroeconomic Disequilibrium

Our central question is to what extent cross-country variation in the growth of returns to schooling in transition economies can be explained by the speed of market reforms and/or by the degree of macroeconomic volatility during the early reform period.

A fundamental methodological question is the need to define reform progress. We measure reform progress in four broad dimensions: liberalization of prices and wages, private ownership, enterprise reforms, and the openness of the economy. We employ quantitative measures such as the proportion of GDP produced in the private sector and the share of foreign direct investment (FDI) in GDP as well as qualitative indices developed by the European Bank for Reconstruction and Development (EBRD) such as the degree of price and trade liberalization, large-scale privatization, and enterprise restructuring. Definitions of all reform measures and data sources are reported in Appendix 2. The EBRD indices are available for all Central and Eastern European countries and Russia for 1991-2002. To extend the series, we have asked experts' opinions on the indices for the pre-reform period and for China. Additionally, we have developed our own index of wage liberalization to assess the countries' departure from the wage grid towards market-based wage determination.⁸ All reform indicators range from 1 to 4, with 1 indicating little or no change from rigid central planning and 4 indicating the level of reform is consistent with a well-functioning market economy.

⁷ The gap in returns to schooling between China and Russia will appear somewhat smaller if we use 1987, the beginning of Gorbachev's gradual economic reforms ("perestroika"), as the start of Russian reforms.

⁸ The index of wage liberalization is constructed on the base of experts' opinions and documented institutional changes in the labor market.

Table 4 contains several measures of the speed of reforms in CEER and China in the early reform period. In addition to the end-period values, we also show the change in reform measures during the first five years of transition. Overall results suggest that after five years from the start of transition, all CEER countries in our sample became essentially market economies, with free prices and wages, open foreign trade, almost completed large-scale privatization, and the significant share of the private sector in GDP. However, the “big bang” reform that describes much of CEER has not characterized China, where the Chinese Communist Party has retained political power throughout the economic transition. The Chinese approach to transition has been aptly described as “growing out of the plan,” by Barry Naughton (1995) and by Deng Xiaoping’s phrase, “crossing the river by groping for stones” (Qian and Wu, 2003). Several years into the reform era, China not only had a much less liberal price, wage, and foreign trade regimes than did any of the CEER countries, but it also exhibited the smallest increase in the degree of liberalization, except for Slovenia, which had far less rigidly controlled prices to begin with. After five years of reforms, China had hardly begun the privatization process and enterprise reforms. An important illustration of slow enterprise reforms is the persistence of soft budget constraints in state owned enterprises until well into the 1990s, almost 20 years after the end of the Cultural Revolution (Appleton, *et al*, 2002).

In contrast to China, all CEER countries in our sample moved very fast in the liberalization of prices, wages, and foreign trade; however, there are significant differences in the speed of privatization and enterprise reforms within the CEER group. For example, EBRD ranked privatization results in Romania, Slovenia, and Ukraine very low compared to other countries in the region. Romania, Russia, and Ukraine still retained soft budget constraints and weak enforcement of bankruptcy legislation well into the reform period, whereas others undertook significant actions to harden budget constraints and promote corporate governance effectively.

In contrast to its relatively very slow movement toward free markets, China experienced the most rapid economic growth among the transition economies we examine. Table 5 contains data on real GDP growth and real wage growth over the first five reform years in 10 transition economies. The five-year real GDP growth rates

range from a low of approximately -52.8 percent in Ukraine to a high of 47.8 percent in China. It appears clear that China experienced the largest real GDP growth and real wage growth during the first five transition years, and that real wages declined in all CEER countries except Hungary.

Table 5 also illustrates that the loss of macroeconomic control as the fraction of total output produced under Plan diminished was much more severe in CEER than in China. In China, where the early transition was furthest from the “big bang” approach, inflation was the mildest of all countries represented. In contrast, every CEER country experienced significant inflation during the early reform period. All other measures of macroeconomic volatility (the standard deviations of real GDP growth, real wage growth, and consumer inflation over the early reform period) also indicate less volatility in China than in the other countries, with one exception: the standard deviation of real wage growth was smallest in Hungary.

The variation in the volatility of economic development across countries and between the European-Russian group and China is a strong candidate to explain cross-country differences in returns to schooling in the early reform period. According to the Shultz hypothesis, the rapid increase in returns to schooling could reflect the ability of highly-educated individuals to exploit opportunities that emerge in periods of disequilibrium. In the transition context, however, testing this hypothesis is complicated by the fact that the period of disequilibrium is coincided with the period of market formation and with the adjustment of schooling returns to market rates. Thus, a major challenge is to disentangle the “speed effect” from the “disequilibrium effect” on the returns to schooling.

4. A Model of Cross-Country Differences in Returns to Schooling

In this section, we present an empirical model that provides a framework for explaining the cross-country and over-time variation in returns to schooling in terms of differences in the speed of reforms and volatility of economic change. We first specify a baseline equation for the returns to schooling as a function of reform timing, methods of estimation, specifications of the earnings functions, and sample characteristics:

$$r_{it} = \alpha_0 + \alpha_1\tau_{it} + \alpha_2\tau_{it}TE_{it} + \alpha_3\tau_{it}TL_{it} + \alpha_4C_i + \gamma_1M_{it} + \gamma_2P_{it} + \gamma_3S_{it} + \varepsilon_{it} \quad (1)$$

where r_{it} represents the estimates of the returns to schooling for country i and year t ; the C 's denote the set of country dummy variables, TE_{it} is the early transition period defined as the first five years since the reforms started⁹, TL_{it} is the late transition period, τ_{it} is time trend relative to the country-specific reform starting point ($\tau_{it}=1$ at the beginning of reforms), and ε_{it} is an error term with i.i.d. properties and $E(\varepsilon)=0$. Other variables control for the methods of estimation (M_{it}), the specifications of the estimated earnings functions (P_{it}), and sample characteristics (S_{it}).¹⁰

The baseline equation enables us to compare trends in returns to schooling between pre-reform, early, and late transition periods; and to identify the extent to which alternative estimation methods, model specifications, and different sample characteristics systematically affect estimates of the returns to schooling. The estimated coefficients of the country dummy variables will reveal if there are *ceteris paribus* significant cross-country differences in the average returns to schooling. We estimate the baseline equation by regular (unweighted) OLS and by using weighting techniques, with estimates of returns to schooling with smaller standard errors and derived from large samples receiving proportionately larger weights (see Denny, Harmon, and Lydon, 2002).

The extended model is specified to provide information on factors that can account for cross-country differences revealed in the baseline estimates. In the first extension, we add various measures of reform progress and macroeconomic volatility as follows.

$$r_{it} = \alpha_0 + \alpha_1\tau_{it} + \alpha_2\tau_{it}TE_{it} + \alpha_3\tau_{it}TL_{it} + \alpha_4C_i + \alpha_5X_{it} + \alpha_6Z_{it} + \gamma_1M_{it} + \gamma_2P_{it} + \gamma_3S_{it} + \varepsilon_{it} \quad (2)$$

where X_{it} is a vector of variables that reflect countries' progress towards a market economy and Z_{it} is a vector of variables measuring macroeconomic volatility. Since many of these variables (X_{it} and Z_{it}) are highly correlated with each other, we employ

⁹ We have also used alternative definitions of the early reform period as the first three and four years since the beginning of reforms. Our results are robust to these alternative specifications.

¹⁰ M_{it} include dummies for non-OLS estimation and imputed estimates from the coefficients on the type of education; P_{it} is a set of dummy variables indicating whether estimated earnings functions include industries, occupations, firm characteristics, and hours of work; S_{it} is a vector of controls for household- and employer-based samples and gender-specific samples.

alternative specifications that include at least one measure of reform progress and one measure of macroeconomic volatility. We hypothesize that there is a positive association of the returns to schooling with the progress of economic reform and with economic volatility, *ceteris paribus*.

Our measures of reform progress (or market development) are cumulative in their nature and reflect not only the state of reforms in any given point of time but also changes accumulated over the past pre-reform and reform years. Thus, these may not measure the speed of reforms for the countries characterized by “market socialism” which were already partially liberalized before the transition started (e.g. Hungary and Slovenia). In a further extension of the baseline model, we distinguish between the effects of initial conditions and the effects of the speed of reforms on the returns to schooling.¹¹

$$r_{it} = \alpha_0 + \alpha_1\tau_{it} + \alpha_2\tau_{it}TE_{it} + \alpha_3\tau_{it}TL_{it} + \alpha_4X_{i0} + \alpha_5\Delta X_{i5} + \alpha_6Z_{it} + \gamma_1M_{it} + \gamma_2P_{it} + \gamma_3S_{it} + \varepsilon_{it} \quad (3)$$

where X_{i0} is a vector of initial conditions and ΔX_{i5} is a vector of the speed of reforms variables. Using the same measures of reform progress as in equation (2), we modify them to reflect the speed of reforms, using the difference between the value of market development index in the fifth year of reforms (X_{i5}) and the value of market development index in the last year of the old system (X_{i0}).

5. Estimation Results

Both OLS and weighted least square estimates of the baseline regression are reported in Table 6. There are no principal differences between the two sets of estimated coefficients. Unless otherwise indicated, the remaining discussion is based on the OLS estimates with country fixed effects, and all estimated coefficients meet customary significance standards. On average, rates of return increased by 0.2 percentage points per year during the respective countries’ planning periods; by 0.5 percentage points per year during early reform, and by 0.3 percentage points during late reform. Thus, returns to schooling are estimated to have the highest rate of growth

¹¹ By including country dummies in Eq.2, we control for initial conditions, but the effect of initial conditions is not directly observable.

during the early period of the transition to a market economy. Even after controlling for reform timing, methods of estimation, the specifications of the estimated earnings functions, and sample characteristics, cross-country differences in return to schooling remain significant, with China and Ukraine having lowest rates. Estimates reported in studies where years of schooling are imputed are marginally smaller. When occupation is included, estimated returns to schooling are considerably smaller for well-known reasons. Including industry of employment and firm characteristics such as size, age, and ownership has no statistically significant effect on the estimated returns to schooling. When earnings data are adjusted for hours worked, estimated returns to schooling are not significantly larger, which is somewhat surprising, given the analysis of Schultz (1988). Estimates based on all-men samples are somewhat smaller, and those based on all-women samples are somewhat larger, than those in which both genders are represented in the data, which is consistent with studies from the U.S. and other countries (see Dougherty, 2003).

The largest “effect” on estimated returns to schooling is estimation by non-OLS, mainly instrumental variables techniques, and when the sample is employer based rather than worker based. We take both of these results to imply that measurement and recall errors are important in schooling data, that employer data are more accurate than worker recollection in measuring years of schooling, and that the omission of “ability” measures from most studies does not dominate other sources of bias in OLS estimation.

The regressions reported in Table 7 represent an attempt to account for the cross-country differences in the rate of return to schooling by adding to the benchmark regression, one at a time, seven alternative measures of the speed of economic reform and seven alternative measures of macroeconomic volatility. The definitions of all these measures are presented in Appendix 2. Our hypotheses are that the level and speed of reforms represent the relaxation of legal, regulatory, and institutional constraints on wage-setting behavior, leading directly to adjustment returns to schooling to market rates, while macroeconomic volatility increases the payoff to schooling in the sense described by Schultz (1975). Adding the speed of reforms and volatility variables to the benchmark equation is a significant step toward explaining the pattern of rates of return

during reform. All coefficients on the speed of reforms and macroeconomic volatility variables are of the expected signs and are statistically significant. When the speed of reforms and volatility variables are added to the baseline regression, the F-statistic for the joint significance of the time variables falls by nearly one-half. Adding the speed of reforms and volatility variables also substantially reduces the F-statistic of the joint country effect. For the baseline regression reported in column (1) of Table 6, the F-statistic for significance of the country dummies as a group is 45.77. But in Table 7 it falls to 23.31-37.92 depending on specification.

Another way to assess the explanatory power of the speed of reforms and volatility variables is to use the estimated coefficients to project the impact of a unit change in the value of a regressor on the dependent variable. Given the arbitrary nature of the units of measurement of the regressors, we use one standard deviation as the unit. The estimated coefficient of privatization as measured by the private share of GDP implies that a one standard deviation increase in the private sector share leads to a 0.53 percentage point increase in the return to schooling, *cet. par.* Using the estimated coefficients reported in column (2) of Table 7, an increase in the index of wage liberalization by one standard deviation is associated with an 0.45 percentage point increase in the rate of return to schooling, while an increase in mean inflation by one standard deviation is associated with a 0.2 percentage point increase in the return to schooling. Our findings are not conclusive about the relative strength of the two hypotheses. The impact of both reform index and volatility variables on the estimated returns to schooling is significant but their relative power depends on the chosen measure.

A complementary approach to investigate the factors associated with cross-country differences in return-to-schooling estimates is reported in Table 8, where we focus on the state of the respective economies at the beginning of reform. Here we drop the country dummies and replace them with the initial levels of the reform variables used in the regressions of Table 7 as well as their change over the first five reform

years.¹² All coefficients on the speed of reforms variables are statistically significant and have expected positive sign. The effect of the speed of reforms measured as the 5-year difference is consistent with the earlier estimates where the speed of reforms is measured as the attained level of market reform progress. An important finding is that initial conditions have substantial effect on the estimated returns to schooling: the higher the level of liberalization at the start of reforms, the higher the returns. Countries with less administrative regulations of wages and prices during the planning period are estimated to have higher schooling returns. The volatility variables have the same signs as in Table 7, with the exception of the standard deviation of real GDP growth that switches the sign and becomes statistically insignificant.

6. Summary

This paper reports the results of a meta-analysis of studies of the returns to schooling in several Central and Eastern European countries, Russia, and China. The data are the estimation results reported in 33 studies of 10 transition economies. We develop an empirical model which permits us to account for cross-section and over-time variation in rates of return as a function of the timing, speed, and volatility of transition from planning to market as well as estimation methods used and sample characteristics. We find that both the speed of economic transformation from planning to market and the degree of economic disequilibrium as reflected in macroeconomic volatility help to explain differences in the increase in the rate of return to schooling over time and across countries. Evaluating the relative explanatory power of the speed and disequilibrium hypotheses is complicated by their interaction and the fact that the transition to a market economy necessarily generates disequilibrium. Nevertheless, as the correlations in Appendix Table A3 indicate, measures of transition speed and disequilibrium are by no means perfectly correlated, and we have been able to identify independent effects of these two forces.

The effect of sample characteristics and estimation technique is for the most part consistent with the results of other meta-studies of returns to schooling. It is noteworthy

¹² Alternatively, we calculated the speed of reforms as the total number of years required to achieve a given level of market development. We chose to not report the results because they are roughly similar to the ones presented in Table 8.

that larger estimated returns to schooling are obtained by non-OLS, mainly instrumental variables techniques and when the sample is employer based rather than worker based. We take both of these results to imply that measurement and recall errors are important in schooling data, that employer data are more accurate than worker recollection in measuring years of schooling and that the omission of “ability” measures from most studies does not dominate other sources of bias in OLS estimation.

Although the explanatory power of country dummy variables and of trend is significantly reduced when the speed of reforms and volatility variables are incorporated in the regression equations, their regression coefficients remain statistically significant. Thus, much remains to be learned. We did not explore the role of technological change and the effect of supply shifts on returns to schooling. We also have ignored the role of worker mobility in promoting changes in relative wages. It is likely that these forces act differently in China than in CEER. The answers to these and related questions await further study.

Table 1: Characteristics of the Metadata on Returns to Schooling

Metadata Characteristics	All	Pre-Reform Period	Reform Period
<i>Observations</i>			
Number of countries	10	9	10
Number of studies	32	15	32
Number of estimates	470	82	388
<i>Methods of estimations</i>			
Non-OLS estimation	0.123	0.098	0.129
Imputed values	0.053	0.073	0.049
<i>Specifications of the earnings functions</i>			
Industry of employment included	0.398	0.415	0.394
Occupation included	0.145	0.073	0.160
Firm characteristics included	0.243	0.122	0.268
Adjusted for hours	0.143	0.000	0.173
<i>Sample characteristics</i>			
Sample of men and women	0.500	0.390	0.523
Men sample	0.268	0.317	0.258
Women sample	0.232	0.293	0.219
Employer-based sample	0.070	0.049	0.075
Household-based sample	0.930	0.951	0.925

Notes: The start of reforms is given as: 1979 for China, 1990 for Hungary and Poland, 1991 for the Czech and Slovak Republics and Slovenia, 1992 for Estonia, Romania, Russia and Ukraine.

Table 2: Average Returns to Schooling in Transition Economies

Year	Mean	Std. dev.	No. of Countries	No. of Studies	No. of Estimates
1975	0.016	0.003	1	1	9
1978	0.014	0.002	1	1	9
1981	0.025	0.000	1	1	1
1984	0.030	0.010	3	2	17
1985	0.029	0.016	2	3	10
1986	0.038	0.013	4	5	13
1987	0.038	0.008	3	5	14
1988	0.040	0.009	3	6	20
1989	0.046	0.017	5	7	15
1990	0.045	0.009	3	3	14
1991	0.046	0.011	5	7	35
1992	0.057	0.020	6	12	35
1993	0.054	0.011	7	7	29
1994	0.064	0.020	7	9	43
1995	0.086	0.035	8	11	38
1996	0.075	0.018	7	12	37
1997	0.070	0.029	6	5	21
1998	0.075	0.024	5	6	27
1999	0.076	0.036	3	3	16
2000	0.088	0.037	5	5	42
2001	0.078	0.027	2	2	17
2002	0.062	0.025	1	1	8
Total	0.060	0.030	10	32	470

Table 3: Returns to Schooling and Reform Starting Points

Country	Reform Starting Point	Pre-Reform Period	Early Reform Period	Late Reform Period
China	1979	0.015 (0.003)	0.025 (0.000)	0.061 (0.033)
Czech Republic	1991	0.039 (0.010)	0.070 (0.026)	0.083 (0.029)
Estonia	1992	0.025 (0.000)	0.076 (0.009)	na
Hungary	1990	0.067 (0.009)	0.074 (0.029)	0.098 (0.024)
Poland	1990	0.046 (0.004)	0.067 (0.010)	0.072 (0.005)
Romania	1992	na	0.046 (0.015)	0.056 (0.023)
Russia	1992	0.039 (0.009)	0.075 (0.012)	0.092 (0.014)
	1987	0.029 (0.004)	0.043 (0.007)	0.081 (0.015)
Slovak Republic	1991	0.038 (0.010)	0.061 (0.021)	0.097 (0.023)
Slovenia	1991	0.043 (0.004)	0.063 (0.006)	0.070 (0.002)
Ukraine	1992	0.040 (0.014)	na	0.055 (0.022)
	1987	0.033 (0.011)	0.047 (0.014)	0.055 (0.022)

Notes: N=470. Standard deviations are in parentheses. Early reform period is defined as first five years of reforms. The reform starting point is defined as the beginning of comprehensive price and trade liberalization programs in CEER and the year following the end of Cultural Revolution in China. For Russia and Ukraine we also consider an alternative starting point: beginning of “perestroika” or gradual economic reforms in 1987.

Table 4: Measures of the Speed of Reforms during the Early Reform Period

	Liberalization of			Large-Scale Privatization	Enterprise Reforms	FDI (% GDP)	Private Sector Share of GDP
	Wages	Prices	Foreign Trade				
<i>End of Period</i>							
China	1.3	1.3	1.3	1	1	0.28	0.02
Czech Republic	4	3	4	4	3	4.93	0.70
Estonia	4	3	4	4	3	3.45	0.70
Hungary	4	3	4.3	3	3	2.76	0.55
Poland	3	3	4	3	3	1.85	0.55
Romania	3	3	3	2.7	2	0.79	0.55
Russia	4	3	4	3	2	0.62	0.60
Slovak Republic	3.7	3	4	3	3	1.23	0.60
Slovenia	3	3	4	2.7	2.7	0.80	0.50
Ukraine	3	3	3	2	2	1.17	0.50
<i>5-Year Change</i>							
China	0.3	0	0	0	0	0.28	0.02
Czech Republic	3	2	3	3	2	4.72	0.58
Estonia	2	1	2	3	2	3.45	0.60
Hungary	1	1	1.3	2	1	2.12	0.40
Poland	2	2	3	2	2	1.83	0.26
Romania	1	1	2	1	1	0.65	0.30
Russia	2	2	3	2	1	0.62	0.55
Slovak Republic	2.7	2	3	2	2	1.23	0.48
Slovenia	1	0	1	1.7	1.7	0.77	0.39
Ukraine	1	2	2	1	1	1.17	0.40

Sources: EBRD Transition Reports (various issues), 2003 World Development Indicators; UNCTAD; national statistical yearbooks.

Notes: Definitions of all measures are reported in Appendix 2. Early reform period is defined as first five years of reforms.

Table 5: Macroeconomic Performance during the Early Reform Period

Country	5-Year Cumulative Change			Annual Standard Deviation		
	Real GDP Growth	Inflation	Real Wage Growth	Real GDP Growth	Inflation	Real Wage Growth
China	47.8	16.7	15.1	2.1	2.4	3.3
Czech Republic	-4.7	152.2	-1.4	6.5	20.2	15.3
Estonia	-23.6	5134.7	-35.7	10.7	460.7	23.7
Hungary	-15.7	209.5	1.8	5.5	6.3	1.8
Poland	-3.4	2887.3	-28.4	6.1	242.2	12.2
Romania	7.9	4704.4	-10.4	6.3	100.2	13.1
Russia	-37.0	322430.7	-55.3	4.9	691.3	21.5
Slovak Republic	-15.3	171.8	-19.2	9.2	21.7	15.0
Slovenia	-2.8	1107.2	-8.8	6.5	83.0	13.1
Ukraine	-52.8	5389377.0	-48.9	5.4	1883.4	24.3

Sources: 2003 World Development Indicators, IMF, and national statistical yearbooks.

Notes: Early reform period is defined as first five years of reforms. The start of reforms is given as: 1979 for China, 1990 for Hungary and Poland, 1991 for the Czech and Slovak Republics and Slovenia, and 1992 for Estonia, Romania, Russia and Ukraine.

Table 6: Returns to Schooling in Early and Late Reform Periods, Fixed Effects

Variables	(1)	Robust	(2)	Robust
	Coeff.	Std. Error	Coeff.	Std. Error
	Unweighted OLS		Weighted OLS	
Constant	0.041 ^a	0.003	0.040 ^a	0.003
Time	0.002 ^a	0.001	0.003 ^a	0.001
Time*TE	0.003 ^a	0.001	0.002 ^c	0.001
Time*TL	0.001 ^c	0.001	0.001	0.001
Non-OLS estimation	0.043 ^a	0.004	0.044 ^a	0.003
Imputed values	-0.006 ^c	0.003	-0.005 ^c	0.003
Industry included	-0.001	0.002	0.001	0.002
Occupation included	-0.018 ^a	0.002	-0.016 ^a	0.002
Firm characteristics included	-0.003	0.002	-0.004 ^c	0.002
Adjusted for hours	0.001	0.003	0.002	0.003
Men sample	-0.008 ^a	0.002	-0.007 ^a	0.002
Women sample	0.009 ^a	0.002	0.008 ^a	0.002
Sample of employers	0.017 ^a	0.004	0.019 ^a	0.004
Countries				
China	-0.026 ^a	0.003	-0.031 ^a	0.003
Czech Republic	0.010 ^a	0.003	0.012 ^a	0.003
Estonia	0.027 ^a	0.008	0.027 ^a	0.008
Hungary	0.021 ^a	0.005	0.022 ^a	0.004
Poland	0.015 ^a	0.004	0.016 ^a	0.003
Russia	0.015 ^a	0.003	0.015 ^a	0.003
Slovak Republic	0.002	0.004	0.001	0.004
Slovenia	0.015 ^a	0.005	0.015 ^a	0.004
Ukraine	-0.030 ^a	0.004	-0.027 ^a	0.004
F-test for 3 time variables	145.72		139.65	
F-test for 10 country dummies	45.77		54.07	
N	470		470	
R-squared	0.793		0.887	

Notes: ^a–significant at 1%; ^b–significant at 5%; ^c–significant at 10%. (1) Basic regression. (2) Weighted regression – weights are given by the standard error of the estimate of the returns of schooling. TE=early transition period defined as first five years since the start of reforms; TL=late transition period. Time=time trend relative to the country-specific reform starting point (Time=1 at the beginning of reforms).

Table 7: Returns to Schooling, the Speed of Reforms, and Macroeconomic Volatility, Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Speed of Reforms	<i>Private Sector Share of GDP</i> 0.021 ^a (0.005)	<i>Liberalization of Wages</i> 0.004 ^a (0.001)	<i>Liberalization of Prices</i> 0.004 ^c (0.002)	<i>Foreign Trade Liberalization</i> 0.002 ^c (0.001)	<i>Large-Scale Privatization</i> 0.003 ^a (0.001)	<i>Enterprise Reforms</i> 0.007 ^a (0.001)	<i>FDI Share of GDP</i> 0.002 ^a (0.001)
Volatility /100	<i>Mean (Real GDP Growth)</i> -0.077 ^b (0.036)	<i>Mean (Inflation)</i> 0.001 ^b (0.001)	<i>Mean (Real Wage Growth)</i> -0.099 ^a (0.024)	<i>Annual Inflation</i> 0.002 ^a (0.001)	<i>Std.dev. (Real GDP Growth)</i> 0.189 ^a (0.046)	<i>Std.dev. (Annual Inflation)</i> 0.002 ^a (0.001)	<i>Std.dev. (Real Wage Growth)</i> 0.058 ^a (0.021)
Time /100	0.091 (0.064)	0.054 (0.072)	0.113 ^c (0.064)	0.107 (0.073)	0.069 (0.066)	0.147 ^b (0.062)	0.139 ^b (0.062)
Time*TE	0.002 ^c (0.001)	0.002 ^b (0.001)	0.001 (0.001)	0.003 ^a (0.001)	0.003 ^a (0.001)	0.000 (0.001)	0.002 (0.001)
Time*TL	0.002 ^b (0.001)	0.002 ^a (0.001)	0.002 ^b (0.001)	0.002 ^b (0.001)	0.002 ^a (0.001)	0.001 (0.001)	0.001 ^c (0.001)
Constant	0.037 ^a (0.004)	0.031 ^a (0.005)	0.033 ^a (0.006)	0.032 ^a (0.005)	0.026 ^a (0.004)	0.033 ^a (0.004)	0.036 ^a (0.003)
F-test for 3 time variables	60.83	65.68	23.18	84.42	66.36	86.09	44.67
F-test for 10 country dummies	25.36	35.18	32.40	37.19	35.51	23.31	37.92
N	466	470	470	470	470	470	470
R ²	0.802	0.798	0.805	0.797	0.802	0.804	0.799

Changes in Returns to Schooling

Speed of Reforms	<i>Private Sector Share of GDP</i> 0.0053	<i>Liberalization of Wages</i> 0.0045	<i>Liberalization of Prices</i> 0.0031	<i>Foreign Trade Liberalization</i> 0.0025	<i>Large-Scale Privatization</i> 0.0031	<i>Enterprise Reforms</i> 0.0054	<i>FDI Share of GDP</i> 0.0030
Volatility /100	<i>Mean (Real GDP Growth)</i> -0.0013	<i>Mean (Inflation)</i> 0.0022	<i>Mean (Real Wage Growth)</i> -0.0053	<i>Annual Inflation</i> 0.0016	<i>Std.dev. (Real GDP Growth)</i> 0.0105	<i>Std.dev. (Inflation)</i> 0.0029	<i>Std.dev. (Real Wage Growth)</i> 0.0032

Notes: Robust standard errors are in parentheses; ^a–significant at 1%; ^b–significant at 5%; ^c–significant at 10%. The dependent variable is returns to schooling. All specifications include the same set of variables as in Table 6, including country fixed effects. Changes in returns to schooling show changes in the mean value of returns to schooling in response to one standard deviation increase in the corresponding measure of the speed of reforms and volatility. TE=early transition period defined as first five years since the start of reforms; TL=late transition period. Time=time trend relative to the country-specific reform starting point (Time=1 at the beginning of reforms). Means and standard deviations are calculated over three periods.

Table 8: Returns to Schooling, Initial Conditions, and the Speed of Reforms

	<i>Private Sector Liberalization</i>	<i>Liberalization</i>	<i>Foreign Trade</i>	<i>Large-Scale</i>	<i>Enterprise</i>	<i>FDI Share of</i>	
	<i>Share of GDP</i>	<i>of Wages</i>	<i>of Prices</i>	<i>Liberalization</i>	<i>Privatization</i>	<i>Reforms</i>	<i>GDP</i>
Initial	0.044 ^a	0.010 ^a	0.014 ^a	0.016 ^a	0.012 ^a	0.026 ^a	0.048 ^a
Conditions	(0.011)	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)	(0.007)
5-year	0.046 ^a	0.015 ^a	0.010 ^{a*}	0.013 ^a	0.016 ^a	0.017 ^a	0.003 ^a
Difference	(0.007)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
	<i>Mean</i>	<i>Mean</i>	<i>Mean</i>	<i>Annual</i>	<i>Std.dev.</i>	<i>Std.dev.</i>	<i>Std.dev.</i>
	<i>(Real GDP</i>	<i>(Inflation)</i>	<i>(Real Wage</i>	<i>Inflation</i>	<i>(Real GDP</i>	<i>(Inflation)</i>	<i>(Real Wage</i>
	<i>Growth)</i>		<i>Growth)</i>		<i>Growth)</i>		<i>Growth)</i>
Volatility	-0.044	0.002 ^a	-0.216 ^a	0.003 ^a	-0.026	0.004 ^a	0.130 ^a
/100	(0.036)	(0.001)	(0.024)	(0.001)	(0.057)	(0.000)	(0.023)
N	470	470	470	470	470	470	470
R ²	0.693	0.726	0.713	0.735	0.730	0.712	0.675

Notes: Returns to schooling is the dependent variable. All specifications include the same set of variables as in Table 6, except for country fixed effects. Means and standard deviations are calculated over three periods.

References

- Appleton, Simon., Knight, John., Song, Lina., and Xia, Q. (2002). "Labor Retrenchment in China: Determinants and Consequences," *China Economic Review* 13 (2-3), 252-276.
- Ashenfelter, Orley, Harmon, Colm, and Oosterbeek, Hessel, "A Review of Estimates of the Schooling/Earnings Relationship, with Tests for Publication Bias," *Labour Economics*, 6(4), (November 1999): 453-470.
- Boeri, Tito and Katherine Terrell, "Institutional Determinants of Labor Reallocation in Transition," *Journal of Economic Perspectives* 16, No. 1 (Winter 2002): 51-76.
- Brainerd, Elizabeth, "Winners and Losers in Russia's Economic Transition," *American Economic Review* 88, No.5 (December 1998): 1094-1116.
- Byron, Raymond P. and Evelyn Q. Manaloto, "Returns to Education in China," *Economic Development and Cultural Change* 38 (1990): 783–796.
- Campos, Nauro and Dean Jolliffe, "After, Before and During: Returns to Education in the Hungarian Transition," *The Davidson Institute Working Paper Series*, No. 475, April 2002.
- Card, David, "The Casual Effect of Education on Earnings," in Orley Ashenfelter and David Card, eds., *Handbook of Labor Economics*, North Holland, 1999.
- Chase, Robert, "Markets for Communist Human Capital: Returns to Education and Experience in the Czech Republic and Slovakia," *Industrial and Labor Relations Review* 51, No. 3 (April 1998): 401-423.
- Denny, Kevin, Harmon, Colm, and Lydon, Raemonn, "Cross-Country Evidence on the Returns to Education: Patterns and Explanations," *CEPR Discussion Paper*, No. 3199 (February 2002).
- Dougherty, C, "Why is the Rate of Return to Schooling Higher for Women than for Men?" *Centre for Economic Performance Discussion Papers*, No. 581, 2003.
- Earle, John S., Sapatoru, Dana, and Mircea Trandafir, Economic Reform and Changes in Returns to Higher Education in Romania, in Andren et al, *Economic Reform and Changes in the Returns to Higher Education: Hungary, Romania, Sweden and the U.K.*, 2002. Paper prepared for PHARE-ACE P98-1020-R provided by the author.

- Filer, Randall; Jurajda, Stepan, and Jan Planovsky, "Education and Wages in the Czech and Slovak Republics during Transition," *Labour Economics* 6 (1999): 581-593.
- Flanagan, Robert, "Were Communists good Human Capitalists: the Case of the Czech Republic," *Labour Economics* 5 (1998): 295-312.
- Fleisher, Belton and Xiaojun Wang, "Returns to Schooling in China Under Planning and Reform," Columbus, OH: Department of Economics, Ohio State University, 2003.
- Giles, John; Park, Albert, and Juwei Zhang, "The Great Proletarian Cultural Revolution, Disruptions to Education, and Returns to Schooling in Urban China," Ann Arbor, MI: Department of Economics, University of Michigan.
- Gregory, R.G. and Xin Meng, "Wage Determination and Occupational Attainment in the Rural Industrial Sector of China," *Journal of Comparative Economics* 21(3) (1995): 353-174.
- Heckman, James J. and Xuesong Li, "Selection Bias, Comparative Advantage and Heterogeneous Returns to Education: Evidence from China in 2000," *NBER Working Paper Series*, No. 9877, July 2003.
- Jamison, Dean T. and Jacques van der Gaag, "Education and Earnings in the People's Republic of China," *Economics of Education Review* 6, No. 2 (1987): 161-166.
- Johnson, Emily N. and Gregory C. Chow, "Rates of Return to Schooling in China," *Pacific Economic Review*, 2:2 (1997): 101-113.
- Keane, Michael P. and Eswar S. Prasad, "Inequality, Transfers, and Growth: New Evidence from the Economic Transition In Poland," *The Review of Economics and Statistics* 84, no. 2 (2002): 324-341.
- Li, Haizheng, "Economic Transition and Returns to Education in China," *Economics of Education Review* 22 (2003): 317-328.
- Li, Haizheng and Yi Luo, "Reporting Errors, Ability Heterogeneity, and Returns to Schooling in China".
- Liu, Zhiqiang, "Earnings, Education, and Economic Reforms in Urban China," *Economic Development and Cultural Change* 46(4) (1998): 697-725.
- Maurer-Fazio, Margaret, "Earnings and Education in China's Transition to a Market Economy: Survey Evidence from 1989 and 1992," *China Economic Review* 10 (1999): 17-40.

- Meng, Xin and Michael P. Kidd, "Labor Market Reform and the Changing Structure of Wage Determination in China's State Sector during the 1980s," *Journal of Comparative Economics* 25(3) (1997): 403-421.
- Meng, Xin, *Labour Market Reform in China*. Cambridge, UK: Cambridge University Press, 2000.
- Munich, Daniel; Svejnar, Jan; and Katherine Terrell, "Returns to Human Capital under the Communist Wage Grid and During the Transition to a Market Economy," *The Davidson Institute Working Paper Series*, No. 272 (October 1999), forthcoming in *The Review of Economics and Statistics*.
- Naughton, Barry, *Growing out of the Plan*. Cambridge, UK: Cambridge, University Press, 1995.
- Noorkoiv, Rivo; Orazem, Peter F.; Puur, Allan; and Vodopivec, Milan, "Employment and Wage Dynamics in the Estonia Transition, 1989-1995," *World Bank Technical Paper*, No 1837 (October 1997).
- Orazem, Peter F and Milan Vodopivec, "The Value of Human Capital in Transition to Market: Evidence from Slovenia," *European Economic Review* 41 (1997): 893-903.
- Rutkowski, Jan, "High Skills Pay Off: The Changing Wage Structure during Economic Transition in Poland," *Economics of Transition* 4(1) (1996): 89-112.
- Rutkowski, Jan, "Low Wage Employment in Transitional Economies of Central and Eastern Europe, *MOCT-MOST: Economic Policy in Transitional Economies* 7(1) (1997): 105-130.
- Rutkowski, Jan, "Earnings Inequality in Transition Economics of Central Europe Trends and Patterns during the 1990s," *Social Protection Discussion Paper Series*, No. 117, July 2001.
- Qian, Yingyi and Wu, Jinglian, "China's Transition to a Market Economy: How Far Across the River?" In Nicholas C. Hope, Dennis Yao Yang, and Mu Yang Li, *How Far Across the River?* Stanford, California: Stanford University Press, 2003: 31-64.

- Sabirianova Peter, Klara, "Skill-Biased Transition: The Role of Market Institutions and Technological Change," *The Davidson Institute Working Paper Series*, No. 616, October 2003.
- Schultz, Theodore, "The Value of the Ability to Deal with Disequilibria," *Journal of Economic Literature* 13 (3) (September 1975): 827-846.
- Schultz, T. Paul, "Education Investments and Returns," in Hollis Chenery and T.N. Srinivasan (eds.), *Handbook of Development Economics*, Amsterdam: North-Holland Publishing Company, 1988: 543-630.
- Varga, Julia, and Peter Galasi, Returns to Higher Education in Hungary 1992 and 2000, in Andren et al, *Economic Reform and Changes in the Returns to Higher Education: Hungary, Romania, Sweden and the U.K*, 2002. Paper prepared for PHARE-ACE P98-1020-R provided by the author.
- Vecernik, Jiri, "Earnings Disparities in the Czech Republic: Evidence of the Past Decade and Cross-National Comparison," *Prague Economic Papers* 10(3) (September 2001): 201-221.
- Vodopivec, Milan, "The Evolution and Determinants of Slovenia's Wage Structure in the 1990s," The World Bank mimeo, 2002.
- Wu, Xiaogang and Yu Xie "Does Market Pay Off? Earnings Inequality and Returns to Education in Urban China," *The Davidson Institute Working Paper Series*, No. 454, April 2002.
- Zhang, Junsen and Yaohui Zhao, "Economic Returns to Schooling in Urban China, 1988-1999," paper presented at 2002 meetings of Allied Social Sciences Association, Washington D.C. Hong Kong; Chinese University of Hong Kong, jszhang@cuhk.edu.hk.

Appendix 1: Sources of Metadata

Study	Year	Country	Published
1. Brainerd	1998	Russia	published
2. Byron and Manaloto	1990	China	published
3. Campos and Julliffe	2002	Hungary	WP*
4. Chase	1998	Czech Republic Slovak Republic	published
5. Earle, Sapatoru and Trandafir	2002	Romania	WP
6. Filer et al.	1999	Czech Republic Slovak Republic	published
7. Flanagan	1998	Czech Republic	published
8. Giles et al	2003	China	WP
9. Gorodnichenko	2004	Ukraine	calculations
10. Gregory and Meng	1995	China	published
11. Heckman and Li	2003	China	WP
12. Jamison and Van Der Gaag	1987	China	published
13. Johnson and Chow	1997	China	published
14. Keane and Prasad	2002	Poland	WP
15. Kollo	2003	Hungary	calculations
16. Li	2003	China	published
17. Li and Luo	2002	China	published
18. Liu	1998	China	published
19. Maurer-Fazio	1999	China	published
20. Meng and Kidd	1997	China	published
21. Munich et al.	1999	Czech Republic	published
22. Noorkoiv et al	1997	Estonia	WP
23. Orazem and Vodopivec	1997	Slovenia	published
24. Rutkowski	1996	Poland	published
25. Rutkowski	1997	Poland	published
26. Rutkowski	2001	Poland	WP
27. Sabirianova	2004	Russia	calculations
28. Varga and Galasi	2002	Hungary	WP
29. Vecernik	2001	Czech Republic	published
30. Vodopivec	2002	Slovenia	WP
31. Wang	2004	China	calculations
32. Wu and Xie	2002	China	WP
33. Zhang and Zhao	2002	China	WP

*WP=working paper.

Appendix 2: Definitions and Data Sources

Index of Price Liberalization

- 1 Most prices formally controlled by the government;
- 2 Price controls for several important product categories; state procurement at non-market prices remain substantial;
- 3 Substantial progress on price liberalization: state procurement at non-market prices largely phased out;
- 4 Comprehensive price liberalization; utility pricing which reflects economic costs.

Source: EBRD, *Transition Report* (various issues) and country experts' assessments.

Index of Foreign Trade Liberalization

- 1 Widespread import and/or export controls or very limited legitimate access to foreign exchange;
- 2 Some liberalization 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 current account convertibility.

Source: EBRD, *Transition Report* (various issues) and country experts' assessments.

Index of Large-Scale Privatization

- 1 Little private ownership;
- 2 Comprehensive scheme almost ready for implementation; some sales completed;
- 3 More than 25% of large-scale enterprise assets in private hands or in the process of being privatized but possibly with major unresolved issues regarding corporate governance;
- 4 More than 50% of state-owned enterprise and farm assets in private ownership and significant progress on corporate governance of these enterprises.

Source: EBRD, *Transition Report* (various issues) and country experts' assessments.

Index of 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 (e.g. through privatization combined with tight credit and subsidy policies and/or enforcement of bankruptcy legislation);
- 4 Substantial improvement in corporate governance, for example, an account of an active corporate control market; significant new investment at the enterprise level.

Source: EBRD, *Transition Report* (various issues) and country experts' assessments.

Index of Wage Liberalization

- 1 Most wages formally set up by the government through the wage grid;
- 2 Attempts of wage liberalization; government sets up wages in some sectors of the economy; enterprises are given some autonomy on determining wages;
- 3 Substantial progress on wage liberalization; some wage regulation still remains (e.g. taxes on excessive wage bills);
- 4 Removal of almost all government regulation of wages (apart from minimum wages).

Source: Country experts' assessments.

Private Sector Share of GDP (%)

The private sector share of GDP represents rough EBRD estimates, based on available statistics from both official and unofficial sources. The private sector value added includes income generated by the activity of private registered companies as well as by private entities engaged in informal activity in those cases where reliable information on informal activity is available. In China, we use the non-state non-collective share of urban employment. This is the only consistent series that we found for 1973-2001.

Sources: EBRD, *Transition Report* (various issues) and *China Statistical Yearbook 2002*.

Share of FDI Net Flows of GDP (%)

FDI is defined as net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments.

Sources: World Bank, *World Development Indicators*; national statistical publications and the UNCTAD database.

Annual GDP Growth (%)

Annual GDP growth (%) is measured as annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 1995 U.S. dollars.

Sources: IMF and World Bank, *World Development Indicators*.

Annual Inflation (%)

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and

services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.

Sources: IMF; World Bank, *World Development Indicators*; ILO, national statistical publications; and EBRD, *Transition Report* (various issues).

Annual Real Wage Growth (%)

Real wage index is calculated from the nominal wage index and CPI. Nominal wages are taken from national statistical yearbooks.

Sources: IMF; World Bank, *World Development Indicators*; ILO, national statistical publications; and EBRD, *Transition Report* (various issues).

**Appendix Table A3: Correlation Coefficients between
the Speed of Reforms and Macroeconomic Volatility**

	Liberalization of			Large- Scale Privati- zation	Enterprise Reforms	Private Sector Share of GDP	FDI (% GDP)
	Wages	Prices	Foreign Trade				
All Period							
Annual Inflation	0.061	-0.092	-0.106	-0.129	-0.172	-0.095	-0.130
Annual Real GDP Growth	-0.163	-0.002	-0.031	0.138	0.123	0.034	0.197
Annual Real Wage Growth	0.003	0.051	0.058	0.160	0.191	0.134	0.152
Mean (Inflation)	0.110	0.014	-0.057	-0.086	-0.138	0.006	-0.168
Mean (Real GDP Growth)	-0.259	-0.046	-0.136	-0.023	0.011	-0.120	0.197
Mean (Real Wage Growth)	-0.122	-0.054	-0.071	-0.038	0.053	-0.082	0.205
Std.dev (Inflation)	0.105	-0.004	-0.067	-0.093	-0.123	-0.001	-0.156
Std.dev (Real GDP Growth)	0.259	0.204	0.152	0.036	0.084	0.020	-0.061
Std.dev (Real Wage Growth)	0.242	0.188	0.070	0.022	-0.059	0.114	-0.189
Pre-Reform Period							
Annual Inflation	0.182	0.642	0.520	0.183	-0.108	0.428	0.016
Annual Real GDP Growth	-0.425	-0.347	-0.189	-0.436	-0.007	-0.403	-0.114
Annual Real Wage Growth	0.069	-0.250	-0.163	-0.208	0.127	-0.202	-0.041
Mean (Inflation)	0.217	0.634	0.525	0.119	-0.128	0.269	-0.037
Mean (Real GDP Growth)	-0.394	-0.311	-0.137	-0.496	0.018	-0.497	-0.061
Mean (Real Wage Growth)	0.024	-0.085	0.130	-0.663	0.113	-0.412	-0.064
Std.dev (Inflation)	0.221	0.578	0.520	-0.053	-0.157	0.140	-0.085
Std.dev (Real GDP Growth)	0.165	0.052	-0.038	0.157	-0.282	-0.373	-0.178
Std.dev (Real Wage Growth)	0.279	0.507	0.317	0.434	-0.136	0.435	-0.001
Early Reform Period							
Annual Inflation	0.027	-0.417	-0.435	-0.270	-0.380	-0.236	-0.235
Annual Real GDP Growth	-0.226	-0.028	0.195	0.313	0.303	0.157	0.137
Annual Real Wage Growth	0.003	0.161	0.305	0.375	0.323	0.320	0.258
Mean (Inflation)	0.117	-0.244	-0.419	-0.144	-0.327	0.032	-0.254
Mean (Real GDP Growth)	-0.565	-0.202	-0.055	-0.187	-0.064	-0.357	-0.060
Mean (Real Wage Growth)	-0.359	-0.169	0.051	-0.182	0.096	-0.327	0.217
Std.dev (Inflation)	0.120	-0.256	-0.420	-0.143	-0.285	0.040	-0.204
Std.dev (Real GDP Growth)	0.605	0.508	0.556	0.403	0.604	0.509	0.440
Std.dev (Real Wage Growth)	0.381	0.152	-0.004	0.215	0.041	0.367	-0.042
Late Reform Period							
Annual Inflation	0.082	0.047	0.085	0.034	-0.171	0.113	-0.030
Annual Real GDP Growth	-0.578	-0.419	-0.565	-0.503	-0.379	-0.611	-0.124
Annual Real Wage Growth	-0.186	-0.038	-0.184	-0.177	0.042	-0.176	-0.050
Mean (Inflation)	0.127	0.123	0.158	0.068	-0.124	0.196	-0.078
Mean (Real GDP Growth)	-0.741	-0.501	-0.721	-0.674	-0.390	-0.782	-0.113
Mean (Real Wage Growth)	-0.475	-0.352	-0.509	-0.481	-0.214	-0.566	0.027
Std.dev (Inflation)	0.028	-0.001	-0.028	-0.060	-0.263	0.067	-0.122
Std.dev (Real GDP Growth)	0.072	-0.242	-0.453	-0.186	-0.440	-0.112	-0.121
Std.dev (Real Wage Growth)	0.147	-0.102	-0.297	-0.123	-0.401	0.023	-0.312

Notes: N=157 for country-year observations. Means and standard deviations are calculated over three periods.

DAVIDSON INSTITUTE WORKING PAPER SERIES - Most Recent Papers

The entire Working Paper Series may be downloaded free of charge at: www.wdi.bus.umich.edu

CURRENT AS OF 6/14/04

Publication	Authors	Date
No. 703: Return to Skills and the Speed of Reforms: Evidence from Central and Eastern Europe, China and Russia	Belton M. Fleisher, Klara Sabirianova Peter, and Xiaojun Wang	June 2004
No. 702: What Makes Small Firms Grow? Finance, Human Capital, Technical Assistance, and the Business Environment in Romania	J. David Brown, John S. Earle and Dana Lup	May 2004
No. 701: The Effects of Multiple Minimum Wages Throughout the Labor Market	T. H. Gindling and Katherine Terrell	May 2004
No. 700: Minimum Wages, Inequality and Globalization	T. H. Gindling and Katherine Terrell	May 2004
No. 699: Self-Selection and Earnings During Volatile Transition	Ralitza Dimova and Ira Gang	May 2004
No. 698: Ecology and Violence: The Environmental Dimensions of War	Timothy L. Fort and Cindy A. Schipani	May 2004
No. 697: Russian Cities in Transition: The Impact of Market Forces in the 1990s	Ira N. Gang and Robert C. Stuart	May 2004
No. 696: Firm Ownership and Internal Labor Practices in a Transition Economy: An Exploration of Worker Skill Acquisition in Vietnam	Jed Friedman	May 2004
No. 695: The Unanticipated Effects of Insider Trading Regulation	Art A. Durnev and Amrita S. Nain	May 2004
No. 694: Volatile Interest Rates, Volatile Crime Rates: A New Argument for Interest Rate Smoothing	Garett Jones and Ali M. Kutan	May 2004
No. 693 Money Market Liquidity under Currency Board – Empirical Investigations for Bulgaria	Petar Chobanov and Nikolay Nenovsky	May 2004
No. 692: Credibility and Adjustment: Gold Standards Versus Currency Boards	Jean Baptiste Desquilbet and Nikolay Nenovsky	May 2004
No. 691: Impact of Cross-listing on Local Stock Returns: Case of Russian ADRs	Elena Smirnova	May 2004
No. 690: Executive Compensation, Firm Performance, and State Ownership in China: Evidence from New Panel Data	Takao Kato and Cheryl Long	May 2004
No. 689: Diverging Paths: Transition in the Presence of the Informal Sector	Maxim Bouev	May 2004
No. 688: What Causes Bank Asset Substitution in Kazakhstan? Explaining Dollarization in a Transition Economy	Sharon Eicher	May 2004
No. 687: Financial Sector Returns and Creditor Moral Hazard: Evidence from Indonesia, Korea and Thailand	Ayşe Y. Evrensel and Ali M. Kutan	May 2004
No. 686: Instability in Exchange Rates of the World Leading Currencies: Implications of a Spatial Competition Model	Dirk Engelmann, Jan Hanousek and Evzen Kocenda	May 2004
No. 685: Spinoffs, Privatization, and Corporate Performance in Emerging Markets	Jan Svejnar, Evzen Kocenda and Jan Hanousek	May 2004
No. 684: CPI Bias and Real Living Standards in Russia During the Transition	John Gibson, Steven Stillman and Trinh Le	May 2004
No. 683: Mission Implausible III: Measuring the Informal Sector in a Transition Economy using Macro Methods	Jan Hanousek and Filip Palda	May 2004
No. 682: The Other Side of the Moon: The Data Problem in Analyzing Growth Determinants	Jan Hanousek, Dana Hajkova and Randall K. Filer	May 2004
No. 681: Consumers' Opinion of Inflation Bias Due to Quality Improvements	Jan Hanousek and Randall K. Filer	May 2004
No. 680: IMF-Related Announcements, Fundamentals, and Creditor Moral Hazard: A Case Study of Indonesia	Ayşe Y. Evrensel and Ali M. Kutan	May 2004
No. 679: Privatization Matters: Bank Efficiency in Transition Countries	John P. Bonin, Iftekhar Hasan and Paul Wachtel	Apr. 2004
No. 678: Does Market Liberalisation Reduce Gender Discrimination? Econometric Evidence from Hungary, 1986—1998	Dean Jolliffe and Nauro F. Campos	Apr. 2004