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The Impact of the Transition and EU Membership on the Returns to Schooling in Europe

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Abstract

Countries across Eastern Europe and Central Asia are in their third decade of independence. What impact does this have on the skills premium and does accession to the European Union have an impact on the returns to education? The returns to education in 28 transition and 20 non-transition countries in Europe and Central Asia are analyzed using panel data analysis and difference-in-difference methods to estimate the impact of transition and EU accession. It is found that the transition from a centrally planned economy to a market economy increases the returns to schooling in post-socialist countries positively and significantly, especially through the EU accession channel.

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Introduction

As the level of schooling increases in a country, the wage benefits of schooling decline, all else equal. This is the result of supply and demand. If the supply of a good increases, all else constant, then its price falls. Following the law of diminishing returns to capital, returns to education are expected to decrease with the increasing supply of human capital, leading to a negative relationship between returns (skill premia) and the supply of skills (Acemoglu 1999; Becker 1975; Denny et al. 2002; Montenegro and Patrinos 2021; Psacharopoulos 1989).

However, if the demand for skills increases, then the price may increase as well, which is what happened in the 1990s in the United States (Bound and Johnson 1992; Juhn et al. 1993; Katz and Murphy 1992), and then elsewhere (Földvári and van Leeuwen 2014; Haskel and Slaughter 2002). During that time, an increase in the returns to schooling was brought about by a change in technology that favored higher-order skills, and a corresponding increase in labor demand. At the same time, there was an increase in the supply of skills that led to a shift in the relative demand curve in response to changes in the supply of skilled workers (Acemoglu 2003; Berman et al. 1998). Although both demand and supply for skilled workers rose due to technological change, the returns to education increased because the demand for skilled workers outpaced the supply (Tinbergen 1974). Increased trade can induce technological change, which in turn can lead to an increase in the demand for skills (Acemoglu 2003).

The negative relationship between returns to schooling and average schooling was particularly strong in transition countries in the early 1990s, attributed to the transition economies being technology importers (Denny et al. 2002). The earnings benefits of schooling were low in socialist countries (see, for example, Campos and Jolliffe 2003; Munich et al. 2005). With the transition, the returns to schooling tended to increase. One reason for low returns in pre-transition countries was that one of the defining characteristics of economies operating under the Soviet Union and Central and Eastern European systems was the wage grids that were introduced to effect income-leveling policies. With the transition, the legal, regulatory, and institutional constraints on wage-setting behavior were relaxed, leading to increasing technical change, higher demand for skills, and augmented returns to education. Therefore, an increase in the demand for skills raised the returns to schooling in Eastern Europe (Mysíková and Večerník 2019).

Also, the structural transformations, disruptions, and economic disequilibria could lead to rapid increases in the returns to schooling as highly-educated people can respond to changing opportunities (Schultz 1975). Schooling returns are high when the returns to learning are also high (Rosenzweig 1995). At the same time, schooling tends to rise more rapidly in areas experiencing technical change (Rosenzweig and Foster 1994). Countries undergoing transitioning to a market economy might experience higher returns to human capital than countries under a planned economy.

It is just over 30 years since the end of the Soviet Union and its bloc. Countries across Eastern and Central Europe are in their third decade of autonomy. So, the overarching question is: What impact

does this autonomy have on the returns to education, both immediately after the transition and into the present? Another interesting question is: Does accession to the European Union (EU) – an institutional change of substantial importance – have any impact on the returns to education in transition countries? Since the transition means markets and competition, this should raise the productivity of workers, and this would be evident in the returns to schooling. The transition also means trade openness, and this should raise the premium on skills which should increase the returns to schooling if demand for labor and human capital increases. Several former bloc countries entered the EU in the decade after the transition. Since the breakup of the bloc and transition means markets and competition, this should raise the productivity of workers, and this would be evident in the returns to schooling. This has implications for policy as an increase in premiums would suggest that market reforms make human capital more productive.

The core reforms in transition include liberalizing prices, markets, new business entry, property rights, and the size of the private sector as a share of GDP (World Bank 1996). The transition also implies reallocating resources to more efficient use; developing indirect, market-oriented instruments for macroeconomic stabilization; achieving effective enterprise management and economic efficiency; and imposing hard budget constraints, which supply incentives to improve efficiency (Havrylyshyn and Wolf 1999).

EU accession stands for institutional change resulting from the adoption of European law, joining the European market (higher investment and capital flows), and mobility of students. An important channel of EU accession could affect the returns to schooling through the changes in the educational system (study programs and internationalization). Moreover, many countries of the region also adopted the euro as their currency, which could have additionally stimulated economic growth (Wincenciak et al. 2022).

While private returns to education increased in transition countries, the evidence is scarce and dated and the returns remained lower than the returns in the non-transition market economies at the end of the 1990s (Flabbi et al. 2008; Domanski 2005). For example, early research suggests that in Bulgaria the largest increase in the rate of returns to education took place in the early transition period and declined after entry to the EU (Staneva and Abdel-Latif 2016). A similar pattern is reported for Hungary (Campos and Jolliffe 2003) and Czechia (Munich et al. 2005). However, earlier studies focused on only a handful of transition countries, and the research covered the period only until the late 1990s/early 2000s, finding modest increases in returns during the early phase of transition (see, for example, Fleisher et al. 2005; Hung 2008). Though returns increase post-transition, at the end of the 1990s, economic benefits to education were still lower in countries undergoing transition than in non-transition countries (Domanski 2005). More recently, the returns to schooling have decreased in Eastern Europe (Mysíková and Večerník 2019). The western part of the region tends to have higher returns to schooling than the eastern part (Horie and Iwasaki 2022).

This paper contributes to the literature on the returns to education after a major transformational shift. It addresses the question of the impact of institutional change on returns to education in transition countries. This paper analyzes the changes in the returns to education in post-socialist countries with the most recent data available. The tested hypotheses are whether the transition

from socialism to a market economy caused a change in the returns to schooling in transition countries. It extends the analysis beyond other papers in this literature by explicitly looking at the impact of EU accession. Since both events (transition and EU accession) represent critical changes in terms of political organization, markets, and trade, among others, this research explores the transmission channel by which each shock could have affected returns to schooling. Given the increased trade and economic integration in Europe post-transition, the premium to skills has increased. We have shown a link between transition and the economic benefits of schooling. We test if the returns to schooling increased significantly as a result of transition and EU integration, with the corollary that the driver of the increase in the returns is openness to trade, eased by transition and EU membership.

Data

The data for this analysis stems from two main sources. First, the Comparable Returns to Education database was used as the main source of private returns to education data. This database was supplemented with Psacharopoulos and Patrinos (2018) to make up for the gaps. Meanwhile, the data source of the average years of schooling per country was taken from the Barro-Lee Educational Attainment Database (Barro and Lee 2013). This dataset contains the educational attainment of the population, including average schooling years, for 146 countries around the world in 5-year intervals. These two key databases were selected as they ensure comparability across countries.

We analyze the returns to education in 28 transition countries (see Annex 1). Here we define post-socialist/transition countries as all European and Central Asian countries that were part of the Soviet Union and socialist pact until the fall of the Soviet Union by the end of 1991. We have data on the returns to schooling before transition (circa 1992) for 11 countries. We have data for 20 non-transition, European, and ECA countries (see Annex 2). Regarding schooling years, Barro and Lee (2013) are used.

Since Barro and Lee (2013) have schooling estimates for five-year intervals, we have computed the five-year average of the returns to education for the 48 transition and non-transition countries in our sample. This procedure leaves us with two observations per decade for each country, by taking as reference the decade of the 1980s, the first five-year observation contains the average of years 1980 to 1984, while the second observation has the average of the years 1985 to 1989. This gives us a total of 235 data points, of which 108 (46 percent) belong to the transition group and 127 (54 percent) are part of the non-transition group.

Since the fall of the Soviet Union and its bloc implied a deep transformation in terms of democracy and trade openness for most of the transition countries, which may have affected their labor demand, we include two sources related to these changes: the polity index and trade as a percentage of GDP. We chose these variables because they affect the labor market and their time series include pre-transition years (i.e., years before 1992). It has been shown that democracy is positively associated with an increase in the returns to education as a result of political and economic reforms adopted by democratic governments (Uwaifo 2008), namely the fraction of the economic output that workers received as wages for their work. International trade increases the demand for skills

as it induces skilled-biased technological change (Acemoglu 2003). Although the skill premia are determined by technological change and the relative supply of skills, there was no data available on technological progress for transition countries before the collapse of the Soviet Union in the early 1990s. We decided to use trade as a percentage of GDP as it represents a trade openness index that measures the importance of trade in the domestic economic output of a country.

The polity index comes from the database of the Polity 5 Project of the Center for Systemic Peace which assesses the concomitant democratic and autocratic characteristics of the governments of 167 independent states around the world since 1946 (https://www.systemicpeace.org/inscrdata.html). The polity index is a compound index of the democracy and autocracy indexes; thus, it captures the nuances of democracy and autocracy that coexist within each independent state. The autocracy index measures the level of autocracy prevailing in a country using a scale that goes from 0 to 10, where 0 is no autocracy traits at all and 10 is the highest level of autocracy (e.g., hereditary monarchy). The democracy index employs the same scale to assess the democracy level that characterized each government and assigns a value of 0 to those countries whose governments exhibit no traits of democracy and a value of 10 to the countries with the highest level of democracy (i.e., consolidated democracy). The polity index results from subtracting the autocracy index from the democracy index of each state so its scale ranges from -10 to 10, where -10 is a perfect autocracy and 10 is a perfect democracy. Therefore, the polity index can be used as a measure of how far each country is from perfect democracy. Democracy can be used to assess the strength of the transition (World Bank 2002).

The polity index database contains information for most of the countries and years included in the study. This database has no information on Iceland at all and misses information for Bosnia and Herzegovina, Cyprus, Czechia, Hungary, Kosovo, Montenegro, Serbia, and the Slovak Republic for only one year in most cases. As in the case of returns to education, we use the 5-year average of the polity index to make it congruent with our schooling data.

It is important to note that we identified in the polity database those countries that emerged from countries that disintegrated during our period of study and assigned to them the polity rate of their origin country before their formal constitution as an independent state. The countries that dissolved during the period of study are the Soviet Union, Yugoslavia, and Czechoslovakia, giving way to the constitution of 24 independent states included in our sample. These countries are shown in Annex 3. Using this strategy, we were able to identify 231 data points included in the analysis.

To include trade openness in our analysis, we analyze trade as a percentage of GDP to account for the influence of trade on economic growth, which in turn can lead to labor market changes that affect wages (Calderon and Cantu 2019; Kapsos 2005; Majid 2004). This quantifies trade as the sum of exports and imports of goods and services measured as a share of GDP. To ensure data comparability, this trade information was obtained from the World Bank, which has been collecting information on this topic since 1960. Again, this was included in the database of analysis using its 5-year average, which provided information for 214 data points.

Using our unbalanced panel data of 48 countries in Europe and Central Asia (28 transition and 20 non-transition) we estimate the determinants of returns to schooling, which are defined as the

percentage-point increase associated with each additional year of education. Firstly, we employ the difference-in-difference method (DiD) to estimate:

$$Y_{i,t} = \alpha + \beta Schooling_{i,t} + \gamma Post_{i,t} + \underline{\delta} Transition_{i,t} + \eta DiD_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ are the returns to schooling for country i at time t; $Schooling_{,t}$ is the average years of schooling for the population in the country i and time t; $Post_{i,t}$ equals 1 if time t is post-transition (starting with the 1995 observation that represents the 5-year average from the year 1995 to 1999) irrespective of whether it is a transition or a non-transition country, 0 otherwise; $Transition_{,t}$ equals 1 if the country is a transition country, 0 otherwise; $DiD_{,t}$ is the interaction term between $Transition_{,t}$ and $Post_{i,t}$ that captures the average treatment effect of the transition; ε is the error term. No employment variable was included because there is no consistent and comparable employment data available before the transition. The available ILO labor data for most transition countries starts in 1994 (https://ilostat.ilo.org/data/#).

Since the fall of the Soviet Union implied deep political and economic transformations for most of the post-socialist countries, we include two variables to account for these changes: the polity index and trade as a percentage of GDP:

$$Y_{i,t} = \alpha + \beta Schooling_{i,t} + \gamma Post_{i,t} + \delta Transition_{i,t} + \eta DiD_{i,t} + \varphi Polity_{i,t} + \kappa Trade_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $DiD_{,t}$ is the interaction term between $Transition_{,t}$ and $Post_{i,t}$; $Polity_{i,t}$ is the polity index for country i at time t ; and $Trade_{i,t}$ is the share that trade represents of GDP for country i at time t (see Table 1).

Table 1: Means and standard deviation of the sample

Type of country	*Variable*	*N*	*Mean*	*SD*	*Min*	*Max*
All	Returns	235	7.51	2.6	0.3	14.7
	Schooling	219	9.37	1.9	3.8	13.0
	Transition	235	0.46	0.5	0.0	1.0
	Post-1992	235	0.63	0.5	0.0	1.0
	Polity index	231	7.06	5.3	-9.0	10.0
	Trade (% GDP)	214	83.29	40.7	24.0	313.6
Transition countries	Returns	108	6.80	2.8	0.3	14.0
	Schooling	92	9.97	1.7	4.4	12.8
	Post-1992	108	0.73	0.4	0.0	1.0
	Polity index	107	4.15	6.4	-9.0	10.0
	Trade (% GDP)	88	95.06	30.6	42.9	172.0
Non-transition countries	Returns	127	8.11	2.3	3.6	14.7
	Schooling	127	8.93	1.9	3.8	13.0
	Post-1992	127	0.55	0.5	0.0	1.0
	Polity index	124	9.58	1.7	-5.4	10.0
	Trade (% GDP)	126	75.07	44.8	24.0	313.6

We applied a panel data model to leverage the cross-sectional and time-series dimensions of our data. Our approach entails a Difference-in-Difference method with a Random Effects (RE) model to estimate the effect on the returns to education brought by two different shocks (i.e., treatments): (i) the fall of the Soviet Union and its bloc, and (ii) the accession of transition countries to the EU. We chose a Difference-in-Difference method because we have two well-defined shocks (i.e., the fall of the Soviet Union and its bloc, and EU accession), and we opted for the RE model to use the between variations to estimate the effect of each treatment on the returns to education while taking into account how the treatment and control groups differentiate from each other. The decision to choose the RE was supported by the results of the Breusch and Pagan Lagrangian Multiplier (LM) test and the Hausman test (Wooldridge 2001; see Annex 4). The results of the first test exhibited evidence of variance across entities, namely the presence of random effects; while the results of the second test showed that the RE estimator is consistent and efficient in comparison to the FE estimator, which is only consistent.

Results

Descriptives

For the post-socialist transition countries in the sample, the average rate of return increased from 4.1 before the transition, to 8.0 percent after the transition. The latest evidence suggests that non-transition European countries have higher returns to schooling than post-socialist countries: 8.2 versus 8.0 percent (Montenegro and Patrinos 2021; Psacharopoulos and Patrinos 2018). For non-transition countries, the returns before 1992 were 8.0 percent, changing slightly thereafter to 8.2 percent. Over time the returns to schooling in post-socialist countries have increased significantly: from 4.1 percent in the 1980s to 8.0 percent today (see Table 2).

Table 2: Returns to schooling: pre-transition to transition

	Returns		Years of Schooling		Change	
	Pre-transition	Transition	Pre-transition	Transition	Returns (% pts)	Years of Schooling
Transition	4.1	8.0	8.9	10.9	3.9	2.0
Bulgaria	4.1	6.5	8.5	10.0	2.5	1.5
Czechia	3.4	8.1	10.3	12.2	4.8	1.9
Estonia	1.5	6.6	8.9	11.1	5.1	2.3
Hungary	6.0	11.3	8.9	11.3	5.3	2.4
Poland	4.2	9.4	8.8	10.6	5.2	1.8
Romania	3.8	8.7	6.4	10.0	4.8	3.6
Russian Federation	3.2	4.2	9.0	10.7	1.0	1.7
Serbia	5.8	9.7	7.1	10.0	3.9	2.9
Slovak Republic	2.8	7.7	10.1	11.6	4.9	1.5
Slovenia	6.3	9.2	10.8	11.5	2.9	0.7
Ukraine	3.7	6.6	9.2	10.7	2.9	1.5
Non-Transition	8.0	8.2	7.7	9.8	0.2	2.1
EU in 1992	7.7	8.5	7.4	9.8	0.9	2.5
EU after 1992	8.7	7.1	8.0	9.7	-1.6	1.8
Non-EU/non-transition	8.4	8.9	8.2	9.6	0.5	1.4

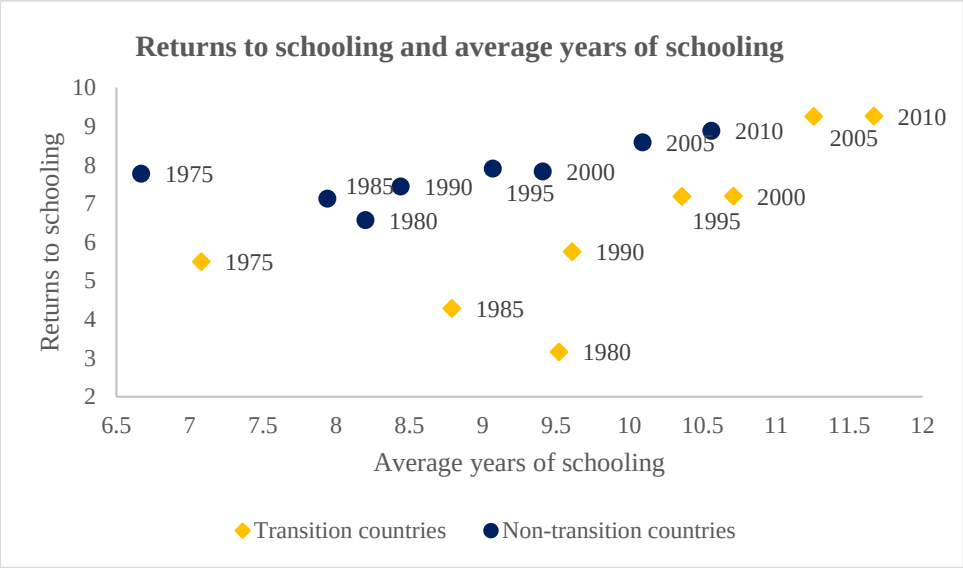
Sources: Barro and Lee 2013; Montenegro and Patrinos 2021; Psacharopoulos and Patrinos 2018

Notes: This table compares information only for those sample countries with data before and after the year of transition, namely 1992. The countries included in "EU in 1992" are Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, and Spain, while those included in "EU after 1992" are Austria, Cyprus, Finland, and Sweden, which joined the EU between 1995 and 2005. The Non-EU non-transition values refer to the average of Norway, Switzerland, and Türkiye.

These changes in the returns to schooling imply a difference of 3.9 points for post-socialist transition countries and only 0.2 for non-transition countries. That the returns to schooling remained almost constant in non-transition countries despite an increase in schooling is remarkable enough (Psacharopoulos 1989). Schooling levels, from an already high level in socialist economies, increased in post-socialist countries, yet the returns increase as well (see Figure 1), suggesting that the rewards to human capital were driven by an increase in skilled labor demand

that outpaced the supply possibly due to an increase of international trade promoting technological change (Acemoglu 2003).

Figure 1. Returns to schooling and average years of schooling for transition and non-transition countries



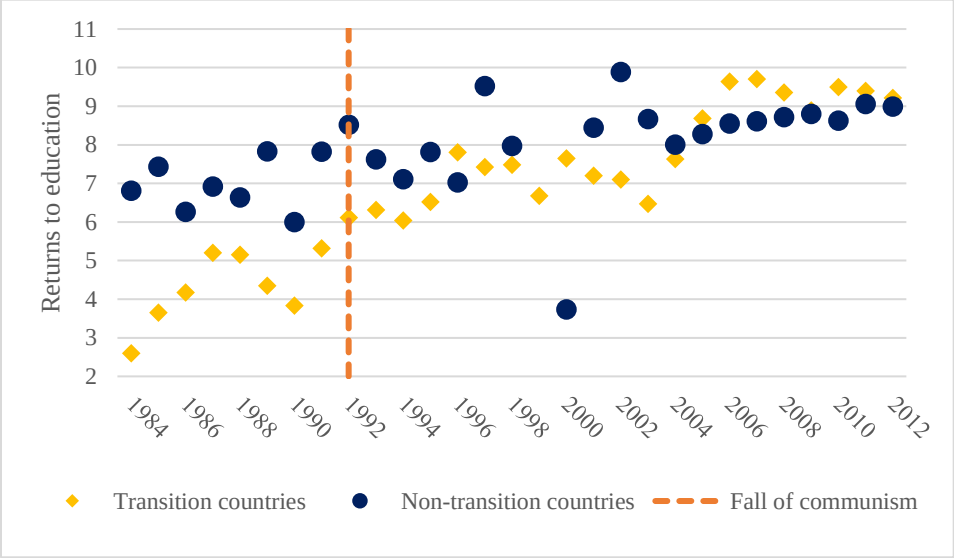
The returns to education in the non-transition countries considered in Table 1 remained stagnant although their average gross domestic product (GDP) per capita increased almost fivefold, changing from $7,301 before 1992 to $36,116 in the after-transition period. The GDP per capita also grew in the post-socialist countries listed in Table 1 for which data on this economic indicator is available before 1992.[2] In this case, the GDP per capita changed from $2,519 before the transition to $8,427 after the transition. This shows that the growth of GDP per capita was visibly smaller in transition countries than in non-transition countries.

Analytical Results

The returns to education of post-socialist transition countries and non-transition countries followed similar trends before the fall of the Soviet Union in December 1991 (see Figure 2). Before the dissolution of the Soviet Union, the returns to schooling were markedly lower in (what became) transition countries. Post-Soviet Union, there is convergence, and the gap disappears once the post-socialist countries transitioned to a market economy. Although the returns to schooling fluctuated pre-transition in Eastern and Central Europe, the gap remained, until the dissolution of the Soviet Union. This suggests that the parallel trend assumption is likely valid.

[2] These countries are Bulgaria, Czechia, Hungary, Poland, Romania, the Russian Federation, the Slovak Republic, and Ukraine.

Figure 2. Returns to schooling for transition and non-transition countries



We run a set of four-panel regressions to further analyze how the returns to schooling differ between post-socialist transition countries and non-transition countries. We used a progressive approach by including the explanatory variables of polity and trade one at a time to observe how they affect the returns to education independently, and by adding both in the final regression to assess their influence on the returns to education at the same time.

The first model of this set (see Table 3) exhibits that the post-socialist transition countries encounter significantly lower returns to education than non-transition countries and that schooling has a positive and significant effect on returns. However, this no longer holds when including democracy level (captured by the polity index variable) and trade openness into the equation, namely two of the major changes undergone by post-socialist countries after the fall of the Soviet Union. Model 2 includes the polity index variable and reveals that the strengthening of democracy positively and significantly affects the returns to education while being a post-socialist country and schooling lose their significance. The same happens when adding trade instead of polity, as only trade openness shows a significant and positive effect on returns. Finally, the fourth model exhibits that when including polity and trade simultaneously, these two variables significantly and positively affect the returns to schooling. The result of the third and fourth models are consistent with the conclusions of Acemoglu (2003), who states that trade openness can lead to a rise in returns to education because of its links to skilled-biased technological change and increased demand for skilled workers.

Table 3: Effect of selected variables on returns to education

	(1)	(2)	(3)	(4)
Transition	-1.596**	-0.108	-0.846	-0.306
	(0.625)	(0.622)	(0.625)	(0.658)
Schooling	0.470***	0.169	0.060	-0.023
	(0.169)	(0.141)	(0.159)	(0.170)
Polity		0.238***		0.134***
		(0.039)		(0.052)
Trade			0.021***	0.020***
			(0.007)	(0.007)
Constant	3.965**	4.409***	5.951***	5.443***
	(1.657)	(1.236)	(1.333)	(1.314)
Prob > chi2	0.002	0.000	0.004	0.000
Observations	219	216	199	196
Groups	40	39	40	39

Robust standard errors in parenthesis

*** p<0.01, ** p<0.05, * p<0.1

To assess how transitioning from a centrally planned economy to a market economy affects the returns to education in post-socialist countries, we run a set of panel regressions using the difference-in-difference (DiD) estimation (see Table 4). The first model of this set shows that post-socialist economies encountered a significantly lower rate of return to schooling in comparison to non-transition countries before the fall of the Soviet Union by the end of 1991 and that the fact of transitioning significantly increased their returns to education in comparison to non-transition countries. The second regression includes the polity variable to take into account changes in governance and shows that the strengthening of democracy has a positive and significant effect on the returns to education, although the positive effect of transitioning on returns to education in post-socialist countries diminishes when including this variable. The third model uses trade instead of polity and reveals that commercial openness has a positive and significant effect on returns to schooling, while being a post-socialist country remains related to a significantly lower rate of return before 1992, although this trend is reversed after transitioning from a command to a market economy. The fourth model includes polity and trade simultaneously in the DiD estimation; in this case, commercial openness has a positive and significant effect on the returns to education of all sample countries, while transitioning preserves a positive and significant effect on the returns to education of post-socialist countries, although the returns gap between transition and non-transition countries before 1992 seems smaller when taking into account polity and trade.

We can conclude from this set of panel regressions that the event of transitioning from a centrally planned economy to a market economy (captured by the variable *DiD*) increased the returns to schooling in transition countries positively and significantly compared to non-transition countries. All else equal, the transition helped workers in post-socialist countries to increase their returns to schooling by 1.6 to 3.2 points, which translates into an increase ranging from 36.0 to 71.9 percent when considering the average returns to education of all post-socialist countries included in the

sample before their transition (i.e., 4.448). Moreover, the results of the models that include trade openness are in line with Acemoglu's (2003) findings, which indicate that an increase in international trade leads to higher returns as a result of its positive association with labor demand and skilled-biased technological change.

Table 4: Impact of transition on all sample countries

	(1)	(2)	(3)	(4)
DiD	3.172***	1.974***	1.953***	1.621***
	(0.523)	(0.559)	(0.463)	(0.542)
Transition	-3.712***	-2.041***	-2.478***	-1.861**
	(0.667)	(0.789)	(0.688)	(0.854)
Post	0.304	0.480	0.449	0.510
	(0.502)	(0.502)	(0.524)	(0.520)
Schooling	0.131	0.017	-0.094	-0.152
	(0.174)	(0.178)	(0.202)	(0.213)
Polity		0.136***		0.083
		(0.041)		(0.053)
Trade			0.017***	0.018***
			(0.006)	(0.006)
Constant	6.855***	6.487***	7.341***	7.015***
	(1.426)	(1.322)	(1.407)	(1.368)
Prob > chi2	0.000	0.000	0.000	0.000
Observations	219	216	199	196
Groups	40	39	40	39

Robust standard errors in parenthesis

*** p<0.01, ** p<0.05, * p<0.1

In conclusion, this analysis has unveiled that transition from a centrally planned economy to a market economy exhibits a positive and significant effect on the returns to education in post-socialist countries. Although post-socialist countries continued to increase their average years of schooling after 1992, schooling kept exerting a positive and significant effect on the returns of these countries. This might be explained by commercial openness, which also showed a positive and significant effect on the returns of post-socialist countries suggesting that trade might have driven additional demand for more educated human capital.

The transition induced by the fall of the Soviet Union was not the only major economic and political change undergone by post-socialist economies. Thirteen years later, a few of them joined the EU, for which they needed to follow a series of economic, political, and institutional reforms that might have affected their returns to education years after their transition out of a centralized economy. To unveil if the EU membership affected the returns of the post-socialist countries that joined it, we do a separate analysis also using the DiD method.

EU Membership Analyses

EU membership might have a positive effect on the returns to education. This could be because of the demand-side effects of access to the European market, increased flows of investments, transparency (decreased corruption) in business activity, and a more favorable economic environment through higher openness to international trade. EU membership tends to contribute to growth in national income (Campos et al. 2014).

A total of 11 of the 28 post-socialist countries included in this analysis officially joined the EU between 2004 and 2013. The countries that entered the EU in 2004 were Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia. Bulgaria and Romania accessed the EU in 2007, while Croatia joined in 2013.

Applying for EU membership involves a complex and time-consuming process that starts with the signing of the Association Agreement. Applicant countries should satisfy the EU membership conditions – known as "Copenhagen Criteria" – before their admission. These conditions include a stable democracy and the rule of law, as well as a functioning market economy and the incorporation of EU legislation into national law (EU 2022). It took the 11 post-socialist countries mentioned earlier an average of 8 years to fulfill all the criteria and officially become members of the EU (see Annex 5).

For this analysis, we included in the EU treatment group only the 10 countries that signed their EU Association Agreement between 1995 and 2000. Croatia was also left aside because there is no observation for it after its incorporation into the EU in 2013.

Figure 3 shows that the returns to education in all post-socialist countries increased after the fall of the Soviet Union despite their continuous increase in average years of schooling and irrespective of whether they became an EU member later. Meanwhile, Figure 4 exhibits that the returns to education of the 10 post-socialist countries in the EU treatment group grew more rapidly between 1995 and 2005 – their EU membership application period – than the returns of the post-socialist countries that did not access the EU, especially during the five years preceding their entrance into the EU. This might be explained by all the political and economic changes these 10 countries underwent over those years to meet all EU membership criteria.

Figure 3: Returns to schooling and average years of schooling in transition countries

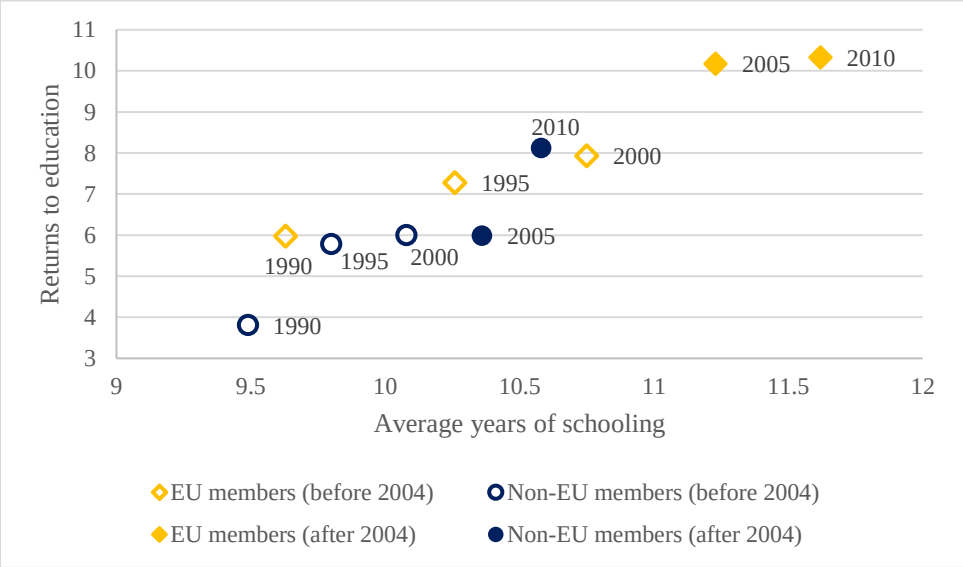
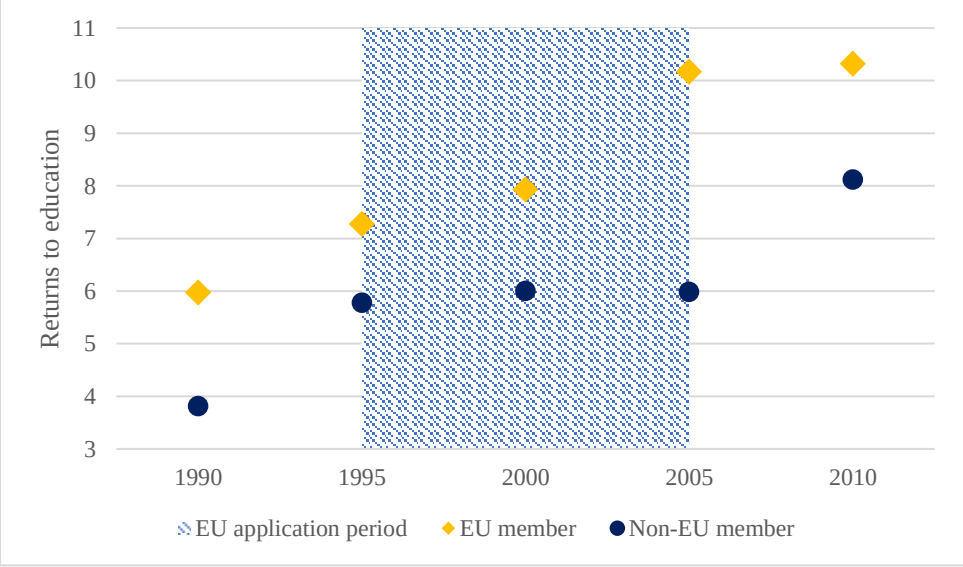


Figure 4: Returns to schooling for transition countries by EU membership status in 2004

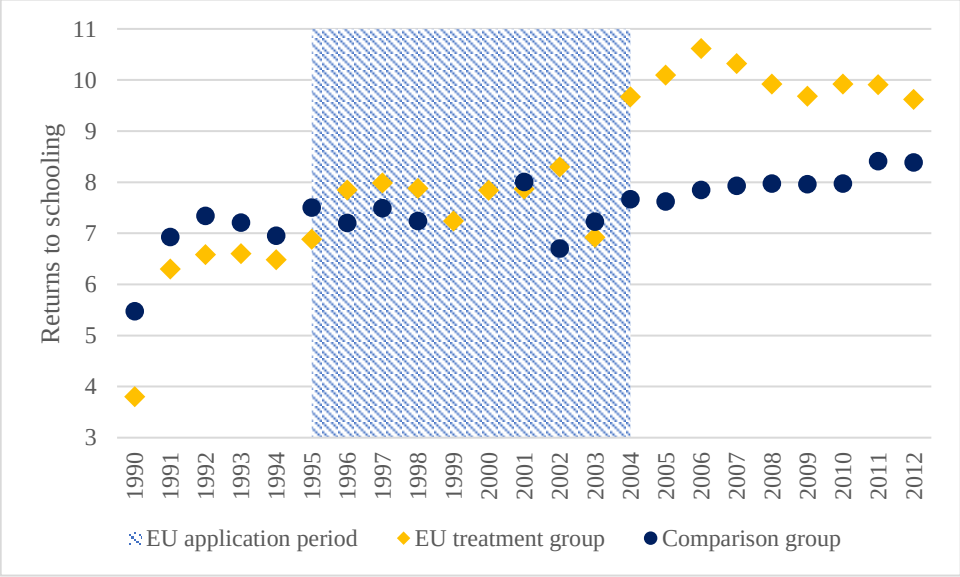


The EU accession comparison group encompasses all 20 non-transition countries, as well as the 17 post-socialist countries that have never joined the EU plus Croatia – which was admitted into the EU in 2013. Only four of the 20 non-transition countries included in our sample (Iceland, Norway, Switzerland, and Türkiye) are not members of the EU, while only four of the non-transition countries that are part of the EU joined this economic and political union after the fall of the Soviet Union. These four countries are Austria (1995), Finland (1995), Sweden (1995), and Cyprus (2004). As our period of analysis ends in 2014, the United Kingdom (UK) is considered part of the EU. The UK officially left the EU in 2020. The post-socialist countries that have never joined the EU are Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia,

Kazakhstan, Kosovo, Kyrgyz Republic, North Macedonia, Moldova, Montenegro, Russian Federation, Serbia, Tajikistan, Turkmenistan, and Ukraine.

Figure 5 shows that the returns to education of the EU treatment and comparison groups followed predominantly growing trends during the period of analysis (i.e., from 1990 to 2010). The returns gap between the EU treatment and comparison group closed in 1995 after the EU treatment countries abandoned socialism. The growth of the returns to education continued in the EU treatment countries from 1995 to 2020 and accelerated between 2000 and 2005, a period in which all 10 treatment countries were implementing the economic and political reforms required for EU membership. This graphical analysis suggests that the transformation implemented by the post-socialist countries that entered the EU in the first decade of the 21st century might have affected their returns to education.

Figure 5. Returns to education for EU treatment and comparison groups



Note: Data for 1999 and 2000 is excluded because the only comparison country in 1999 is Russia and the low average returns in 2000 occurred because there are only 5 comparison countries with data available for that year (Russia, Portugal, Spain, UK, and Ukraine).

We run a set of four-panel regressions to explore if the returns to education differed between EU treatment and control countries, adding the explanatory variables of polity and trade one by one (see Table 5). The period for this analysis goes from 1990 to 2010. We include the observation of 1990 to have one observation before the signing of the Association Agreement of Bulgaria, Czech Republic, Hungary, Poland, and Romania (i.e., the first cohort of countries that started their EU membership process around 1994). None of the four regressions shows a significant difference between the returns to education in EU treatment and control countries nor an effect of schooling on the returns to education. But the last three regressions reveal the strengthening of democracy

(captured by the polity index) and commercial openness exert a positive and significant effect on the returns to schooling when considering them separately (Regression 2 and 3) and simultaneously (Regression 4).

Table 5: Effect of selected variables on returns to education

	(1)	(2)	(3)	(4)
EU accession	0.986	0.821	0.941	0.737
	(0.688)	(0.652)	(0.692)	(0.667)
Schooling	-0.146	-0.105	-0.277	-0.239
	(0.243)	(0.236)	(0.278)	(0.267)
Polity index		0.161**		0.169**
		(0.079)		(0.076)
Trade (% GDP)			0.013**	0.014***
			(0.005)	(0.005)
1995	0.984***	0.952***	0.866**	0.881**
	(0.356)	(0.349)	(0.370)	(0.364)
2000	1.316***	1.155**	1.145**	1.026**
	(0.498)	(0.506)	(0.509)	(0.517)
2005	2.332***	2.142***	2.133***	1.974***
	(0.463)	(0.457)	(0.464)	(0.457)
2010	2.826***	2.646***	2.559***	2.407***
	(0.466)	(0.452)	(0.444)	(0.435)
Constant	7.562***	5.989***	7.895***	6.172***
	(2.112)	(2.096)	(2.201)	(2.215)
Prob > chi2	0.000	0.000	0.000	0.000
Observations	158	155	155	152
Groups	40	39	40	39

Clustered standard errors at national level in parenthesis.

*** p<0.01, ** p<0.05, * p<0.1

DiD = Difference-in-Difference

EU accession includes only the post-communist countries that signed their association agreement to the EU between 1994 and 1999, namely: Bulgaria, Czech Republic, Hungary, Poland, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia.

1995, 2000, 2005, and 2010 are time controls.

Since the economic and political transformations required to join the EU takes time to build up, which may not show in the exploratory regression analysis (Table 5) and could explain its contradiction with the inferences from the graphical analysis (Figure 5), we adopted a similar strategy to that used for the transition analysis, namely a DiD method with an RE model, to find if the staggered EU accession process effectively caused an increase in the returns to education of those post-socialist countries that joined the EU. The tests that support the selection of an RE model are shown in Annex 4.

We consider that EU treatment begins with the signing of the EU Association Agreement since it represents the point at which countries commit to start implementing all the economic and political transformations required to meet EU membership criteria. This leads us to divide the 10 EU treatment post-socialist countries into two cohorts based on the year they signed such an agreement (see Annex 5). The first cohort – named Cohort 1995 – encompasses Bulgaria, Czech Republic, Hungary, Poland, and Romania as these countries signed their EU Association Agreement between 1994 and 1995. The second cohort – named Cohort 2000 – gathers Estonia, Latvia, Lithuania, Slovak Republic, and Slovenia –, which signed the Association Agreement between 1998 and 1999. The period for this analysis goes from 1990 to 2010 and it includes the 1990 data point to have at least one observation before Cohort 1995 signed the Association Agreement, which is a requirement to implement the DiD method.

The presence of two cohorts implies a staggered treatment that calls for a Staggered DiD method. The Staggered DiD approach allows the treatment effect to be different for each cohort, as well as to differ in different periods. Once all these treatment effects that vary over treatment groups and over time are estimated, they can be combined into a single effect. That is why we ran three sets of panel regressions: the first to estimate the treatment effect for each cohort, the second to compute the treatment effect by period, and the third to combine all cohort and time effects into a single effect.

Table 6 shows the results of the regression set used to estimate the treatment effect for each cohort. The first model of this set exhibits that only the treatment countries that started the EU adhesion process around 1995 experienced a positive and significant effect on their returns due to all the changes brought by EU membership. The second model adds the type of governance through the variable of polity, which also proves to be positively and significantly associated with the returns to education. The third model uses trade instead of polity, and in this case, the first cohort still reports a slightly higher positive and significant effect on their returns to education due to EU adhesion while trade also positively and significantly contributes to this variable. The fourth model adds polity and trade at the same time and exhibits that EU membership preserves its positive and significant effect on the returns to education of the first cohort while trade and polity also exert a positive and significant effect on the returns of all the countries included in the sample.

Table 6: Impact of EU accession on post-communist countries by entry cohort

	(1)	(2)	(3)	(4)
DiD cohort 1995	2.049***	1.821***	2.127***	1.870***
	(0.446)	(0.479)	(0.380)	(0.391)
DiD cohort 2000	0.788	0.574	0.462	0.373
	(0.722)	(0.772)	(1.027)	(0.999)
Cohort 1995	-0.518	-0.473	-0.539	-0.493
	(0.840)	(0.813)	(0.918)	(0.888)
Cohort 2000	0.275	0.309	0.293	0.156
	(0.932)	(0.871)	(1.183)	(1.088)
Schooling	-0.157	-0.136	-0.278	-0.241
	(0.248)	(0.237)	(0.286)	(0.277)
Polity		0.138*		0.147**
		(0.079)		(0.075)
Trade			0.012***	0.013***
			(0.005)	(0.005)
1995	0.562	0.595	0.502	0.552
	(0.403)	(0.394)	(0.416)	(0.409)
2000	0.815	0.759	0.739	0.667
	(0.561)	(0.564)	(0.559)	(0.569)
2005	1.836***	1.773***	1.732***	1.637***
	(0.441)	(0.442)	(0.435)	(0.446)
2010	2.328***	2.293***	2.154***	2.065***
	(0.450)	(0.436)	(0.431)	(0.438)
Constant	8.087***	6.790***	8.266***	6.680***
	(2.173)	(2.177)	(2.247)	(2.316)
Prob > chi2	0.000	0.000	0.000	0.000
Observations	158	155	155	152
Groups	40	39	40	39

Clustered standard errors at national level in parenthesis.

*** p<0.01, ** p<0.05, * p<0.1

"DiD cohort" shows how the treatment effect varies by entry cohort.

Cohort 1995 comprises the post-communist countries that signed their association agreement to the EU between 1994 and 1995, namely: Bulgaria, Czech Republic, Hungary, Poland, and Romania.

Cohort 2000 comprises the post-communist countries that signed their association agreement to the EU between 1998 and 1999, namely: Estonia, Latvia, Lithuania, Slovakia, and Slovenia.

1995, 2000, 2005, and 2010 are time controls.

The results of the regression set run to estimate the effect of EU treatment by period are presented in Table 7. All four models show that EU adhesion had a positive and significant effect on the returns to education in 2005 and 2010, namely years after EU treatment countries started their political and economic transformations to become part of the EU. Once polity is added into the equation, as in model 2, the EU adhesion effect in 2005 and 2010 slightly diminishes while polity also exerts a positive and significant effect. The third model shows that EU adhesion preserves its positive and significant effect in the years 2005 and 2010 after replacing the polity variable for the trade variable, which also positively impacts the returns. Lastly, the fourth regression displays that when polity and trade are added simultaneously, both variables still stay positive and significant, while the positive effect of EU treatment remains significant in 2005 and 2010.

Table 7: Impact of EU accession on post-communist countries by period

	(1)	(2)	(3)	(4)
DiD in 1995	-0.587	-0.810	-0.479	-0.675
	(0.582)	(0.598)	(0.644)	(0.650)
DiD in 2000	0.864	0.655	0.987	0.817
	(0.706)	(0.726)	(0.749)	(0.749)
DiD in 2005	2.496***	2.284***	2.501***	2.333***
	(0.811)	(0.839)	(0.841)	(0.827)
DiD in 2010	2.129***	1.850**	1.995**	1.731**
	(0.788)	(0.832)	(0.829)	(0.837)
Cohort 1995	0.126	0.182	0.165	0.189
	(0.958)	(0.932)	(1.058)	(1.013)
Cohort 2000	-0.515	-0.457	-0.770	-0.801
	(0.826)	(0.772)	(0.924)	(0.841)
Schooling	-0.126	-0.117	-0.225	-0.233
	(0.266)	(0.250)	(0.294)	(0.268)
Polity		0.145*		0.165**
		(0.077)		(0.078)
Trade			0.009*	0.010**
			(0.005)	(0.004)
1995	0.996**	1.036**	1.008**	1.079**
	(0.426)	(0.413)	(0.443)	(0.432)
2000	0.978	0.939	0.952	0.927
	(0.644)	(0.649)	(0.637)	(0.641)
2005	1.529***	1.472***	1.518***	1.459***
	(0.417)	(0.417)	(0.412)	(0.417)
2010	2.098***	2.106***	2.089***	2.105***
	(0.454)	(0.427)	(0.443)	(0.418)
Constant	7.759***	6.516***	7.933***	6.562***
	(2.335)	(2.278)	(2.351)	(2.269)
Prob > chi2	0.000	0.000	0.000	0.000
Observations	158	155	155	152
Groups	40	39	40	39

Clustered standard errors at national level in parenthesis.

*** p<0.01, ** p<0.05, * p<0.1

"DiD in (year)" shows how the treatment effect varies by period.

Cohort 1995 comprises the ex-socialist/eastern bloc countries that signed their association agreement to the EU between 1994 and 1995, namely: Bulgaria, Czech Republic, Hungary, Poland, and Romania.

Cohort 2000 comprises the ex-socialist/eastern bloc countries that signed their association agreement to the EU between 1998 and 1999, namely: Estonia, Latvia, Lithuania, Slovakia, and Slovenia.

1995, 2000, 2005, and 2010 are time controls.

The step following the estimation of the treatment effects by cohorts and periods is to estimate the average treatment effect of EU membership on the returns to education of the post-socialist countries that joined the EU. The results of these estimations are exhibited in Table 8. According to the first model, EU adhesion has a positive and significant effect on those countries that met the criteria and were accepted. The positive effect of EU membership prevails even when considering the type of governance through the polity variable and trading openness independently and simultaneously, as in models 2, 3, and 4, respectively. In all the cases, the type of governance and commercial openness showed a positive and significant effect on returns.

Table 8: Average impact of EU accession on post-communist countries

	(1)	(2)	(3)	(4)
DiD	1.661***	1.430***	1.630***	1.428***
	(0.495)	(0.532)	(0.545)	(0.552)
Cohort 1995	-0.554	-0.496	-0.601	-0.515
	(0.853)	(0.823)	(0.905)	(0.876)
Cohort 2000	0.075	0.123	0.052	-0.053
	(0.935)	(0.874)	(1.177)	(1.053)
Schooling	-0.143	-0.133	-0.245	-0.251
	(0.266)	(0.249)	(0.296)	(0.270)
Polity		0.144*		0.159**
		(0.077)		(0.078)
Trade			0.009*	0.010**
			(0.005)	(0.004)
1995	0.864**	0.904**	0.821*	0.904**
	(0.428)	(0.416)	(0.445)	(0.433)
2000	0.911	0.870	0.855	0.835
	(0.654)	(0.659)	(0.646)	(0.649)
2005	1.472***	1.415***	1.433***	1.382***
	(0.421)	(0.421)	(0.413)	(0.419)
2010	2.050***	2.055***	2.014***	2.037***
	(0.457)	(0.430)	(0.445)	(0.420)
Constant	7.995***	6.746***	8.225***	6.867***
	(2.317)	(2.250)	(2.344)	(2.256)
Prob > chi2	0.000	0.000	0.000	0.000
Observations	158	155	155	152
Groups	40	39	40	39

Clustered standard errors at national level in parenthesis.

*** p<0.01, ** p<0.05, * p<0.1

DiD = Difference-in-Difference

Cohort 1995 comprises the post-communist countries that signed their association agreement to the EU between 1994 and 1995, namely: Bulgaria, Czech Republic, Hungary, Poland, and Romania.

Cohort 2000 comprises the post-communist countries that signed their association agreement to the EU between 1998 and 1999, namely: Estonia, Latvia, Lithuania, Slovakia, and Slovenia.

1995, 2000, 2005, and 2010 are time controls.

Since half of the post-socialist countries that joined the EU started their accession process just a couple of years after the fall of the Soviet Union, there might be an overlap of the effects of transitioning to a market economy and becoming part of the EU on their returns to education. To disentangle a potential overlap of both effects, we implement a triple interaction model that incorporates both treatments (i.e., transitioning and EU accession) in the same specification. In

this case, we add to the "EU accession" treatment group the four non-post-socialist countries that joined the EU after the fall of the Soviet Union, namely: Austria, Finland, Sweden, and Cyprus. This allows us to observe if the events of transitioning and becoming an EU member have an effect on the returns to education on their own, and when a country undergoes both transformations.

The results of the triple-interaction model are shown in Table 9. Following the same approach used in the previous analyses, we run a set of four panel regressions to examine the effect of both treatments (transition and EU accession) and their interaction, as well as the effect that democracy and trade might have on returns. In the first model, where neither polity nor trade is taken into account, the transition is significantly associated with an increase of 2.1 points in the returns to education (captured by the "DiD Transition" variable), which is complemented with a further increase of 1.5 points for those post-socialist countries that joined the EU (captured by the "Transition*Post-transition*Post-EU accession" variable). In contrast, the effects of transitioning and becoming an EU member afterward decrease and lose their significance when including the polity index into the equation, as in model 2. However, when considering trade, as in models 3 and 4, the effect of experiencing both treatments (i.e., being a post-socialist country that joined the EU) and trade openness are significantly associated with an increase in the returns to schooling, independently of the presence of the polity variable. In both models, being a post-socialist country that acceded the EU is significantly associated with an increase of around 1.5 points in the returns to schooling. Another interesting finding is that no regression reveals an effect of EU membership on the returns to schooling on its own (captured by the "DiD EU accession" variable).

Table 9: Impact of transition, EU accession, and both treatments

	(1)	(2)	(3)	(4)
Transition*Post-transition*Post-EU accession	1.453*	1.092	1.546*	1.497*
	(0.876)	(0.880)	(0.874)	(0.901)
DiD Transition	2.053**	1.347	0.973	0.933
	(0.931)	(0.971)	(1.024)	(1.046)
DiD EU accession	-0.239	-0.226	-0.826	-0.801
	(0.605)	(0.599)	(0.644)	(0.653)
Transition	-3.704***	-2.265**	-2.768***	-2.578**
	(0.861)	(1.080)	(0.960)	(1.122)
EU accession	1.378*	1.042	1.804**	1.747**
	(0.789)	(0.828)	(0.801)	(0.874)
Post-transition	0.600	0.621	0.813	0.792
	(0.542)	(0.537)	(0.547)	(0.551)
Post-EU accession	-0.142	-0.043	-0.026	-0.038
	(0.543)	(0.541)	(0.549)	(0.554)
Always EU	0.749	0.610	0.536	0.564
	(0.859)	(0.935)	(0.829)	(0.895)
Schooling years	0.070	-0.008	-0.173	-0.173
	(0.133)	(0.140)	(0.163)	(0.169)
Polity index		0.114**		0.019
		(0.049)		(0.067)
Trade			0.016***	0.017***
			(0.006)	(0.006)
Constant	6.599***	6.282***	7.347***	7.121***
	(1.254)	(1.293)	(1.360)	(1.411)
Prob > Chi2	0	0	0	0
Obs.	219	216	199	196
Groups	40	39	40	39

*** p<0.01, ** p<0.05, * p<0.1

DiD = Difference-in-Difference

EU accession includes all the post-communist countries that signed their association agreement to the EU between 1994 and 1999 (Bulgaria, Czech Republic, Hungary, Poland, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia), as well as the four European countries that joined the EU after the fall of the Soviet Bloc (Austria, Finland, Sweden, and Cyprus).

Always EU comprises the EU-12 contries (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and UK), namely the countries that were part of the EU prior to the fall of the Soviet Bloc.

Therefore, the triple interaction model allows us to conclude that neither transitioning nor EU membership affects returns on its own, both only when a country undergoes both treatments. In other words, the main channel through which the transition increased the returns to schooling was through the EU accession channel. This may be because the post-socialist countries that became EU members should be the ones that implemented the deepest trade, economic, and political transformations when compared to other post-socialist countries and to other countries that joined the EU around the same time but that were not part of the Soviet Bloc. It is worth noting that these results are in line with our previous findings. This is because the effects of being a post-socialist country that joined the EU and of trade openness in the Staggered DiD (see Table 8) and in the triple interaction model (see Table 9) have similar magnitudes and follow the same direction.

Discussion

It is just over 30 years since the end of the Soviet Union and its bloc. Countries across Eastern and Central Europe are in their third decade of independence. This paper investigates the impact of the transition on the returns to education, both at once after the transition, and into the present, when some transition countries joined the European Union. The breakup of the bloc and transition meant markets and competition, which should give rise to productivity increases, and this would be evident in the returns to schooling. EU accession stands for institutional change resulting from the adoption of European law, joining the European market (higher investment and capital flows), and mobility of students. An important channel of EU accession could affect the returns to schooling through the changes in the educational system (study programs and internationalization).

We can conclude from the analysis that the channel through which the transition affected the returns to education was EU accession, and that neither transitioning from a centrally planned to a market economy nor EU membership significantly affected the returns to education on its own. The effect of transitioning we found in the first DiD model might have captured the effect of the economic and political transformations implemented by the post-socialist countries that were applying for EU membership, which started just a few years after the fall of the Soviet Union. Equally interesting is the finding that EU accession is not necessarily associated with higher returns *per se*, but only for those countries whose economy was centrally planned in the first place.

Our results confirm that after accession to the EU, returns to schooling were generally higher in the post-socialist countries that joined the union. This conclusion is supported by the results of the Staggered DiD and the Triple Interaction models, which reveal a positive and significant effect of around 1.5 percentage points for those countries that abandoned socialism and acceded to the EU. There are many channels through which EU accession could have increased the returns to education: better labor market opportunities (higher investment and flow of international capital), increased speed of reforms, adopting modern teaching styles, restructuring the study programs in line with the Bologna process, but also improvements in student achievement which leads to higher levels of human capital accumulation. The accession of Eastern European countries to the EU increased family wealth and the returns to schooling (Bergbauer 2019).

Moreover, the analysis also reveals that trade openness is a factor explaining the increase in the returns to education while transitioning from a centralized to a market economy and once becoming an EU member. We could not explore how technological change could have affected the returns to schooling on its own because data on technological evolution is scarce for most of the twentieth century. Therefore, this represents an opportunity area for further research.

To sum up, our empirical results indicate that the further accumulation of schooling in post-socialist countries kept its positive impact on returns to education despite its continuous accumulation of education. This suggests that the increase of educated labor supply was offset in some way by the demand for educated labor, which could be partially captured by the positive and significant effect of trade openness.

The transition induced by the fall of the Soviet Union was not the only major economic and political change undergone by post-socialist economies. Thirteen years later, a few of them joined

the EU, for which they needed to follow a series of economic, political, and institutional reforms that might have affected their returns to education years after they transitioned out of a centralized economic system.

In conclusion, this analysis has revealed that transitioning from a centrally planned economy to a market economy had a positive and significant effect on the returns to education in post-socialist countries despite their increase in average years of schooling after 1992. This positive effect might be explained by trade openness, which may have increased demand for technology and, with that, for more educated human capital.

It is just over 30 years since the end of the Soviet Union and countries across Eastern and Central Europe are into their third decade of independence. The transition has increased the premium on skills for post-socialist countries, especially the ones that acceded to the European Union. Using the comparable returns to education overtime for 28 transition and 20 non-transition countries in Europe and Central Asia, and panel data analysis and difference-in-difference methods, we find that the event of transitioning from a centrally planned economy to a market economy increased the returns to schooling in post-socialist countries positively and significantly, especially through the EU accession channel. Neither transitioning to a market economy without acceding the EU nor joining the EU without transitioning out of a centrally planned economy are associated with higher returns to education. The returns to education of the post-socialist countries that joined the EU grew rapidly during their membership application period. Trade openness positively contributed to the returns to education, which may show that it has propelled more demand for labor and human capital. The increase of educated labor supply was offset by the demand for educated labor. The transition from a centrally planned to a market economy had a positive and significant effect on the returns to education in post-socialist countries.

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Annex 1: Transition Countries

Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czechia, Estonia, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyz Republic, Latvia, Lithuania, Moldova, Montenegro, North Macedonia, Poland, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine

Annex 2: Non-Transition Countries

Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Türkiye, United Kingdom

Annex 3: Countries that emerged during the period of study (ear of independence shown in parentheses)

Czechoslovakia	USSR	Yugoslavia
Czechia (1993)	Armenia (1991)	Bosnia and Herzegovina (1992)
Slovak Republic (1993)	Azerbaijan (1991)	Croatia (1991)
	Belarus (1991)	North Macedonia (1991)
	Estonia (1991)	Slovenia (1991)
	Georgia (1991)	Serbia and Montenegro (1992)
	Kazakhstan (1991)	Montenegro (2006)
	Kyrgyz Republic (1991)	Serbia (2006)
	Latvia (1991)	Kosovo (2008)
	Lithuania (1990)	
	Moldova (1991)	
	Russian Federation (1991)	
	Tajikistan (1991)	
	Turkmenistan (1991)	
	Ukraine (1991)	
	Uzbekistan (1991)	

Annex 4: Results of the Breusch and Pagan Lagrangian Multiplier Test and the Hausman Test.

A. Results for the Transition Analysis

Breusch and Pagan Lagrangian Multiplier Test for RE: Impact of transition on all sample countries

	(1)		(2)		(3)		(4)	
	Variance	SD	Variance	SD	Variance	SD	Variance	SD
Dependent variable	6.885	2.624	6.964	2.639	6.165	2.483	6.245	2.499
Usual error term	3.070	1.752	3.028	1.740	3.008	1.734	3.035	1.742
Random effects term	2.987	1.728	2.734	1.653	2.767	1.664	2.165	1.471
Chi^2	70.09		56.62		64.33		44.35	
Prob > chi^2	0.000		0.000		0.000		0.000	

Hausman test to choose between FE and RE: Impact of transition on all sample countries

	(1)		(2)		(3)		(4)	
	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE
DiD	3.180	3.172	2.211	1.974	1.693	1.953	0.200	0.510
Post 1992	0.141	0.304	0.268	0.480	0.262	0.449	1.855	1.621
Schooling	0.219	0.131	0.131	0.017	-0.049	-0.094	-0.012	-0.152
Polity			0.108	0.136			-0.035	0.083
Trade					0.026	0.017	0.026	0.018
Chi^2	1.76		2.67		3.99		9.70	
Prob > chi^2	0.624		0.614		0.408		0.084	

B. Results for the EU accession Analysis

Breusch and Pagan Lagrangian Multiplier Test for RE: Effect of selected variables on returns to education

	(1)		(2)		(3)		(4)	
	Variance	SD	Variance	SD	Variance	SD	Variance	SD
Dependent variable	5.598	2.366	5.688	2.385	5.656	2.378	5.749	2.398
Usual error term	2.472	1.572	2.454	1.567	2.427	1.558	2.389	1.545
Random effects term	1.774	1.332	1.755	1.325	1.685	1.298	1.661	1.289
Chi^2	36.70		25.35		35.21		23.68	
Prob > chi^2	0.000		0.000		0.000		0.000	

Hausman test to choose between FE and RE: Effect of selected variables on returns to education

	(1)		(2)		(3)		(4)	
	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE
Schooling	0.612	-0.146	0.651	-0.105	0.521	-0.277	0.572	-0.239
Polity			0.156	0.161			0.222	0.169
Trade					0.029	0.013	0.031	0.014
1995	0.492	0.984	0.385	0.952	0.223	0.866	0.123	0.881
2000	0.453	1.316	0.202	1.155	0.018	1.145	-0.267	1.026
2005	1.036	2.332	0.830	2.142	0.422	2.133	0.150	1.974
2010	1.067	2.826	0.888	2.646	0.187	2.559	-0.071	2.407
Chi^2	2.18		14.09		6.86		7.28	
Prob > chi^2	0.824		0.029		0.334		0.400	

Breusch and Pagan Lagrangian Multiplier Test for RE: Impact of EU accession by entry cohort

	(1)		(2)		(3)		(4)	
	Variance	SD	Variance	SD	Variance	SD	Variance	SD
Dependent variable	5.598	2.366	5.688	2.385	5.656	2.378	5.749	2.398
Usual error term	2.406	1.551	2.404	1.550	2.409	1.552	2.391	1.546
Random effects term	1.883	1.372	1.661	1.289	1.867	1.366	1.857	1.363
Chi^2	39.09		27.13		36.08		24.25	
Prob > chi^2	0.000		0.000		0.000		0.000	

Hausman test to choose between FE and RE: Impact of EU accession by entry cohort

	(1)		(2)		(3)		(4)	
	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE
DiD cohort 1995	1.928	2.049	1.877	1.821	1.668	2.127	1.442	1.870
DiD cohort 2000	0.745	0.788	0.692	0.574	0.383	0.462	0.258	0.373
Schooling	0.511	-0.157	0.552	-0.136	0.469	-0.278	0.519	-0.241
Polity			0.033	0.138			0.135	0.147
Trade					0.023	0.012	0.026	0.013
1995	0.137	0.562	0.103	0.595	0.006	0.502	-0.042	0.552
2000	0.056	0.815	-0.070	0.759	-0.181	0.739	-0.372	0.667
2005	0.700	1.836	0.632	1.773	0.300	1.732	0.129	1.637
2010	0.778	2.328	0.723	2.293	0.150	2.154	-0.022	2.065
Chi^2	14.05		16.61		15.59		15.62	
Prob > chi^2	0.029		0.020		0.049		0.075	

Breusch and Pagan Lagrangian Multiplier Test for RE: Impact of EU accession by period

	(1)		(2)		(3)		(4)	
	Variance	SD	Variance	SD	Variance	SD	Variance	SD
Dependent variable	5.598	2.366	5.688	2.385	5.656	2.378	5.749	2.398
Usual error term	2.213	1.488	2.219	1.490	2.261	1.504	2.262	1.504
Random effects term	1.878	1.370	1.539	1.240	1.763	1.328	1.358	1.165
Chi^2	44.55		30.62		40.24		26.78	
Prob > chi^2	0.000		0.000		0.000		0.000	

Hausman test to choose between FE and RE: Impact of EU accession by period

	(1)		(2)		(3)		(4)	
	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE
DiD in 1995	-0.734	-0.587	-0.706	-0.810	-0.606	-0.479	-0.677	-0.675
DiD in 2000	0.832	0.864	0.945	0.655	1.006	0.987	0.988	0.817
DiD in 2005	2.334	2.496	2.346	2.284	2.449	2.501	2.273	2.333
DiD in 2010	2.188	2.129	2.161	1.850	2.252	1.995	1.967	1.731
Schooling	0.577	-0.126	0.609	-0.117	0.645	-0.225	0.667	-0.233
Polity			-0.026	0.145			0.073	0.165
Trade					0.005	0.009	0.008	0.010
1995	0.568	0.996	0.550	1.036	0.526	1.008	0.466	1.079
2000	0.169	0.978	0.061	0.939	0.057	0.952	-0.134	0.927
2005	0.360	1.529	0.339	1.472	0.188	1.518	0.063	1.459
2010	0.435	2.098	0.440	2.106	0.200	2.089	0.099	2.105
Chi^2	16.48		1.65		3.01		4.06	
Prob > chi^2	0.021		0.998		0.981		0.968	

Breusch and Pagan Lagrangian Multiplier Test for RE: Average impact of EU accession on post-communist countries

	(1)		(2)		(3)		(4)	
	Variance	SD	Variance	SD	Variance	SD	Variance	SD
Dependent variable	5.598	2.366	5.688	2.385	5.656	2.378	5.749	2.398
Usual error term	2.178	1.476	2.184	1.478	2.240	1.497	2.244	1.498
Random effects term	1.889	1.375	1.550	1.245	1.769	1.330	1.363	1.168
Chi^2	46.80		32.62		42.16		28.41	
Prob > chi^2	0.000		0.000		0.000		0.000	

Hausman test to choose between FE and RE: Impact of EU accession by period

	(1)		(2)		(3)		(4)	
	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE	Coef. FE	Coef. RE
Cohort 1995 * 1995	-0.024	0.166	-0.021	-0.060	0.071	0.388	-0.002	0.127
Cohort 1995 * 2000	1.200	1.375	1.282	1.160	1.275	1.559	1.253	1.319
Cohort 1995 * 2005	3.747	3.934	3.730	3.713	3.774	3.979	3.599	3.731
Cohort 1995 * 2010	2.928	2.877	2.871	2.596	2.931	2.812	2.674	2.479
Cohort 2000 * 2000	0.723362	0.591558	0.82025	0.389868	0.871886	0.51213	0.905915	0.430662
Cohort 2000 * 2005	0.998528	1.180096	0.992409	0.981751	1.099525	1.004773	0.98254	0.934262
Cohort 2000 * 2010	1.512171	1.50165	1.464883	1.230759	1.557946	1.15374	1.325966	0.976113
Schooling	0.534	-0.143	0.568	-0.133	0.600	-0.245	0.625	-0.251
Polity			-0.009	0.144			0.050	0.159
Trade					0.004	0.009	0.007	0.010
1995	0.456	0.864	0.434	0.904	0.403	0.821	0.353	0.904
2000	0.130	0.911	0.015	0.870	0.021	0.855	-0.155	0.835
2005	0.347	1.472	0.316	1.415	0.183	1.433	0.075	1.382
2010	0.445	2.050	0.441	2.055	0.225	2.014	0.139	2.037
Chi^2	16.72		0.18		1.54		2.86	
Prob > chi^2	0.019		1.000		1.000		0.999	

Annex 5: Post-socialist countries that accessed the EU between 2004 and 2013

Country	***Association Agreement year***	***Admission year***	***Length of adhesion process (years)***	***Sample group***
Bulgaria	1995	2007	12	Treatment cohort 1995
Czech Republic	1995	2004	9	
Hungary	1994	2004	10	
Poland	1994	2004	10	
Romania	1995	2007	12	
Estonia	1998	2004	6	Treatment cohort 2000
Latvia	1998	2004	6	
Lithuania	1998	2004	6	
Slovak Republic	1999	2004	5	
Slovenia	1999	2004	5	
Croatia	2005	2013	8	Control

Annex 5: Non-post-socialist countries that accessed the EU after the fall of the Soviet Union

Country	***Association Agreement year***	***Admission year***	***Length of adhesion process (years)***
Austria	1989	1995	6
Finland	1992	1995	3
Sweden	1991	1995	4
Cyprus	1990	2004	14