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Returns to Schooling in European Emerging Markets: A Meta-Analysis*

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Abstract: In this paper, we perform a meta-analysis of 848 estimates extracted from 43 previous studies to identify time-series changes in returns to schooling in European emerging markets. We also examine possible difference in returns to schooling across the countries. A meta-synthesis of collected estimates suggests a decreasing trend over time in returns to schooling in European emerging markets as a whole. Synthesis results also indicate that countries in the western part of the region tend to have higher returns to schooling than their counterparts in the eastern part. Both the meta-regression analysis of literature heterogeneity and the test for publication selection bias produced findings that are highly consistent with the meta-synthesis results.

JEL classification numbers: D31, I26, J31, P23, P36

Keywords: return to schooling, wages, meta-analysis, publication selection bias, European emerging markets

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1 Introduction

At the beginning of the transition from the socialist planned system to a market economy, most firms in Central and Eastern Europe (CEE) and the former Soviet Union (FSU) encountered difficulties in recruiting talented and skilled workers who would adapt to the new economic environment. The so-called "red executives" in enterprises established during the socialist era in these European emerging markets also did not have the knowledge and skills required to survive the transition; in addition, there was no managerial labor market to encourage their turnover. Not only corporate executives and managers, but also white- and blue-collar workers who were accustomed to working in formerly socialist enterprises faced difficulties in adapting to newly introduced duties in the market economy. Many researchers regarded the shortage of highly skilled and talented workers in the labor market to be one of the major bottlenecks to economic transition (Jones et al., 1995; Muravyev, 2001, 2003; Crino, 2005; Eriksson, 2005; Ryan, 2006; Horie and Kumo, 2020). In the 1990s, many traditional vocational schools and colleges still continued to train youth for jobs that no longer existed and were no longer required in the labor market (Walker, 2006). In these circumstances, a dramatic increase in the corporate need for workers competent in the new economic environment considerably increased the returns to secondary and higher education.

During the socialist period, vocational schools and colleges had provided education and training to students in a tight relationship with state enterprises. The transfer of graduates from school to work was organized by the State, and graduates were mandatorily assigned to jobs in state enterprises institutionally linked to the schools and colleges (Horie, 2005). It was called the State Job-Assignment System (SJAS). Under the SJAS, state enterprises virtually had no decision-making power to recruit and select new graduates from schools and colleges but simply accepted the new employees assigned by the State. The transition to a market economy meant that these firms were suddenly faced with the challenges of recruiting and selecting new graduates they need on their own, and that new graduates were now valued based on their ability to fit their knowledge and skills to the firms' new strategies. Wages, which used to be quite rigid during the socialist period due to the wages fixed by narrowly classified occupation by the State, became more flexible in the newly established labor market. Eventually, soon after the transition to a market economy, a wage gap began to form between winners and losers: workers who were competitive in the labor market and those who did not adapt to the new economic environment. Undoubtedly, all of these institutional changes had a considerable impact on the relationship between education and wages.

The drastic changes described above have inspired many researchers to study the effect of education on wage levels in European emerging markets, and most of their work has focused on a considerable increase in the returns to schooling during the early stage of transition. However, many of these countries have already changed the institutions embedded during the socialist period into new ones during the last three decades, successfully doing away with socialist legacies. Therefore, we can expect that the returns to schooling, which skyrocketed immediately after the collapse of socialism, have gradually diminished over the years. Evidence regarding the time trend in the returns to schooling throughout the transition period, however, is quite limited; thus, the overall picture on this point is ambiguous.

In addition, studies that have examined the returns to schooling in European emerging markets have largely failed to provide empirical evidence by cross-country comparison. In fact, the literature empirically examining returns to schooling in transition economies is strongly constrained by datasets of differing quality levels and sample designs across countries (Flabbi et al., 2008). Educational systems are also diverse throughout the region. As a result, most researchers often end up focusing on a specific country or a few countries that have comparable datasets and sample designs.

Nevertheless, empirical analyses of a relatively large number of countries have been covered in a handful of studies, including those of Flabbi et al. (2008), who estimated the returns to schooling in seven CEE countries and Russia by using data derived from the International Social Survey Program; Hölscher et al. (2011), who used cross-sectional data regarding 10 CEE EU member states obtained from the European Union Statistics on Income and Living Conditions (EU-SILC) to compare these countries against West European EU member states; and Mysíková and Večerník (2019), who also used EU-SILC data to estimate the returns to schooling in EU member states, including 11 CEE countries. However, it is regrettable that, due to data limitations, Hölscher et al. (2011) and Mysíková and Večerník (2019) did not include any non-EU countries. In addition, these two studies cover a period in the recent 2000s; thus, they do not provide evidence regarding the longitudinal tendency in the returns to schooling throughout the transition period.

In this paper, we aim to overcome the above-mentioned research constraints and provide deeper insights into the returns to schooling in European emerging markets by conducting a large meta-analysis of the extant literature. The meta-analysis, which takes advantage of the heterogeneity across studies, is capable of answering questions that would be almost impossible to examine in standard empirical analyses (Stanley and Doucouliagos, 2012; Ma and Iwasaki, 2020). As shown later, the meta-analysis in this paper indeed enables us to explore longitudinal changes in returns to schooling and find diverse characteristics among European emerging markets, including non-EU member states. Fleisher et al. (2005) present a pioneering meta-analysis on the returns to schooling in 10 CEE and FSU countries[1] and China, using estimates reported in 25 previous studies. Our meta-analysis examines the literature uncovered by Fleisher et al. (2005) to estimate and compare the returns to schooling in major European emerging markets including Hungary, the Czech Republic, Poland, Bulgaria, Romania, and Russia. We also examine the long-term time trend in the returns to schooling in the region. By achieving these two objectives, this paper considerably complements the findings of Fleisher et al. (2005).

Meta-synthesis of 848 estimates extracted from 43 previous studies suggests a decreasing trend over time in the returns to schooling in European emerging markets as a whole. Synthesis results also indicate that countries in the western part of the region tend to have higher returns to schooling than their counterparts in the eastern part. Both meta-regression analysis (MRA) and testing for publication selection bias produced findings that are highly consistent with the meta-synthesis results.

The remainder of the paper is organized as follows: Section 2 develops testable hypotheses for meta-analysis, taking account of the regional context of the educational systems and labor markets in European emerging markets. Section 3 describes the procedures used for searching and selecting the literature subject to the meta-analysis and overviews the selected studies. Section 4 performs a meta-synthesis of the collected estimates. Section 5 conducts MRA of heterogeneity among studies to assess the statistical robustness of the synthesis results presented in Section 4. Section 6 tests for publication selection bias. Finally, Section 7 summarizes the major findings and concludes the paper.

2 Returns to Schooling in European Emerging Markets: Hypothesis Development

The returns to schooling in European emerging markets at the very beginning of the transition period have attracted the attention of many researchers. This is because there

[1] They include Bulgaria, the Czech Republic, Estonia, Hungary, Poland, Romania, Slovakia, Slovenia, Ukraine, and Russia.

was an argument that the transition to a market economy could cause a peculiar phenomenon in which CEE and FSU countries might experience a sharp upward trend in the returns to schooling. It was commonly asserted that returns to schooling in the socialist period were generally low in these countries because wages were determined by the centralized planning system, in which a rigid wage structure that gave equal pay for jobs was rarely affected by differences in educational background (Graeser, 1988).[2] Accordingly, researchers expected that the economic transition had reset the socialist wage system, making wages flexible in the labor market, and resulting in a stronger link between educational backgrounds and wages. As a consequence, there was a drastic rise in returns to schooling.

Several attempts have been made to ascertain the validity of this prediction. Actually, there are a variety of empirical studies that have examined the returns to schooling during the early period of transition in European emerging markets. For example, Grogan (1997), Arabsheibani and Lau (1999), Lehmann and Wadsworth (2001), and Gerry et al. (2004) found a notable increase in returns to schooling in Russia, while Newell and Reilly (1996) and Deloach and Hoffman (2002) showed a skeptical view regarding the presence of an enhanced wage effect of schooling in this country. Pastore and Verashchagina (2006) concluded that the returns to schooling in Belarus were generally low throughout the early stage of transition, which could be explained by the gradualist approach to structural reform of the Lukashenko administration. In Poland, wage premiums for skilled white-collar workers grew dramatically at the beginning of the transition, which brought a striking increase in the returns to education (Rutkowski 1996). Similar trends were observed in the Czech Republic. In fact, Flanagan (1995) demonstrated that, in the Czech Republic, the returns to secondary and higher education increased remarkably as compared to primary education. Münich et al. (2005) also found that the returns to education in the early stage of the transition significantly exceeded those under the old regime. As these previous studies show, most researchers share the belief that returns to schooling grew considerably during the early stage of economic transition in many of European emerging markets.

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[2] According to Gregory and Kohlhase (1988), even under centralized wage setting in the Soviet Union, higher education enabled individuals to enter higher-paying occupations and, once in a given occupation, those more highly educated tended to earn more than others in the same occupation with lower educational attainment. However, the wage differences between those with higher and lower educational attainments in the Soviet Union were not comparable to those in Western capitalist countries.

However, studies that span a period extending into the 2000s and beyond often report a gradual decrease in returns to schooling over time. For instance, Strawinski et al. (2018) examined the returns to schooling in Poland from 1995 to 2013 and suggested that overeducation likely caused a decrease in the returns to higher education. Mysíková and Večerník (2019) used panel data covering a period from 2005 to 2014 to examine returns to higher education in East European countries in comparison with their Western counterparts and confirmed that no country displayed a constant upward or downward trend throughout the observation period. Hölscher et al. (2011) also stated that there was a consensus that wage inequality rose in the early stage of transition, but empirical evidence in the later stages is more mixed and diverse.

The changing trend in the returns to schooling in European emerging markets is likely to be closely linked with the spread of higher education fueled by education reforms. Although former socialist countries in Europe generally offered good access to primary and secondary education, access to higher education was quite limited. The educational systems in CEE and FSU countries resembled each other institutionally because they originated in the Soviet system. Until the 1960s, the Moscow-approved system targeted full access to primary education, after which, the principal goal turned to universal secondary education, which was achieved in the most CEE countries by the 1980s (Roberts, 2001). On the other hand, these socialist states provided only limited opportunities in higher education, and admission to such schools was highly competitive (Gregory and Kohlhase, 1988; Gerber, 2000).

During the transition period, higher education institutions in most European emerging markets were transformed from budget-run institutions to organizations that voluntarily charge tuition, which compelled them to accept more students. This tendency was reinforced by the establishment of new colleges and universities after the collapse of socialism. As **Figure 1** shows, although the rates of higher education enrollment in all countries except Russia were less than 20% in 1985, a rapid increase was observed through the 1990s and 2000s. In the 2010s, however, most of the countries experienced slight or drastic declines in their enrollment rates. It is logical to expect that returns to schooling may soar during the early stage of the transition when access to higher education was still very limited. Over the subsequent period of 30 years, however, the population with higher education gradually increased, which naturally resulted in a gradual decrease in the returns to higher education.

As shown in **Figure 2**, a consistent increase can be confirmed in the population with higher educational attainment in the working-age population (ages 15 to 64) in all five

European emerging markets. The population with higher educational attainment in Poland, which joined the EU in 2004, was almost half that of the EU15 in 2000, but it reached almost 90% of that of the EU15 by 2019. Bulgaria, which became a member of the EU in 2007, had surpassed the EU15's 2007 record by 2014. The shortage of highly educated workers, which gave the initial large impact on their wage levels during the early stage of the economic transition, is considered to be largely eased today. The EU had promoted human resource development to enhance smart, sustainable, and inclusive growth; it also set a target of increasing the share of the population aged 30 to 34 to have completed tertiary education to 40% by 2020 (European Commission, 2010). Increasing the population of highly educated workers in EU member states in CEE is expected to change the trend in returns to schooling in the early stage of transition to a new trend after the enlargement of the EU. Based on these arguments, we predict that:

Hypothesis 1: *The returns to schooling in European emerging markets have gradually decreased over time* (decreasing trend hypothesis).

Even though a decreasing trend can be seen in the returns to schooling in European emerging markets as a whole, the differences between countries from this viewpoint should not be ignored. The EU accession of CEE countries has required each individual government and firm to reinforce their institutional convergence to EU standards in their governance and business. In this context, the returns to schooling would be affected by the institutional convergence in terms of the accession period and geographical adjacency to the EU core. In other words, the earlier they became a member of the EU, the deeper the convergence would be. The closer geographically to the old core members of the EU, the deeper the convergence would be. Therefore, it is probable that the wage effect of education in the western part of European emerging markets is relatively higher than that in the eastern part, including not only non-EU countries such as Russia but also countries like Romania, whose EU membership has been delayed.

In this regard, we raise two important factors in the divergent returns to schooling across European emerging markets. The first factor is the notable advancement in the Europeanization of the educational systems in CEE countries that joined the EU in 2004. The Europeanization of the educational system comes from the Bologna Process, an intergovernmental agreement incorporating a series of reforms in higher education. It aims to work toward setting up the European Higher Education Area, which encourages international cooperation, academic exchanges, and transition from school to work throughout the area. Through the Bologna Process, a series of institutional reforms were implemented to ensure comparable higher-education qualifications. The Bologna Process has been implemented in most European emerging markets, but to what extent its objectives have been realized across the region is questionable. In fact, the impacts of the Bologna Process on educational systems were significant in Hungary, the Czech Republic, and Poland, which became initial signatories in the Bologna Declaration, along with the EU15, in 1999. Although Romania also signed the declaration in 1999, the Europeanization of the educational system in this country practically began only after it joined the EU in 2007 (Deca, 2015). Russia joined the Bologna Process in 2003 but has retained its own system of higher education qualifications and, in practicality, lags far behind other CEE countries (Luchinskaya and Ovchynnikova, 2011). The Europeanization of the educational system ensures the quality of education and can eventually strengthen the signaling effect of an academic background in the labor market.

The second factor to make the returns to schooling divergent among European emerging markets is the uneven distribution of foreign direct investment (FDI) across the region. Bhandari (2007) and other empirical works repeatedly verified that FDI can widen wage disparities in emerging markets. After the fall of the Berlin Wall, the newly advanced foreign enterprise firms in host countries helped them navigate to freedom from the rigid wage system inherited from the socialist era. The human resource management they introduced in the host countries also acted as a powerful measure to create a close relationship between a human resource and its reward. These foreign firms tended to pay higher wages to skilled and educated workers than did their domestic counterparts, which contributed to the widening wage disparities in CEE countries (Alili and Adnett, 2018). As Iwasaki and Tokunaga (2020) revealed, the farther away geographically from the EU 15, the greater reduction in FDI per capita European emerging markets experienced. This means that foreign firms in the eastern part of European emerging markets are expected to exert less impact on the wage systems than in their western counterparts. This expectation coincides with the findings of Estrin (2017), who claimed that the variation in FDI spillover effects can be explained by differences in two main factors: integration with the global economy (e.g., EU membership) and the quality of institutions.

Taking the above discussions into consideration, concerning cross-country variations in the returns to schooling in European emerging markets, we hypothesize that:

Hypothesis 2: *Returns to schooling in European emerging markets are higher in the western area than the eastern are*a (west-high/east-low hypothesis).

In the following sections, we examine the above two hypotheses by conducting a meta-analysis of the existing literature. Although the major focus of this paper is on the returns to higher education in European emerging markets, our meta-analysis also involves the returns to secondary education, because it is important to identify whether a similar or diverse trend can be observed between higher and secondary education in terms of the wage effect of education with the aim of obtaining a more accurate picture of the returns to schooling in European emerging markets.

3 Literature Selection Procedure and Overview of Selected Studies

This section first describes how we searched for and identified research works to be included in the meta-analysis to test the decreasing trend hypothesis and the west-high/east-low hypothesis proposed in the previous section. It also provides an overview of the selected studies.[3]

As the first step in identifying studies that provide estimates of the returns to secondary and higher education in European emerging markets, we used the electronic academic literature databases of EconLit and Web of Science and accessed the websites of major academic publishers to find relevant articles.[4] The search covered a period from 1990 to the third quarter of 2020. We carried out an "AND" search using the term *wage* or *education* in combination with one of the terms *emerging markets*, *transition economies*, *Central Europe*, *Eastern Europe*, *former Soviet Union*, and the name of one of the European emerging markets and obtained approximately 380 articles in either electronic form or hard copies. We then carefully examined each of the collected articles and narrowed the field to only those studies that provide estimates of returns to secondary and higher education in European emerging markets as outcomes from regression estimation of a Mincer-type wage function. As a result, we confirmed that, for the six countries of Hungary, the Czech Republic, Poland, Bulgaria, Romania, and Russia, a sufficient number of studies have been published to perform a meaningful

[3] The literature selection and meta-analysis in this paper were carried out in general conformity with the guidelines described in Havránek et al. (2020).

[4] We used the websites of the following academic publishers for our literature search: Emerald Insight, Oxford University Press, Sage Journals, ScienceDirect, Springer Link, Taylor & Francis Online, and Wiley Online Library. The final literature search was conducted in October 2020.

synthesis and comparison of empirical results using meta-analytic techniques. In the end, we selected a total of 43 studies from Flanagan (1995) to Liwiński (2020) that investigated one or more of these six countries.[5]

The 43 selected studies are quite useful for testing the decreasing trend hypothesis because they cover the 29-year period from 1988 to 2016 as a whole. In addition, only seven of 43 studies used panel data, meaning that the overwhelming majority of estimates reported in the selected studies are empirical results of the returns to schooling in a particular year. This fact is also favorable for testing the decreasing trend hypothesis.

The selected studies satisfy the conditions for testing the west-high/east-low hypothesis by comparing the returns to schooling among six European emerging markets. A breakdown of these studies by publication year shows that seven (16.3% of the total) of the 43 articles were published in the 1990s, 19 (44.2%) in the 2000s, 15 (34.9%) in the 2010s, and two (4.7%) in the 2020s. This clearly reflects the active attempt of econometrical analysis in studies of European emerging markets conducted in the 2000s onward. In other words, our meta-analysis is based mostly on the empirical results obtained in recent years when remarkable improvements have been made in the empirical methodology, which greatly increases our chances to identify the true effect size of returns to schooling in the target countries.

We collected a total of 848 estimates from the above 43 studies. The mean (median) of the number of collected estimates per study is 19.7 (12). All of these are single-term estimates of either the dummy variable for the completion of secondary education or that for the completion of higher education, for which the group of compulsory education graduates was set as the reference category. A total of 448 estimates were collected for the former variable type and 400 for the latter.[6] Estimates of the secondary education completion dummy are collectively referred to as the "secondary education studies," and those of the higher education completion dummy as the "higher education studies"

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[5] **Appendix Table A1** lists the 43 selected studies. Bibliographic information of these research works is provided at the end of this paper. A study by Flabbi et al. (2008), which we mentioned in the Introduction, was excluded from our meta-analysis due to some technical reasons related to the style of reporting empirical results.

[6] Estimates of the interaction terms of academic background dummy variables and other independent variables that were simultaneously estimated along with the single terms were excluded from our meta-analysis. Furthermore, although many previous studies use not only academic background dummy variables but also years-of-schooling variables in their empirical analyses, our analysis does not use estimates of years-of-schooling variables because it specifically focuses on returns to secondary and higher education.

hereinafter.

We converted all 848 collected estimates to partial correlation coefficients (PCCs) in order to adjust the difference in the units of estimation results and with or without logarithmic transformation of the wage variable. The PCC is a unitless statistic that measures the association of a dependent variable and the independent variable in question when other variables are held constant. When t_k and df_k denote the t value and the degree of freedom of the k-th estimate (k = 1, ..., K), respectively, the PCC (r_k) is calculated with the following equation:

$$r_k = \frac{t_k}{\sqrt{t_k^2 + df_k}} \qquad (1)$$

The standard error (SE_k) of r_k is given by $\sqrt{(1 - r_k^2)/df_k}$.

As the evaluation criteria for correlation coefficients, Cohen (1988) suggested using the values of 0.10, 0.30, and 0.50 as cut-offs to distinguish a small effect, medium effect, and large effect, respectively. These criteria, however, are meant for zero-order correlations and are, therefore, somewhat unsuitable for evaluating empirical results in the field of economics, where a large number of control variables are usually employed. To address this issue, Doucouliagos (2011) proposed a new standard for labor economic research, setting 0.048, 0.112, and 0.234 as the lowest thresholds of small, medium, and large effects, respectively (Table 3, p. 11). In the meta-analyses presented in the following sections, we evaluate returns to schooling in accordance with these criteria.

4 Meta-Synthesis

A meta-analysis conventionally consists of three steps: (1) meta-synthesis of collected estimates, (2) meta-regression analysis (MRA) of heterogeneity across studies, and (3) testing for publication selection bias (Iwasaki, 2020a). Our meta-analysis will follow this standard procedure to test the hypotheses proposed in Section 2.[7] As the first step of meta-analysis, this section performs meta-synthesis of the 848 estimates collected from 43 selected articles.

First, let us look at the distribution of the collected estimates. **Table 1** shows the descriptive statistics of the collected estimates, as well as results of a t-test of means and

[7] The methodological description of the meta-analysis presented in this paper is kept to a minimum due to space limitations. For more details, see Borenstein et al. (2009), Stanley and Doucouliagos (2012), and Iwasaki (2020b, Chapter 1).

the Shapiro-Wilk normality test. **Figure 3** draws kernel density estimation results. In both **Table 1** and **Figure 3**, results are exhibited separately for secondary education and higher education studies. The results by period and by country are also displayed for each study type.

In both Panels (a) and (b) of **Table 1**, the mean and median of the estimates collected from all studies are positive, and Panels (a) and (b) of **Figure 3** show highly skewed distributions toward the positive side. These findings indicate that the overwhelming majority of selected studies report positive returns to schooling, as predicted by the human capital theory. In fact, the PCCs of 388 (86.6%) of the 448 estimates collected from secondary education studies are positive. Similarly, the PCCs of 385 (96.3%) of the 400 estimates reported in higher education studies also take a positive value. When the Doucouliagos standard is applied to estimates showing positive effects of secondary (higher) education on wages, the effect sizes of 6 (33) estimates (1.5% (8.6%) of the total) are rated as large, those of 63 (84) estimates (16.2% (21.8%) of the total) are rated as medium, those of 122 (97) estimates (31.4% (25.2%) of the total) are rated as small, and those of the remaining 188 (157) estimates (48.5% (40.8%) of the total) are rated as less than small. This finding suggests that returns to both secondary and higher education have most likely reached an economically meaningful level in European emerging markets.

For both study types, the distributions of estimates displayed by period and country in **Table 1** and **Figure 1** support both the decreasing trend hypothesis and the west-high/east-low hypotheses. Specifically, estimates covering the period of 1994 or before are more positively skewed than those covering the period from 1995 to 2004, and estimates covering the period from 1995 to 2004 are more positively skewed than those covering the period of 2005 or later. Furthermore, estimates reported in studies of Hungary, the Czech Republic, Poland, and Bulgaria exhibit more positively skewed distributions than those in studies of Romania and Russia.

Table 2 presents the meta-synthesis results. This table not only shows the results using the traditional fixed-effect model and random-effects model but also presents the results of new synthesis methods proposed by Stanley and Doucouliagos (2017) and Stanley et al. (2017): the unrestricted weighted least squares averaging method (UWA) and the UWA of estimates with statistical power of greater than 0.80 (weighted average of the adequately powered—WAAP), respectively.[8] Just as in **Table 1** and **Figure 1**,

[8] The synthesized effect size obtained with the UWA approach is a point estimate produced by the

Table 2 shows the results individually for secondary education studies and higher education studies and the results by period and country for each study type.

In Column (2) of both Panels (a) and (b) of **Table 2**, the Q test of homogeneity consistently rejects the null hypothesis at the 1% significance level, and the I^2 and H^2 statistics also suggest the presence of heterogeneity across studies in all cases. Therefore, we adopt the synthesized effect sizes of the random-effects model in Column (1) as the reference values. In respect to the results of UWA and WAAP estimations in Column (3), all of the synthesis values, except the one computed for the Romania subgroup of secondary education studies, are based on a considerable number of estimates whose statistical power exceeds the threshold of 0.80. Accordingly, except for the Romania subgroup of the secondary education studies, we adopt the WAAP synthesis values, which are more reliable than the UWA ones, as the reference values for comparison with those generated by the random-effects model. For the Romania subgroup of the secondary education studies, we employ the UWA synthesis value of 0.018.

As shown in the first row of Panel (a) of **Table 2**, the synthesized effect size for all secondary education studies is 0.052 with the random-effects model and 0.041 with the WAAP approach in terms of PCC. According to the Doucouliagos standard, the returns to secondary education in all of the European emerging markets can be rated as small according to the random-effects model and less than small when the WAAP approach is used. On the other hand, Panel (b) of **Table 2** shows that the synthesized effect size for all higher education studies is 0.093 with the random-effects model and 0.095 with the WAAP approach. Thus, whichever approach is used, the returns to higher education in the region can be regarded as small. It deserves special mention that, as compared to secondary education, higher education doubles the effect of human capital on wages.

The synthesized effect sizes computed by period clearly support the decreasing trend hypothesis. In fact, synthesis values for the period of 2005 or later are consistently

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regression that takes the standardized effect size as the dependent variable and the estimation precision as the independent variable. Specifically, we estimate the following equation, in which there is no intercept term, and the coefficient α_1 is utilized as the synthesized value of the PCCs:

$$t_k = \alpha_1(1/SE_k) + \varepsilon_k,$$

where ε_k is a residual term. In theory, the coefficient α_1 is identical to the estimated value in a traditional fixed-effect model. Its standard error, however, is believed to be more robust to heterogeneity across studies. Furthermore, according to Stanley et al. (2017), WAAP is a promising alternative to the estimate obtained from the estimation of a traditional random-effects model because the former is less affected by publication selection bias than the latter.

smaller than those for the period from 1995 to 2004, and those for the period from 1995 to 2004 are consistently smaller than those for the period of 1994 or before, regardless of study type or synthesis method. It is likely, however, that these results are produced by roughly dividing the estimation period into three time frames. For further clarification, in **Figure 4**, we broke down the collected estimates into shorter time frames based on the average estimation period and examined changes in effect sizes over time. In both Panels (a) and (b) of the figure, the slope of the approximate line is estimated to be negative and statistically significant at the 1% level, implying that, as the average estimation period draws closer to the present, the returns to secondary education and higher education drop yearly by 0.0018 and 0.0031, respectively. In sum, even when the study period is divided into units of years, the decreasing trend hypothesis is supported.

A comparison of the random-effects estimates by country indicates that, in the case of secondary education studies, while the synthesized effect sizes for studies of Hungary, the Czech Republic, Poland, and Bulgaria are larger compared to that for all studies, those for Romania and Russia are much smaller. On the other hand, the results for higher education studies show that, while the synthesized effect sizes for studies of Hungary, the Czech Republic, and Bulgaria exceed that for all studies, those for studies of Poland, Romania, and Russia fall below the entire region level.

The UWA estimates have slightly different implications. Actually, the synthesis results for secondary education studies show that only studies of Hungary and Bulgaria have effect sizes that are larger than the one of all studies, whereas the results for higher education studies show that only studies of Hungary and the Czech Republic have larger effect sizes than that of the whole region. Thus, almost all of the synthesized effect sizes estimated for country-specific subgroups seem to support the west-high/east-low hypothesis, with the exception of those for the country-specific subgroups of secondary education studies by using the UWA approach.

5 Meta-Regression Analysis

While the meta-synthesis presented in the previous section enables explicit hypothesis testing by providing point estimates as synthesized effect sizes, it fails to give sufficient consideration to the possible influence of heterogeneity across the selected studies on their reported estimates. This section verifies the reliability of synthesis results by estimating a multivariate meta-regression model in which differences in study conditions and quality levels of the selected works are simultaneously controlled for. Specifically, we estimate a regression equation in the form of:

$$y_k = \beta_0 + \sum_{n=1}^{N-1} \beta_n x_{kn} + \beta_N se_k + e_k\,, \qquad k = 1, \cdots, K, \qquad (2)$$

where y_k is the PCC of the k-th estimate, β_0 is the intercept, β_n denotes the meta-regression coefficient to be estimated (n = 1, 2, ..., N), x_{kn} denotes a meta-independent variable that captures the various study-related factors that can potentially affect the estimate, se_k is the standard error of the PCC of the k-th estimate, and e_k is the residual term.

Although the most important aspect in the estimation of Eq. (2) is its effectiveness in controlling for literature heterogeneity, there is currently no consensus among meta-analysts regarding the best estimator for this purpose (Iwasaki et al., 2020). Hence, following the precedent of Stanley and Doucouliagos (2012) and other previous meta-studies, we perform an MRA using the following five estimators to check the statistical robustness of coefficient β_n: (1) the cluster-robust ordinary least squares (OLS) estimator, which clusters the collected estimates by study and computes robust standard errors; the cluster-robust weighted least squares (WLS) estimator, which uses (2) the inverse of the standard error (1/*SE*), (3) the degree of freedom (*df*), or (4) the inverse of the number of estimates reported per study (1/*EST*) as an analytical weight; and (5) the cluster-robust random-effects panel GLS estimator.[9]

As meta-independent variable x_{kn}, a series of variables are employed to capture differences in not only estimation periods and target countries that are keys to hypothesis testing but also target region, target gender, data type, survey data used, estimator, wage type, presence of control for selection bias and endogeneity, selection of control variables with potentially significant impact on estimates, and the quality level of the study. All of these variables are simultaneously estimated along with the standard errors of the PCCs. The names, definitions, and descriptive statistics of the meta-independent variables are provided in **Table 3**, while the estimation results of Eq. (2) with all of these independent variables are presented in **Table 4**. In the rest of this section, we interpret

[9] In addition to using these estimators, many of the previous studies conducted meta-regression analyses by using the cluster-robust fixed-effects panel estimator. However, to test the west-high/east-low hypothesis, we need estimates of dummy variables for target countries that are free from within-study variations. For this reason, we do not perform estimation by using a panel fixed-effects model.

the results based on the assumption that estimates that not only are statistically significant but also have the same sign in at least three of five models constitute statistically robust estimates.

In both Panels (a) and (b) of **Table 4**, the variable of the average estimation year is repeatedly given robust and negative coefficients; therefore, it strongly supports the decreasing trend hypothesis in agreement with the results of meta-synthesis reported in **Table 2**. In fact, when other conditions are held constant, as the estimation period draws closer to the present, the returns to secondary (higher) education tend to drop yearly in a range between 0.0045 (0.0023) and 0.0050 (0.0118). This finding well corresponds with the results obtained from the regression analysis in **Figure 4** as well.

On the other hand, the estimates of target country variables in Panel (a) of **Table 4** reveal that the returns to secondary education in Romania and Russia are significantly lower than those in Hungary (treated as the default category), by a margin of 0.0679 to 0.1058 and 0.0603 to 0.0697, respectively, *ceteris paribus*. Similarly, the returns to secondary education in the Czech Republic are also significantly lower than those in Hungary by a margin of 0.0172 to 0.0556. With regard to Poland and Bulgaria, no statistically significant differences are detected between these two countries and Hungary. In sum, the regression coefficients in Panel (a) point to the presence of marked differences in returns to secondary education between four of the target countries, including Hungary, the Czech Republic, Poland, and Bulgaria, and the remaining two countries, Romania and Russia. Furthermore, according to Panel (b) of **Table 4**, when compared to the returns to higher education in three of the target countries—Hungary, the Czech Republic, and Bulgaria—those in Poland are somewhat lower, by a margin of 0.0453 to 0.0556, those in Romania are still lower, by a margin of 0.0593 to 0.1511, and those in Russia are far lower, by a margin of 0.1020 to 0.1445. These findings suggest that the returns to both secondary and higher education in the three CEE countries and Bulgaria tend to exceed those in Romania and Russia, which is mostly in line with the meta-synthesis results reported in the previous section.

Estimates of other meta-independent variables imply that the estimator, wage type, control for selection bias and endogeneity, control for industry fixed effects, and quality level may systematically generate significant differences in the empirical results reported in secondary education studies. However, target region, data type, estimator, control for selection bias, and control for occupation, age/age group, firm size, location, and industry fixed effects tend to cause systematic differences in the reported estimates of the returns to higher education. These findings also have important implications for understanding wage studies in European emerging markets.

As pointed out by Bayesian meta-analysts such as Polák (2019) and Havranek and Sokolova (2020), MRA faces the so-called "model uncertainty" problem, which means that the true model cannot be identified in advance. Furthermore, it is probable that the simultaneous estimation of a large number of meta-independent variables can give rise to multicollinearity. To address these issues, following the approach adopted in Brada et al. (2021), we conducted Bayesian model averaging (BMA) by taking the average estimation period, target country variables, and the standard errors of the PCCs as focus regressors and the remaining 19 independent variables as auxiliary regressors to extract posterior inclusion probabilities (PIPs) of the latter 19 variables. We then estimated a meta-regression model that introduces only those auxiliary regressors with 0.80 or more PIP (i.e., selected moderators) with focus regressors on the right-hand side.[10] The results are presented in **Table 5**. The coefficients provided in this table differ from those displayed in **Table 4**, in that a considerable loss of statistical significance can be noted in the Czech variable in Panel (a) of **Table 5** and the Poland variable in Panel (b) of **Table 5**. The coefficients derived from the variable of the average estimation period, the Romania variable, and the Russia variable are estimated to be robustly negative, which is in agreement with **Table 4**. Summing up, a robustness check that takes model uncertainty and multicollinearity into account produces coefficients that plausibly support both the decreasing trend hypothesis and the west-high/east-low hypothesis.

6 Testing for Publication Selection Bias

As described in the preceding sections, both the meta-synthesis of collected estimates and the MRA of literature heterogeneity produced findings that are consistent with our expectations. However, in order to establish the reliability of our hypothesis testing, we need to rule out the possibility that the selected studies might not contain genuine evidence due to the effect of publication selection bias. Hence, as the final stage of the meta-analysis, we test for publication selection bias and, if it does exist, examine the extent of its impact and verify the presence of genuine evidence. To this end, we not only utilize a funnel plot but also conduct a funnel-asymmetry test (FAT), precision-effect test (PET), and precision-effect estimate with standard error (PEESE). This FAT-PET-PEESE procedure was proposed by Stanley and Doucouliagos (2012) and has been used widely in recent meta-studies (Iwasaki, 2020a).

[10] The BMA estimation results are provided in **Appendix Table A2**.

The FAT can be performed by regressing the t value of the k-th estimate on the inverse of the standard error ($1/SE$) using Eq. (3), thereby testing the null hypothesis that the intercept term γ_0 is equal to zero:

$$t_k = \gamma_0 + \gamma_1(1/SE_k) + v_k, \qquad (3)$$

where v_k is the error term. When the intercept term γ_0 is statistically significantly different from zero, we can assume that the distribution of the effect sizes is asymmetric. Even when FAT detects publication selection bias, genuine evidence can still exist in the selected studies. Stanley and Doucouliagos (2012) proposed examining this possibility by testing the null hypothesis that the coefficient γ_1 is equal to zero in Eq. (3). The rejection of the null hypothesis $\gamma_1 = 0$ implies the presence of genuine evidence. This null hypothesis is tested using the so-called "precision-effect test" (PET), precisely because the coefficient γ_1 is the coefficient of precision. Moreover, Stanley and Doucouliagos (2012) also stated that an estimate of the effect size adjusted for publication selection bias (i.e., coefficient γ_1) can be obtained by estimating Eq. (4), which has no intercept. If the null hypothesis $\gamma_1 = 0$ is rejected, then the non-zero true effect does actually exist in the selected studies, and the coefficient γ_1 can be regarded as the estimate of the non-zero effect.

$$t_k = \gamma_0 SE_k + \gamma_1(1/SE_k) + v_k \qquad (4)$$

The use of Eq. (4) to estimate a publication-selection-adjusted effect size is called "the PEESE approach." To test the robustness of the regression coefficients obtained from this FAT-PET-PEESE procedure, we estimate Eqs. (3) and (4) using not only the unrestricted WLS estimator but also four additional estimators that are capable of addressing heterogeneity across studies.

Figure 5 presents the funnel plots. As Panels (a) and (b) of the figure show, estimates collected from both secondary education studies and higher education studies are strongly skewed to the positive side. If the true effect is assumed to be zero, as the dotted line in **Figure 5** demonstrates, the ratio of positive to negative estimates is 388:6 for secondary education studies; therefore, the null hypothesis that the number of positive estimates equals that of negative estimates is strongly rejected by a goodness-of-fit test (z = 15.496, p = 0.000). The same ratio for higher education studies is 385:15, which reflects a highly positively skewed distribution that rejects the null hypothesis (z= 18.500, p = 0.000). If the WAAP synthesis value reported in **Table 2** is assumed to be the approximate value of the true effect, as depicted by the solid line in **Figure 5**, the estimates collected from secondary education studies are divided into a ratio of 217:231, with a value of 0.041 being the threshold, and the null hypothesis that the ratio of estimates below the WAAP value versus those over it is 50:50 is not rejected ($z = 0.661$, $p = 0.508$). On the other hand, estimates reported in higher education studies are divided into a ratio of 255 to 145 when the WAAP synthesis value of 0.095 is set as the threshold. In this case, the distribution of estimates is strongly skewed to the left side, rejecting the null hypothesis ($z = -5.500$, $p = 0.000$). While it is highly likely that publication selection bias is at work in higher education studies, the assessment of funnel symmetry for secondary education studies strongly depends on the assumption of the true effect.

We therefore leave the final judgment to the FAT-PET-PEESE procedure, which is methodologically more rigorous than a visual examination by funnel plot. The test results for secondary education studies are reported in **Table 6**. Panel (a) of the table shows that the FAT rejects the null hypothesis that the intercept γ_0 is zero in three of five models. This implies that the collected estimates likely lack funnel symmetry; accordingly, the presence of publication selection bias is strongly suspected in the secondary education studies. However, even when publication selection bias is present, the selected studies can still contain evidence of the true effect. The PET is used to test for the presence of genuine evidence. As reported in Panel (a) of **Table 6**, the PET rejects the null hypothesis that the coefficient of the inverse of the standard errors (γ_1) is zero in four models, meaning that the collected estimates do contain genuine evidence. Furthermore, the PEESE approach shows that the coefficient (γ_1) is statistically significantly different from zero in four models, therefore implying that the true effect size of returns to secondary education should be in a range from 0.0409 to 0.0459 in terms of PCC.

Table 7 shows the test results for the higher education studies. The results in this table resemble those for the secondary education studies in that, although the FAT suggests a high likelihood of publication selection bias in the selected studies, the PET confirms the presence of genuine empirical evidence, and the PEESE generated statistically robust coefficients showing that the true effect size lies in a range from 0.0955 to 0.0983. For both types of studies, the estimates derived from the PEESE approach well correspond with the synthesis results that are very close to the WAAP synthesis values reported in **Table 2**. In sum, according to the Doucouliagos standard, the returns to secondary education in European emerging markets fall slightly below the threshold of a small effect size, whereas the returns to higher education are well above the threshold of a small effect size but fall short of the medium threshold.[11]

We also applied the FAT-PET-PEESE procedure to the selected studies by period and country, which, along with the results for all studies described above, are summarized in **Table 8**. In both types of studies, although publication selection bias was detected in the collected estimates from 2005 or later, the presence of empirical evidence regarding a non-zero true effect was confirmed for all periods. The effect sizes by period corrected for publication selection bias in **Table 8** clearly indicate decreases in returns to both secondary and higher education over time; these findings are highly in line with those of the meta-synthesis and MRA that also strongly support the decreasing trend hypothesis.

On the other hand, when we look at the findings of the FAT-PET-PEESE procedure by country, we note that the FAT did not reject the null hypothesis for any of the countries, with the exception of higher education studies of the Czech Republic. Thus, the effect of publication selection bias at the country level seems to be minor at best. On the other hand, we can see that the PET rejected the null hypothesis and the PEESE generated a non-zero publication-selection-adjusted effect size in the secondary education studies of Hungary, Poland, and Russia and higher education studies of Hungary, the Czech Republic, Romania, and Russia. When we focus our attention on those country-specific studies that have genuine evidence, it is evident that the returns to secondary education in Hungary are greater than those in the entire European emerging markets and much higher than those in Russia; also, the returns to higher education in Hungary and the Czech Republic are greater than those in the whole region and far greater than those in Romania and Russia. These findings strongly back up the results of meta-synthesis and MAR reported in the previous sections.

7 Conclusions

A drastic increase in returns to schooling was a peculiar and characteristic phenomenon noted during the early phase of the transition from a planned system to a market economy in CEE and FSU countries. Therefore, many researchers have attempted to empirically examine changes in returns to schooling in these countries during this period. More than

[11] According to the guidelines provided by Havránek (2015) and Havranek and Sokolova (2020), we also conducted the instrumental variable (IV) estimation of Eq. (3) by using the inverse of the square root of an observed value as the instrumental variable, and found that the null hypothesis was rejected by both FAT and PET.

three decades have passed since these European emerging markets began their economic transition, during which time there have been many developments that could have greatly affected returns to schooling, including drastic education reforms, the remarkable expansion of higher education, the Europeanization of educational systems, followed by economic integration with the EU and accumulation of FDIs. These developments have significantly altered the social and economic environments in this region. In view of this fact, we set out to answer two questions in the present study: first, whether returns to schooling in European emerging markets have gradually decreased over time and, second, whether differences in the progress of Europeanization have resulted in regional gaps in returns to schooling. To address these issues, we conducted a meta-analysis of a total of 848 estimates extracted from 43 studies to identify time-series changes in returns to schooling in European emerging markets and to examine possible differences across the region from this viewpoint.

The meta-synthesis of the collected estimates strongly supports our prediction that the returns to schooling in European emerging markets decrease over time. The synthesis results also verify the west-high/east-low hypothesis that countries in the western part of the region tend to have higher returns to both secondary and higher education than their counterparts in the eastern part. The estimation results of a meta-regression model in which differences in study conditions and quality levels of the selected studies were simultaneously controlled for and the test results for publication selection bias obtained from both the use of a funnel plot and the FAT-PET-PEESE procedure are also consistent with the meta-synthesis results, for the most part.

The findings of meta-analysis in this paper suggest that, as each European emerging market worked toward the Europeanization of its educational system and economic integration with the EU, the returns to schooling in the region gradually decreased; additionally, delays in Europeanization and economic integration seen in some countries might have betrayed the public's hope for better returns from investment in education and contributed to further decreasing the returns to schooling. One might even argue that changes in returns to schooling in CEE countries and Russia are due more to the pace of Europeanization of the educational and economic systems than to factors related to economic transition. However, for some of the countries treated in our meta-analysis, we did not find genuine evidence of the true effect size in the collected estimates. Further research is needed for the proper testing of the west-high/east-low hypothesis.

Appendix. Method for Evaluating a Study's Quality Level

This appendix describes how we evaluated the quality levels of studies included in our meta-analysis.

As the basic source of information for evaluating the quality levels of journal articles, we used the rankings of economic journals published on February 1, 2018 by IDEAS (http://ideas.repec.org/), a bibliographic database dedicated to economics and available freely on the Internet. IDEAS provided the most comprehensive rankings of 2159 economic journals as of February 2018. We conducted a cluster analysis by using the comprehensive evaluation scores provided by IDEAS to divide the 2159 journals into 20 clusters and then graded (weight) each journal on a scale from 20 (a group of journals belonging to the highest cluster) to 1 (a group of journals belonging to the lowest cluster).

For journals not indexed by IDEAS, we referred to impact factors (Thomson Reuters) and other journal rankings that allowed us to compare them against the journals indexed by IDEAS, and then graded them according to the scores given to the equivalent journals listed in IDEAS.

For academic books or book chapters, we gave an initial score of 1 and upgraded them to a median score of 10 when any of the following conditions were satisfied: (1) it is clearly specified that the book or article in question has been peer-reviewed; (2) the book or article in question has been published by a major academic publisher that receives assessment by outside experts; and, (3) the quality level of the research in question is clearly high.

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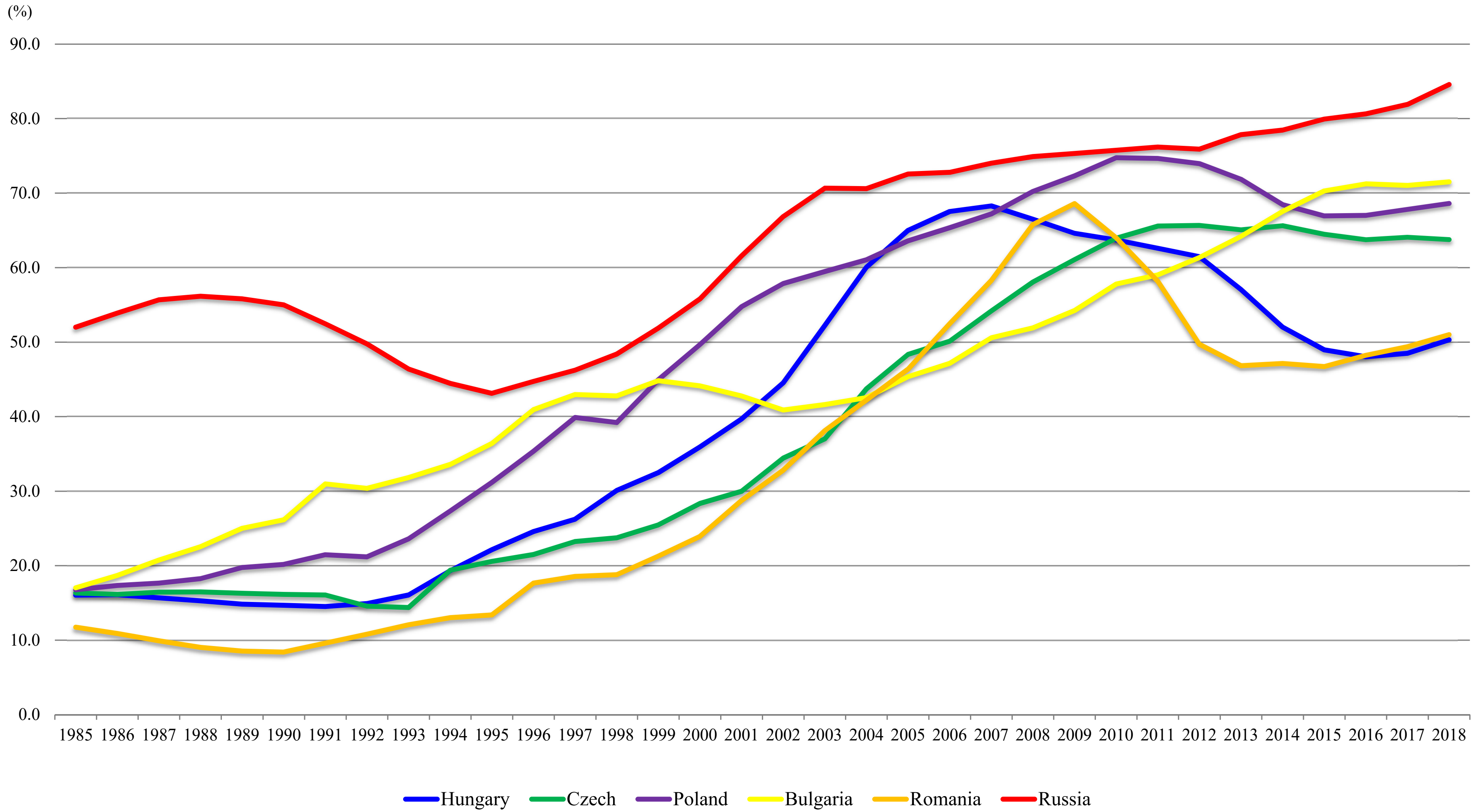


Figure 1. Higher education enrollment rates in 6 European emerging markets: 1985–2018

Source: UNESCO Institute for Statistics (http://uis.unesco.org/en/home)

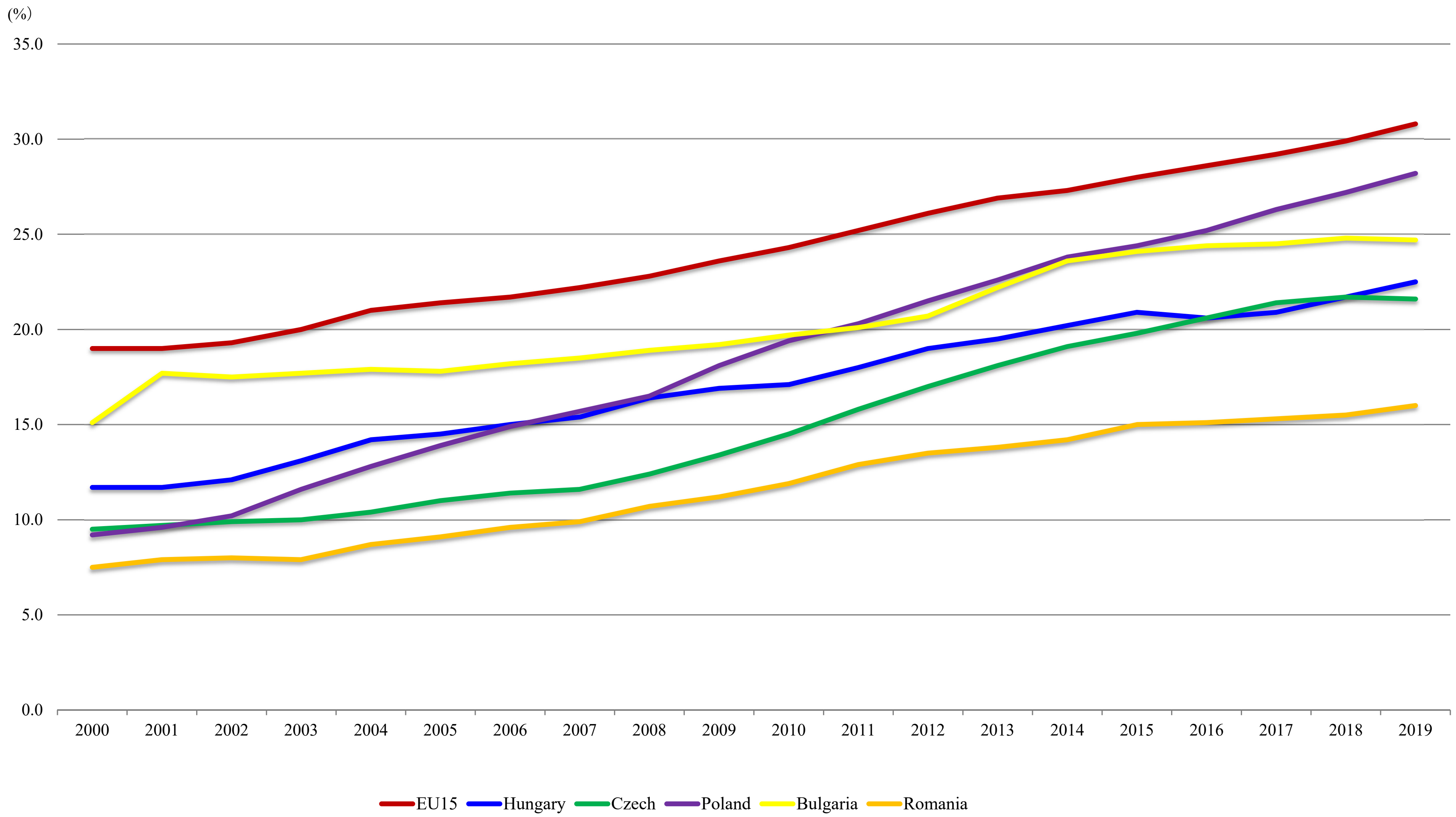


Figure 2. Ratio of higher education graduates to the working population in EU15 and 5 European emerging markets: 2000–2019

Source: EUROSTAT (https://ec.europa.eu/eurostat)

Table 1. Descriptive statistics of partial correlation coefficients, *t*-test, and Shapiro–Wilk normality test of collected estimates

(a) Secondary education studies

Study type	Number of estimates (*K*)	Mean	Median	S.D.	Max.	Min.	Kurtosis	Skewness	*t*-test [a]	Shapiro–Wilk normality test (z) [b]
All studies	448	0.057	0.042	0.066	0.349	-0.112	4.630	1.057	18.270 ***	7.240 †††
By period										
1994 or before	119	0.062	0.049	0.058	0.349	-0.020	7.490	1.717	11.586 ***	5.694 †††
1995–2004	268	0.062	0.042	0.071	0.305	-0.095	3.568	0.825	14.175 ***	5.385 †††
2005 or later	61	0.026	0.013	0.043	0.186	-0.112	5.747	0.381	4.635 ***	2.651 †††
By country										
Hungary	39	0.083	0.076	0.040	0.174	-0.029	3.355	0.097	12.811 ***	0.967
Czech Republic	58	0.069	0.052	0.097	0.349	-0.095	3.236	0.686	5.459 ***	1.715 ††
Poland	113	0.082	0.058	0.073	0.258	-0.050	2.059	0.486	11.939 ***	4.098 †††
Bulgaria	24	0.083	0.060	0.091	0.305	-0.112	3.402	0.525	4.466 ***	0.677
Romania	81	0.029	0.029	0.032	0.107	-0.032	2.562	0.067	8.229 ***	1.236
Russia	133	0.035	0.032	0.041	0.173	-0.069	4.068	0.655	9.731 ***	2.526 †††

(b) Higher education studies

Study type	Number of estimates (*K*)	Mean	Median	S.D.	Max.	Min.	Kurtosis	Skewness	*t*-test [a]	Shapiro–Wilk normality test (z) [b]
All studies	400	0.094	0.063	0.096	0.588	-0.045	7.877	1.941	19.702 ***	9.313 †††
By period										
1994 or before	106	0.104	0.075	0.086	0.411	-0.014	4.414	1.350	12.499 ***	5.439 †††
1995–2004	190	0.101	0.076	0.095	0.475	-0.045	5.819	1.542	14.513 ***	6.726 †††
2005 or later	104	0.072	0.034	0.102	0.588	-0.022	14.521	3.174	7.194 ***	7.816 †††
By country										
Hungary	49	0.120	0.129	0.064	0.239	0.013	1.911	-0.032	13.223 ***	1.673 ††
Czech Republic	58	0.166	0.080	0.161	0.588	0.030	2.779	1.021	7.854 ***	4.952 †††
Poland	118	0.090	0.054	0.084	0.439	-0.010	5.011	1.408	11.624 ***	5.932 †††
Bulgaria	20	0.107	0.057	0.100	0.344	0.009	2.841	1.024	4.798 ***	2.644 †††
Romania	92	0.050	0.032	0.050	0.249	-0.045	5.772	1.469	9.536 ***	5.275 †††
Russia	63	0.075	0.078	0.055	0.171	-0.037	2.022	-0.175	10.924 ***	1.131

Notes:
[a] ***: Null hypothesis that the mean is zero is rejected at the 1% level.
[b] †††: Null hypothesis of normal distribution is rejected at the 1% level; ††: at the 5% level.

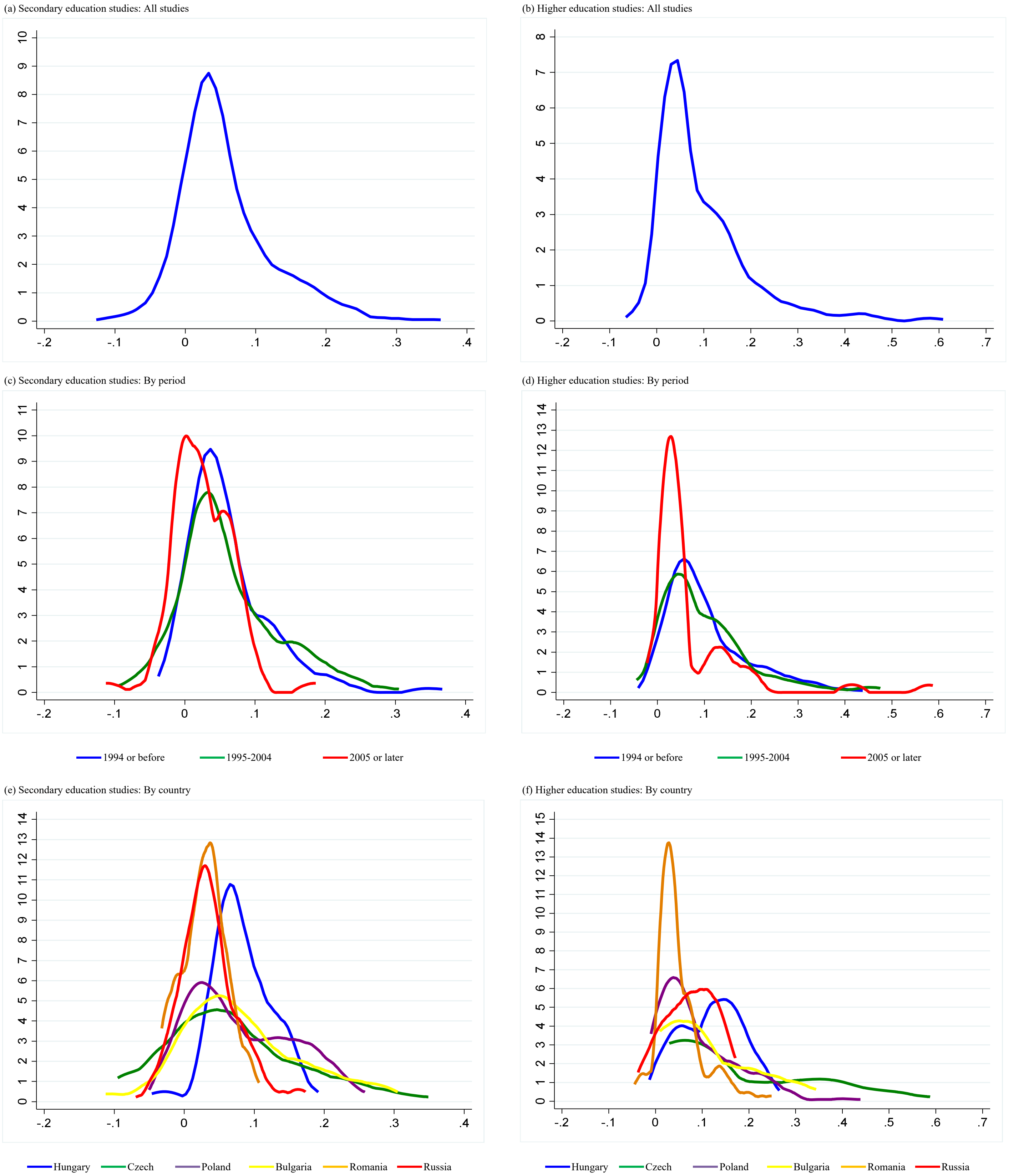


Figure 3. Kernel density estimation of collected estimates

Note: The vertical axis is the kernel density. The horizontal axis is the partial correlation coefficient of collected estimates. See Table 1 for the descriptive statistics of collected estimates.

Table 2. Synthesis of estimates

(a) Secondary education studies

Study type	Number of estimates (K)	(a) Traditional synthesis: Fixed-effect model (z value)[a]	(a) Traditional synthesis: Random-effects model (z value)[a]	(b) Heterogeneity test and measures: Cochran's Q test of homogeneity (p value)[b]	I^2 statistic[c]	H^2 statistic[d]	(c) Unrestricted weighted least squares average (UWA): UWA of all estimates (t value)[a,e]	Number of the adequately powered estimates[f]	WAAP (weighted average of the adequately powered estimates) (t value)[a]	Median S.E. of estimates	Median statistical power
All studies	448	0.041 ***	0.052 ***	95059.65 ***	99.28	138.96	0.041 ***	194	0.041 ***	0.016	0.713
		(188.63)	(18.35)	(0.00)			(12.93)		(0.04)		
By period											
1994 or before	119	0.092 ***	0.059 ***	4043.61 ***	96.08	25.51	0.092 ***	101	0.091 ***	0.019	0.998
		(106.69)	(12.33)	(0.00)			(18.22)		(16.83)		
1995–2004	268	0.055 ***	0.055 ***	75268.02 ***	99.37	159.43	0.055 ***	144	0.055 ***	0.017	0.884
		(191.03)	(13.75)	(0.00)			(11.38)		(8.30)		
2005 or later	61	0.009 ***	0.027 ***	2804.33 ***	99.41	170.17	0.009 ***	16	0.008 *	0.009	0.192
		(25.51)	(5.05)	(0.00)			(3.73)		(2.12)		
By country											
Hungary	39	0.066 ***	0.086 ***	8297.74 ***	99.54	217.17	0.066 ***	35	0.066 ***	0.003	1.000
		(173.95)	(13.81)	(0.00)			(11.77)		(11.14)		
Czech Republic	58	0.014 ***	0.066 ***	47546.29 ***	99.84	642.72	0.014	19	0.012	0.030	0.066
		(28.79)	(5.19)	(0.00)			(1.00)		(0.50)		
Poland	113	0.038 ***	0.067 ***	29265.47 ***	99.55	224.43	0.038 ***	55	0.037 ***	0.014	0.783
		(108.16)	(11.33)	(0.00)			(6.69)		(4.58)		
Bulgaria	24	0.082 ***	0.084 ***	124.57 ***	84.46	6.43	0.082 ***	5	0.092 **	0.032	0.720
		(12.92)	(5.07)	(0.00)			(5.55)		(3.44)		
Romania	81	0.018 ***	0.027 ***	791.69 ***	89.97	9.97	0.018 ***	0	-	0.010	0.433
		(16.09)	(7.32)	(0.00)			(5.12)		(-)		
Russia	133	0.040 ***	0.035 ***	684.24 ***	77.21	4.39	0.040 ***	20	0.046 ***	0.024	0.371
		(26.76)	(10.22)	(0.00)			(11.75)		(4.58)		

(b) Higher education studies

Study type	Number of estimates (K)	(a) Traditional synthesis: Fixed-effect model (z value)[a]	(a) Traditional synthesis: Random-effects model (z value)[a]	(b) Heterogeneity test and measures: Cochran's Q test of homogeneity (p value)[b]	I^2 statistic[c]	H^2 statistic[d]	(c) Unrestricted weighted least squares average (UWA): UWA of all estimates (t value)[a,e]	Number of the adequately powered estimates[f]	WAAP (weighted average of the adequately powered estimates) (t value)[a]	Median S.E. of estimates	Median statistical power
All studies	400	0.095 ***	0.093 ***	270000.00 ***	99.79	471.88	0.095 ***	346	0.095 ***	0.015	1.000
		(449.73)	(19.25)	(0.00)			(17.40)		(16.18)		
By period											
1994 or before	106	0.144 ***	0.103 ***	8275.23 ***	98.68	76.04	0.144 ***	104	0.143 ***	0.016	1.000
		(167.01)	(12.95)	(0.00)			(18.81)		(18.64)		
1995–2004	190	0.134 ***	0.100 ***	190000.00 ***	99.83	588.93	0.134 ***	166	0.134 ***	0.015	1.000
		(481.41)	(13.76)	(0.00)			(15.26)		(14.26)		
2005 or later	104	0.025 ***	0.071 ***	7900.49 ***	99.86	707.66	0.025 ***	30	0.023 ***	0.016	0.347
		(70.19)	(7.18)	(0.00)			(8.02)		(5.14)		
By country											
Hungary	49	0.100 ***	0.121 ***	18777.50 ***	99.79	468.43	0.100 ***	47	0.100 ***	0.006	1.000
		(262.02)	(13.55)	(0.00)			(13.25)		(12.97)		
Czech Republic	58	0.139 ***	0.165 ***	160000.00 ***	99.97	3349.10	0.139 ***	56	0.139 ***	0.017	1.000
		(393.63)	(7.81)	(0.00)			(7.32)		(7.19)		
Poland	118	0.043 ***	0.088 ***	45456.87 ***	99.71	346.14	0.043 ***	70	0.043 ***	0.015	0.825
		(107.21)	(10.62)	(0.00)			(5.44)		(4.12)		
Bulgaria	20	0.073 ***	0.104 ***	187.81 ***	93.42	15.21	0.073 ***	9	0.056 **	0.028	0.757
		(14.27)	(4.97)	(0.00)			(4.54)		(2.97)		
Romania	92	0.038 ***	0.048 ***	1724.79 ***	95.43	21.87	0.038 ***	60	0.037 ***	0.010	0.969
		(35.62)	(9.30)	(0.00)			(8.18)		(6.41)		
Russia	63	0.068 ***	0.074 ***	389.12 ***	84.49	6.45	0.068 ***	30	0.068 ***	0.024	0.798
		(27.46)	(11.05)	(0.00)			(10.96)		(7.60)		

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

[a] Null hypothesis: The synthesized effect size is zero.

[b] Null hypothesis: Effect sizes are homogeneous.

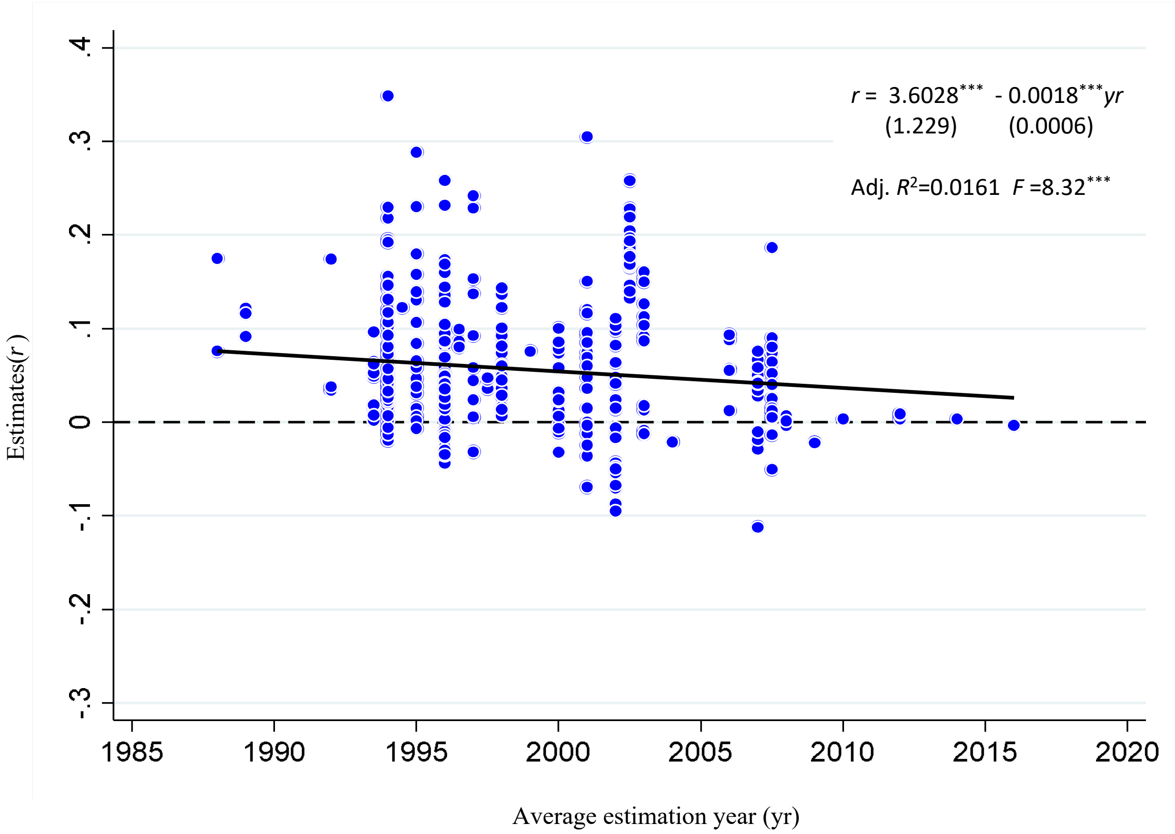
[c] Ranges between 0 and 100% with larger scores indicating heterogeneity

[d] Takes zero in the case of homogeneity

[e] Synthesis method advocated by Stanley and Doucouliagos (2017) and Stanley et al. (2017)

[f] Denotes number of estimates with statistical power of 0.80 or more, which is computed by referring to the UWA of all collected estimates

(a) Secondary education studies (K=448)



(b) Higher education studies (K=400)

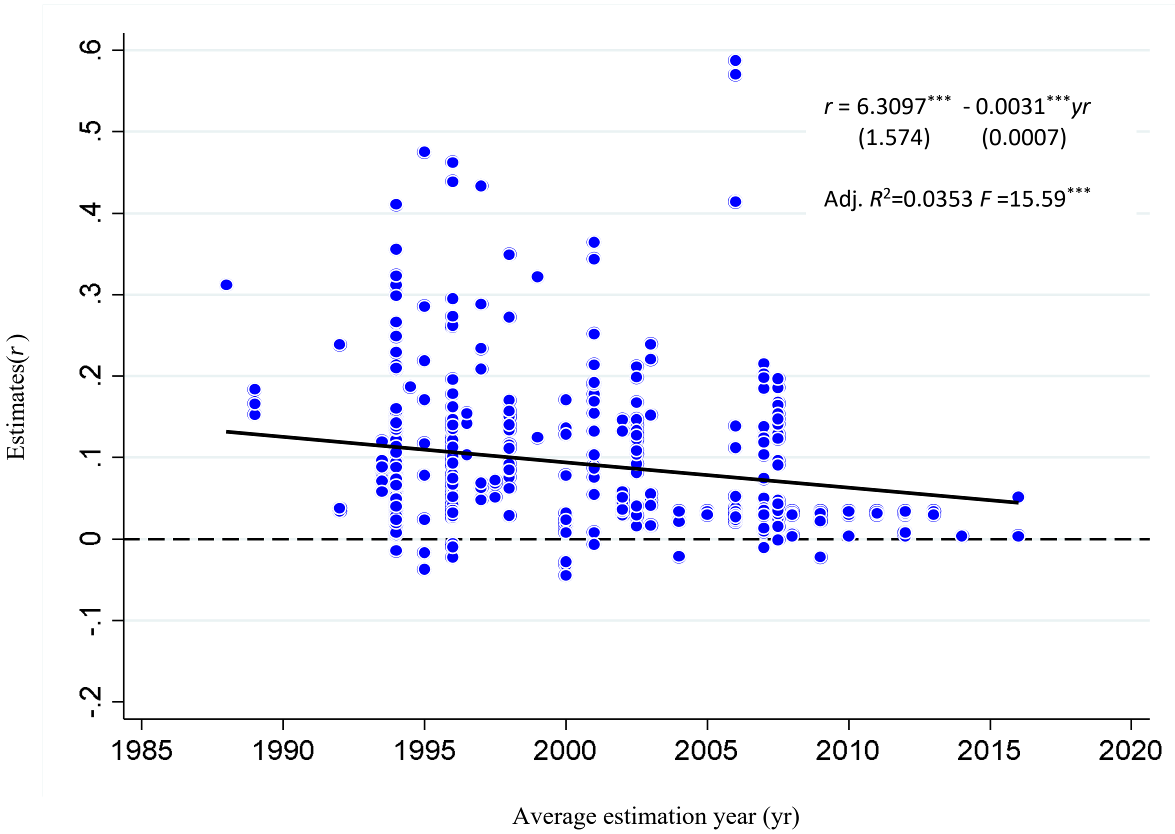


Figure 4. Chronological order of partial correlation coefficients

Notes: The values in parentheses below the coefficients in the equation are robustness standard errors. *** denotes statistical significance at the 1% level.

Table 3. Name, definition, and descriptive statistics of meta-independent variables

Variable name	Definition	Descriptive statistics					
		Secondary education studies			Higher education studies		
		Mean	Median	S.D.	Mean	Median	S.D.
Average estimation year	Average estimation year	1998.619	1996	5.020	2000.041	1998	5.971
Czech Republic	1 = if the target country is Czech Republic, 0 = otherwise	0.129	0	0.336	0.145	0	0.353
Poland	1 = if the target country is Poland, 0 = otherwise	0.252	0	0.435	0.295	0	0.457
Bulgaria	1 = if the target country is Bulgaria, 0 = otherwise	0.054	0	0.225	0.050	0	0.218
Romania	1 = if the target country is Romania, 0 = otherwise	0.181	0	0.385	0.230	0	0.421
Russia	1 = if the target country is the Russian Federation, 0 = otherwise	0.297	0	0.457	0.158	0	0.365
Urban region	1 = if the target region is urban, 0 = otherwise	0.188	0	0.391	0.068	0	0.251
Rural region	1 = if the target region is rural, 0 = otherwise	0.013	0	0.115	0.005	0	0.071
Male	1 = if the sample is limited to male workers, 0 = otherwise	0.357	0	0.480	0.295	0	0.457
Female	1 = if the sample is limited to female workers, 0 = otherwise	0.270	0	0.445	0.228	0	0.420
Panel data	1 = if panel data is employed for empirical analysis, 0 = otherwise	0.121	0	0.326	0.103	0	0.304
Original household survey	1 = if the results of an original household survey are used as the data source, 0 = otherwise	0.594	1	0.492	0.423	0	0.495
Non-OLS	1 = if an estimator rather than OLS is used for estimation, 0 = otherwise	0.183	0	0.387	0.283	0	0.451
IV/2SLS/3SLS	1 = if IV, 2SLS, or 3SLS estimator is used for estimation, 0 = otherwise	0.042	0	0.202	0.055	0	0.228
Regular wage	1 = if regular wage/income is used for empirical analysis, 0 = otherwise	0.484	0	0.500	0.470	0	0.500
Control for selection bias	0 = if the sample selection bias of employment is controlled for, 0 = otherwise	0.069	0	0.254	0.165	0	0.372
Control for endogeneity	1 = if the endogeneity between education and wage level is controlled for, 0 = otherwise	0.009	0	0.094	0.025	0	0.156
Occupation	1 = if the estimation simultaneously controls for occupation, 0 = otherwise	0.411	0	0.493	0.468	0	0.500
Age/age group	1 = if the estimation simultaneously controls for age or age group, 0 = otherwise	0.540	1	0.499	0.603	1	0.490
Health condition	1 = if the estimation simultaneously controls for the health condition of workers, 0 = otherwise	0.009	0	0.094	0.005	0	0.071
Firm size	1 = if the estimation simultaneously controls for the size of firms to which workers belong, 0 = otherwise	0.266	0	0.442	0.405	0	0.492
Location fixed effects	1 = if the estimation simultaneously controls for location fixed effects, 0 = otherwise	0.696	1	0.460	0.620	1	0.486
Industry fixed effects	1 = if the estimation simultaneously controls for industry fixed effects, 0 = otherwise	0.471	0	0.500	0.505	1	0.501
Time fixed effects	1 = if the estimation simultaneously controls for time fixed effects, 0 = otherwise	0.161	0	0.368	0.108	0	0.310
Quality level	20-point scale of the quality level of the study	16.183	18	5.434	16.493	18	4.168
SE	Standard error of partial correlation coefficient	0.022	0.0164	0.019	0.021	0.0154	0.019

Note: See Appendix for details of quality level.

Table 4. Meta-regression analysis of literature heterogeneity: Estimation using all moderators

(a) Secondary education studies

Estimator	Cluster-robust OLS	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [*d.f.*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS
Meta-independent variable (default category)/model	[1]	[2]	[3]	[4]	[5] [a]
Estimation period					
Average estimation year	-0.0045 ***	-0.0050 ***	-0.0048 ***	-0.0048 ***	-0.0016
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Target country (Hungary)					
Czech Republic	-0.0221	-0.0556 *	-0.0172 **	-0.0227	-0.0351 **
	(0.029)	(0.027)	(0.042)	(0.039)	(0.017)
Poland	-0.0024	-0.0069	-0.0194	-0.0042	-0.0107
	(0.009)	(0.015)	(0.034)	(0.012)	(0.019)
Bulgaria	-0.0271	-0.0167	0.0257	-0.0152	-0.0472 ***
	(0.027)	(0.034)	(0.058)	(0.029)	(0.013)
Romania	-0.0679 ***	-0.0694 ***	-0.1058 **	-0.0828 ***	-0.0442
	(0.013)	(0.022)	(0.052)	(0.020)	(0.032)
Russia	-0.0697 ***	-0.0603 **	-0.0738	-0.0679 **	-0.0678 **
	(0.021)	(0.025)	(0.053)	(0.028)	(0.028)
Taget region (region unspecified)					
Urban region	-0.0001	-0.0061	0.0159	0.0340	0.0084
	(0.034)	(0.036)	(0.038)	(0.037)	(0.037)
Rural region	0.0228	-0.0024	0.0471	0.0651 *	0.0180
	(0.040)	(0.035)	(0.047)	(0.036)	(0.038)
Target gender (gender unspecified)					
Male	-0.0151	0.0006	0.0133	-0.0198	-0.0054
	(0.013)	(0.019)	(0.022)	(0.014)	(0.010)
Female	-0.0054	-0.0070	-0.0085	-0.0114	0.0083
	(0.012)	(0.014)	(0.020)	(0.013)	(0.010)
Data type (cross-sectional data)					
Panel data	-0.0306	-0.0043	0.0468	-0.0507 *	-0.0466 ***
	(0.024)	(0.031)	(0.040)	(0.026)	(0.006)
Survey data used (government statistics)					
Original household survey	-0.0100	-0.0047	0.0101	-0.0267	0.0085
	(0.018)	(0.019)	(0.031)	(0.024)	(0.026)
Estimator					
Non-OLS (OLS)	0.0062	0.0136	0.0072	0.0058	0.0064
	(0.018)	(0.012)	(0.006)	(0.021)	(0.005)
IV/2SLS/3SLS	0.0468 **	0.0418 *	0.0476	0.0330	0.0231 ***
	(0.022)	(0.022)	(0.037)	(0.025)	(0.005)
Wage type (total wage)					
Regular wage	-0.0283 **	-0.0289 **	-0.0092	-0.0297 **	-0.0278
	(0.012)	(0.014)	(0.025)	(0.013)	(0.019)
Control for selection bias and endogeneity					
Control for selection bias	-0.0345 *	-0.0404 *	-0.0682 *	-0.0419 *	-0.0256 ***
	(0.020)	(0.022)	(0.037)	(0.022)	(0.010)
Control for endogeneity	-0.1081 ***	-0.1056 ***	-0.1029 ***	-0.1072 ***	-0.0863 ***
	(0.019)	(0.021)	(0.035)	(0.022)	(0.004)
Selection of control variable					
Occupation	-0.0130	-0.0256	-0.0423	-0.0292 **	-0.0037
	(0.011)	(0.021)	(0.031)	(0.014)	(0.008)
Age/age group	0.0208	0.0489 **	0.0825 **	0.0178	0.0024
	(0.019)	(0.024)	(0.034)	(0.019)	(0.009)
Health condition	-0.0015	0.0206	0.0581	0.0043	-0.0310
	(0.018)	(0.021)	(0.051)	(0.023)	(0.025)
Firm size	0.0299	0.0565 *	0.0542	0.0257	0.0060
	(0.019)	(0.032)	(0.042)	(0.018)	(0.012)
Location fixed effects	0.0299 *	0.0262	0.0270	0.0256	0.0089
	(0.016)	(0.024)	(0.029)	(0.018)	(0.022)
Industry fixed effects	-0.0553 ***	-0.0450 **	-0.0008	-0.0371	-0.0210 **
	(0.020)	(0.020)	(0.040)	(0.023)	(0.011)
Time fixed effects	-0.0456	-0.0576 **	-0.0651 **	-0.0419	0.0102
	(0.027)	(0.027)	(0.029)	(0.029)	(0.030)
Quality level					
Quality level	0.0023 *	0.0025 **	0.0025	0.0026 **	0.0026
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
SE	1.1839 ***	1.2442 ***	0.3015	1.3573 ***	0.1446
	(0.433)	(0.412)	(1.063)	(0.464)	(0.519)
Intercept	9.0159 ***	10.0901 ***	9.6248 ***	9.6181 ***	3.1843
	(2.142)	(2.236)	(2.870)	(2.099)	(2.511)
K	448	448	448	448	448
R^2	0.485	0.549	0.728	0.540	0.244

(Continued)

(b) Higher education studies

Estimator	Cluster-robust OLS	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [*d.f.*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS
Meta-independent variable (default category)/model	[6]	[7]	[8]	[9]	[10] [b]
Estimation period					
Average estimation year	-0.0035 *	-0.0080 ***	-0.0118 ***	-0.0048 ***	-0.0023 **
	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)
Target country (Hungary)					
Czech Republic	0.0166	-0.0083	-0.0311	0.0314	-0.0197
	(0.033)	(0.037)	(0.056)	(0.040)	(0.018)
Poland	-0.0453 **	-0.0161	0.0040	-0.0556 **	-0.0518 **
	(0.021)	(0.024)	(0.051)	(0.024)	(0.024)
Bulgaria	-0.0229	-0.0065	-0.0069	-0.0317	-0.0450
	(0.029)	(0.034)	(0.054)	(0.036)	(0.030)
Romania	-0.1208 ***	-0.1096 ***	-0.1319	-0.1511 ***	-0.0593 *
	(0.033)	(0.038)	(0.092)	(0.033)	(0.035)
Russia	-0.1092 ***	-0.0672	-0.0103	-0.1445 ***	-0.1020 **
	(0.038)	(0.047)	(0.062)	(0.041)	(0.041)
Taget region (region unspecified)					
Urban region	-0.0442	-0.0270	0.0228	-0.0230	0.0175
	(0.038)	(0.046)	(0.058)	(0.043)	(0.033)
Rural region	0.0976 **	0.0894 *	0.1214	0.0824 *	0.0827 **
	(0.042)	(0.053)	(0.081)	(0.044)	(0.033)
Target gender (gender unspecified)					
Male	-0.0118	-0.0069	-0.0320	-0.0225	-0.0293 **
	(0.020)	(0.033)	(0.039)	(0.020)	(0.014)
Female	-0.0018	-0.0223	-0.0584 **	-0.0117	-0.0187
	(0.019)	(0.024)	(0.026)	(0.020)	(0.015)
Data type (cross-sectional data)					
Panel data	-0.1186 ***	-0.0786 **	-0.0424	-0.1507 ***	-0.0870 ***
	(0.031)	(0.039)	(0.056)	(0.030)	(0.013)
Survey data used (government statistics)					
Original household survey	0.0335	-0.0185	-0.1035 **	0.0377	0.0260
	(0.031)	(0.039)	(0.044)	(0.028)	(0.040)
Estimator					
Non-OLS (OLS)	0.0041	0.0325	0.0267	0.0090	-0.0259 ***
	(0.026)	(0.026)	(0.016)	(0.024)	(0.010)
IV/2SLS/3SLS	-0.0729 ***	-0.1386 **	-0.1486	-0.1245 **	-0.0573 ***
	(0.024)	(0.055)	(0.115)	(0.047)	(0.005)
Wage type (total wage)					
Regular wage	-0.0205	-0.0163	-0.0231	-0.0193	0.0151
	(0.020)	(0.022)	(0.059)	(0.015)	(0.026)
Control for selection bias and endogeneity					
Control for selection bias	-0.0951 ***	-0.0929 ***	-0.0627	-0.0908 ***	-0.0187
	(0.024)	(0.034)	(0.064)	(0.028)	(0.024)
Control for endogeneity	-0.0276	-0.0277	-0.0738	-0.0178	0.0287
	(0.032)	(0.038)	(0.068)	(0.034)	(0.022)
Selection of control variable					
Occupation	-0.0287	-0.0555 *	-0.1072	-0.0564 **	-0.0223 *
	(0.018)	(0.030)	(0.070)	(0.021)	(0.013)
Age/age group	0.0234	0.0565 *	0.0948 **	0.0474 *	-0.0193
	(0.026)	(0.030)	(0.039)	(0.027)	(0.014)
Health condition	-0.0781 **	0.0024	0.0391	-0.0475	-0.0759 **
	(0.033)	(0.047)	(0.075)	(0.036)	(0.036)
Firm size	0.0683 **	0.0936 ***	0.0735 *	0.0834 ***	0.0200
	(0.033)	(0.032)	(0.043)	(0.030)	(0.023)
Location fixed effects	0.0732 **	0.0672 **	0.0425	0.0857 ***	0.0380
	(0.030)	(0.027)	(0.034)	(0.025)	(0.031)
Industry fixed effects	-0.0704 **	-0.0684 **	-0.0412	-0.0657 **	-0.0229
	(0.029)	(0.028)	(0.057)	(0.028)	(0.017)
Time fixed effects	-0.0030	-0.0274	-0.0925	0.0224	0.0216
	(0.036)	(0.038)	(0.058)	(0.040)	(0.032)
Quality level					
Quality level	0.0023	0.0032	0.0036	0.0030	0.0043 *
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
SE	1.6632 ***	2.3789 ***	2.4442	2.3404 **	0.6536
	(0.443)	(0.882)	(1.656)	(0.963)	(0.770)
Intercept	7.0823 *	16.0725 ***	23.5728 ***	9.5882 ***	4.6964 **
	(3.642)	(4.480)	(5.697)	(3.367)	(2.055)
K	400	400	400	400	400
R^2	0.436	0.543	0.741	0.602	0.243

Notes:

[a] Breusch–Pagan test: $\chi^2 = 61.67$, $p = 0.000$

[b] Breusch–Pagan test: $\chi^2 = 55.55$, $p = 0.000$

Figures in parentheses beneath the regression coefficients are robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: See Table 3 for the definitions and descriptive statistics of meta-independent variables.

Table 5. Meta-regression analysis of literature heterogeneity: Estimation with selected moderators

(a) Secondary education studies

Estimator	Cluster-robust OLS	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [*d.f.*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS
Meta-independent variable (default category)/model	[1]	[2]	[3]	[4]	[5] [a]
Estimation period					
Average estimation year	-0.0035 ***	-0.0055 ***	-0.0085 ***	-0.0037 ***	-0.0014
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)
Target country (Hungary)					
Czech Republic	-0.0244	-0.0170	-0.0104	0.0116	-0.0324 *
	(0.032)	(0.042)	(0.030)	(0.043)	(0.017)
Poland	-0.0050	0.0272	0.0825 ***	0.0214	-0.0094
	(0.016)	(0.022)	(0.015)	(0.023)	(0.019)
Bulgaria	-0.0399	-0.0080	0.0432	-0.0036	-0.0426 ***
	(0.029)	(0.031)	(0.041)	(0.032)	(0.015)
Romania	-0.0571 ***	-0.0434 **	-0.0254	-0.0457 **	-0.0382
	(0.014)	(0.019)	(0.020)	(0.017)	(0.026)
Russia	-0.0757 ***	-0.0430 *	0.0027	-0.0469 **	-0.0677 ***
	(0.016)	(0.023)	(0.036)	(0.022)	(0.021)
Selected moderators					
IV/2SLS/3SLS	0.0583 **	0.0711 *	0.0654	0.0699 **	0.0240 ***
	(0.027)	(0.038)	(0.044)	(0.030)	(0.007)
Regular wage	-0.0217 *	-0.0245	-0.0329	-0.0254 *	-0.0251
	(0.011)	(0.021)	(0.032)	(0.015)	(0.017)
Control for endogeneity	-0.1139 ***	-0.1089 ***	-0.0962 ***	-0.1218 ***	-0.0890 ***
	(0.017)	(0.020)	(0.025)	(0.020)	(0.005)
Industry fixed effects	-0.0253 **	-0.0027	0.0239 **	-0.0177	-0.0180 **
	(0.012)	(0.013)	(0.012)	(0.015)	(0.008)
SE	0.7297 *	0.4175	-0.4042	0.5490	0.1307
	(0.380)	(0.701)	(1.488)	(0.473)	(0.474)
Intercept	7.0491 ***	10.9697 ***	17.0768 ***	7.3799 ***	2.8385
	(1.883)	(3.308)	(5.301)	(2.273)	(2.254)
K	448	448	448	448	448
R^2	0.407	0.363	0.536	0.397	0.322

(b) Higher education studies

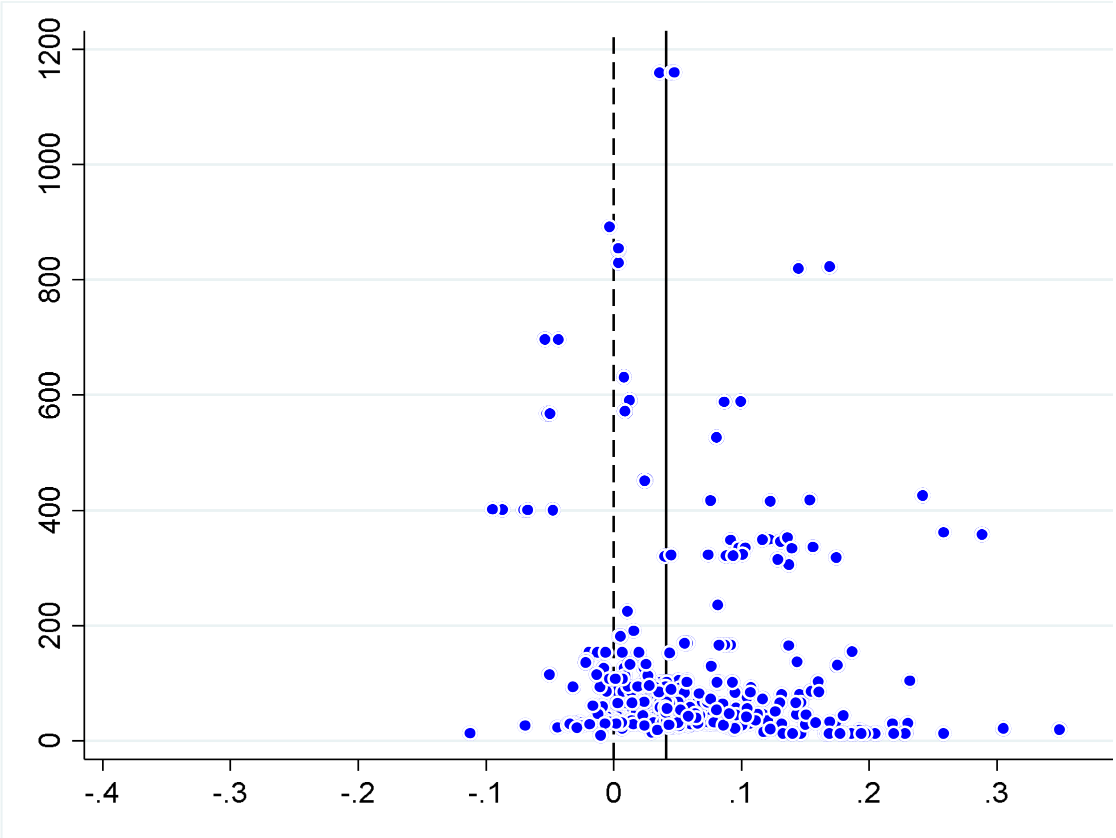
Estimator	Cluster-robust OLS	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [*d.f.*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS
Meta-independent variable (default category)/model	[6]	[7]	[8]	[9]	[10] [b]
Estimation period					
Average estimation year	-0.0036 **	-0.0074 ***	-0.0135 ***	-0.0036 **	-0.0027 ***
	(0.002)	(0.002)	(0.005)	(0.002)	(0.001)
Target country (Hungary)					
Czech Republic	0.0305	0.0326	0.0709	0.0703 *	-0.0129
	(0.036)	(0.052)	(0.063)	(0.042)	(0.018)
Poland	-0.0423 **	0.0038	0.1047 *	-0.0405	-0.0504 **
	(0.019)	(0.031)	(0.059)	(0.030)	(0.022)
Bulgaria	-0.0099	0.0103	0.1052	-0.0020	-0.0395
	(0.030)	(0.038)	(0.073)	(0.038)	(0.027)
Romania	-0.1056 ***	-0.0776 **	-0.0082	-0.1093 ***	-0.0596 *
	(0.029)	(0.032)	(0.057)	(0.039)	(0.033)
Russia	-0.0935 ***	-0.0854 **	-0.0173	-0.1192 ***	-0.0987 ***
	(0.029)	(0.034)	(0.060)	(0.032)	(0.033)
Selected moderators					
Panel data	-0.0979 ***	-0.0710 ***	-0.0534	-0.1288 ***	-0.0857 ***
	(0.028)	(0.023)	(0.035)	(0.030)	(0.017)
IV/2SLS/3SLS	-0.0726 ***	-0.1034 ***	-0.0340	-0.1076 ***	-0.0538 ***
	(0.021)	(0.037)	(0.084)	(0.034)	(0.007)
Control for selection bias	-0.0749 ***	-0.0553 **	-0.0382	-0.0891 ***	-0.0463 *
	(0.024)	(0.022)	(0.036)	(0.030)	(0.025)
Firm size	0.0490 **	0.0730 ***	0.0994 **	0.0721 ***	0.0313 *
	(0.019)	(0.022)	(0.043)	(0.025)	(0.016)
Location fixed effects	0.0548 **	0.0591 **	0.0451	0.0917 ***	0.0399
	(0.025)	(0.024)	(0.032)	(0.028)	(0.030)
Industry fixed effects	-0.0578 ***	-0.0867 ***	-0.0899 ***	-0.0885 ***	-0.0364 **
	(0.017)	(0.023)	(0.028)	(0.025)	(0.018)
Quality level	0.0035 **	0.0047 **	0.0019	0.0054 ***	0.0043 **
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)
SE	1.6982 ***	1.5017 *	-1.2391	2.1831 **	0.7386
	(0.462)	(0.761)	(2.286)	(0.913)	(0.760)
Intercept	7.3415 **	14.7390 ***	27.1075 ***	7.2485 **	5.5116 ***
	(3.030)	(4.177)	(9.402)	(3.050)	(1.822)
K	400	400	400	400	400
R^2	0.396	0.467	0.595	0.533	0.255

Notes: Figures in parentheses beneath the regression coefficients are robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Selected moderators denote the meta-independent variables having a PIP of 0.80 or more in the Bayesian model averaging estimation reported in Appendix Table A2. See Table 3 for the definitions and descriptive statistics of meta-independent variables.

[a] Breusch–Pagan test: $\chi^2 = 121.92$, $p = 0.000$

[b] Breusch–Pagan test: $\chi^2 = 61.63$, $p = 0.0000$

(a) Secondary education studies (*K* =448)



(b) Higher education studies (*K* =400)

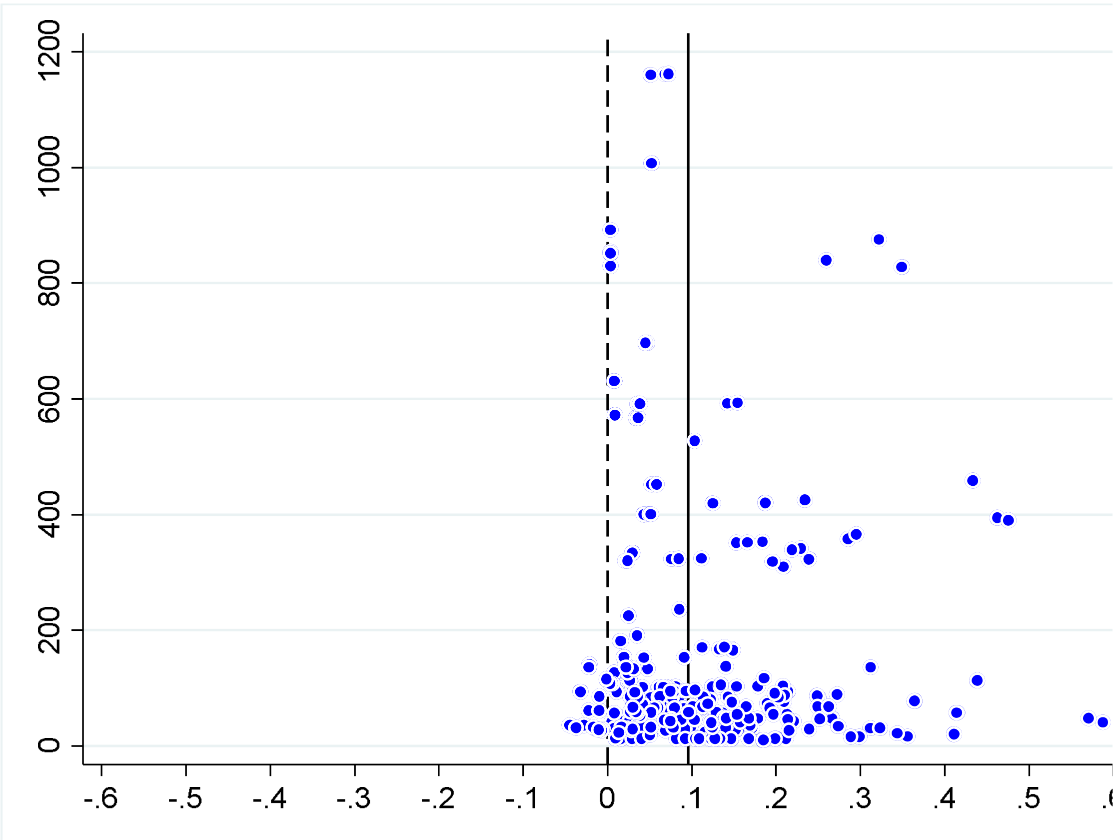


Figure 5. Funnel plot of partial correlation coefficients

Note: The solid line indicates the synthesized effect size by WAAP estimation as reported in Table 2.

Table 6. Meta-regression analysis of publication selection bias: Secondary education studies

(a) FAT-PET test (Equation: $t = \gamma_0 + \gamma_1(1/SE) + v$)

Estimator	Unrestricted WLS	Cluster-robust unrestricted WLS	Multi-level mixed-effects RML	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Model	[1]	[2]	[3]	[4] [a]	[5] [b]
Intercept (FAT: H_0: $\gamma_0 = 0$)	1.0836	1.0836	6.4514 *	3.6514 *	3.6514 *
	(0.685)	(1.226)	(3.553)	(3.518)	(2.027)
$1/SE$ (PET: H_0: $\gamma_1 = 0$)	0.0384 ***	0.0384 *	0.0233	0.0236 ***	0.0174 ***
	(0.010)	(0.020)	(0.017)	(0.006)	(0.006)
K	448	448	448	448	448
R^2	0.182	0.182	-	0.182	0.182

(b) PEESE approach (Equation: $t = \gamma_0 SE + \gamma_1(1/SE) + v$)

Estimator	Unrestricted WLS	Cluster-robust unrestricted WLS	Multi-level mixed-effects RML	Random-effects panel ML	Population-averaged panel GEE
Model	[6]	[7]	[8]	[9]	[10]
SE	19.1865 **	19.1865	-64.1729	-64.1729 *	9.3915
	(9.398)	(19.557)	(40.436)	(33.176)	(11.844)
$1/SE$ (H_0: $\gamma_1 = 0$)	0.0409 ***	0.0409 **	0.0413	0.0413 ***	0.0459 **
	(0.009)	(0.018)	(0.034)	(0.012)	(0.019)
K	448	448	448	448	448
R^2	0.273	0.273	-	-	-

Notes: Figures in parentheses beneath the regression coefficients are standard errors. Except for Model [9], robust standard errors are estimated. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

[a] Breusch–Pagan test: $\chi^2 = 302.94$, $p = 0.0000$

[b] Hausman test: $\chi^2 = 6.32$, $p = 0.0119$

Table 7. Meta-regression analysis of publication selection bias: Higher education studies

(a) FAT-PET test (Equation: $t = \gamma_0 + \gamma_1(1/SE) + v$)

Estimator	Unrestricted WLS	Cluster-robust unrestricted WLS	Multi-level mixed-effects RML	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Model	[1]	[2]	[3]	[4] [a]	[5] [b]
Intercept (FAT: H_0: $\gamma_0 = 0$)	0.1634	0.1634	17.5016 **	17.2541 **	7.6036 ***
	(1.534)	(2.571)	(7.855)	(7.740)	(1.434)
$1/SE$ (PET: H_0: $\gamma_1 = 0$)	0.0951 ***	0.0951 ***	0.0432 ***	0.0442 ***	0.0392 ***
	(0.019)	(0.032)	(0.012)	(0.013)	(0.011)
K	400	400	400	400	400
R^2	0.339	0.339	-	0.339	0.339

(b) PEESE approach (Equation: $t = \gamma_0 SE + \gamma_1(1/SE) + v$)

Estimator	Unrestricted WLS	Cluster-robust unrestricted WLS	Multi-level mixed-effects RML	Random-effects panel ML	Population-averaged panel GEE
Model	[6]	[7]	[8]	[9]	[10]
SE	-1.7331	-1.7331	-126.9301 **	-126.9301 **	20.4227
	(19.306)	(34.291)	(54.603)	(59.481)	(29.827)
$1/SE$ (H_0: γ_1=0)	0.0955 ***	0.0955 ***	0.0982 ***	0.0982 ***	0.0983 ***
	(0.016)	(0.028)	(0.031)	(0.015)	(0.031)
K	400	400	400	400	400
R^2	0.431	0.431	-	-	-

Notes: Figures in parentheses beneath the regression coefficients are standard errors. Except for Model [9], robust standard errors are estimated. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

[a] Breusch–Pagan test: $\chi^2 = 102.46$, $p = 0.0000$

[b] Hausman test: $\chi^2 = 31.99$, $p = 0.0000$

Table 8. Summary of publication selection bias test

(a) Secondary education studies

Study type	Number of estimates (K)	Test results[a]		
		Funnel asymmetry test (FAT) (H_0: $\gamma_0=0$)	Precision-effect test (PET) (H_0: $\gamma_1=0$)	Precision-effect estimate with standard error (PEESE) (H_0: $\gamma_1=0$)[b]
All studies	448	Rejected	Rejected	Rejected (0.0409/0.0459)
By period				
1994 or before	119	Not rejected	Rejected	Rejected (0.0784/0.0958)
1995–2004	268	Not rejected	Rejected	Rejected (0.0543/0.0642)
2005 or later	61	Rejected	Rejected	Rejected (0.0069/0.0092)
By country				
Hungary	39	Not rejected	Rejected	Rejected (0.0606/0.0658)
Czech Republic	58	Not rejected	Not rejected	Not rejected
Poland	113	Not rejected	Rejected	Rejected (0.0372/0.0443)
Bulgaria	24	Not rejected	Not rejected	Rejected (0.0707/0.0754)
Romania	81	Not rejected	Not rejected	Not rejected
Russia	133	Not rejected	Rejected	Rejected (0.0320/0.0483)

(b) Higher education studies

Study type	Number of estimates (K)	Test results[a]		
		Funnel asymmetry test (FAT) (H_0: $\gamma_0=0$)	Precision-effect test (PET) (H_0: $\gamma_1=0$)	Precision-effect estimate with standard error (PEESE) (H_0: $\gamma_1=0$)[b]
All studies	400	Rejected	Rejected	Rejected (0.0955/0.0983)
By period				
1994 or before	106	Not rejected	Rejected	Rejected (0.1432/0.1527)
1995–2004	190	Not rejected	Rejected	Rejected (0.1347/0.1498)
2005 or later	104	Rejected	Rejected	Rejected (0.0223/0.0234)
By country				
Hungary	49	Not rejected	Rejected	Rejected (0.0932/0.0991)
Czech Republic	58	Rejected	Rejected	Rejected (0.1235/0.1382)
Poland	118	Not rejected	Not rejected	Not rejected
Bulgaria	20	Not rejected	Not rejected	Rejected (0.0470/0.0993)
Romania	92	Not rejected	Rejected	Rejected (0.0337/0.0502)
Russia	63	Not rejected	Rejected	Rejected (0.0502/0.0623)

Notes:

[a] The null hypothesis is rejected when more than three of five models show a statistically significant estimate. Otherwise not rejected.

[b] Figures in parentheses are PSB-adjusted estimates. If two estimates are reported, the left and right figures denote the minimum and maxin estimates, respectively.

Appendix Table A1. List of selected studies on returns to schooling in European emerging markets for meta-analysis

Author(s) (Publication year)	Target country						Estimation period	Number of collected estimates	
	Hungary	Czech Republic	Poland	Bulgaria	Romania	Russia		Secondary education studies	Higher education studies
Flanagan (1995)		✓					1988 - 1994	12	6
Grogan (1997)						✓	1994 - 1994	6	6
Bedi (1998)			✓				1996 - 1996	4	4
Newell and Socha (1998)			✓				1992 - 1996	20	20
Arabsheibani and Lau (1999)						✓	1994 - 1994	9	9
Filer et al. (1999)		✓					1995 - 1997	6	6
Paternostro and Sahn (1999)					✓		1994 - 1994	8	4
Lehmann and Wadsworth (2001)						✓	1994 - 1998	6	5
Deloach and Hoffman (2002)						✓	1994 - 1996	0	6
Jolliffe (2002)				✓			1995 - 1995	3	0
Puhani (2002)			✓				1994 - 1998	6	6
Adamchik et al. (2003)			✓				1994 - 2001	24	24
Guariglia and Kim (2003)						✓	1994 - 1998	2	2
Skoufias (2003)					✓		1994 - 1994	32	32
Delteil et al. (2004)	✓						1989 - 1998	14	14
Falaris (2004)				✓			1995 - 1995	12	4
Gerry et al. (2004)						✓	1994 - 1998	36	12
Hansberry (2004)						✓	1996 - 2002	36	12
Jurajda (2005)		✓					2002 - 2002	9	9
Münich et al. (2005)		✓					1991 - 1996	24	12
Ogloblin and Brock (2005)						✓	2000 - 2002	4	1
Ogloblin and Brock (2006)						✓	2002 - 2004	2	0
Myck et al. (2007)						✓	1996 - 2002	24	8
Kazakova (2007)			✓				1996 - 1996	2	1
Csengödi et al. (2008)	✓						1992 - 2001	5	5
Earle and Telegdy (2008)	✓						1992 - 2003	3	3
Eriksson and Pytlikova (2011)		✓					2006 - 2006	0	6
Hölscher et al. (2011)	✓	✓	✓	✓	✓		2007 - 2007	15	15
Kovacheva (2011)				✓			1997 - 2003	6	6
Andrén (2012)					✓		1994 - 2000	16	20
Voinea and Mihaescu (2012)					✓		2004 - 2009	8	8
Eriksson et al. (2013)		✓					1998 - 1999	0	2
Andrén and Andrén (2015)					✓		1994 - 2000	14	16
Dustmann et al. (2015)			✓				1998 - 2007	22	22
Gustafsson et al. (2015)						✓	2003 - 2003	4	0
Tiwari et al. (2015)						✓	2006 - 2010	4	2
Cukrowska-Torzewska and Lovasz (2016)	✓		✓				2006 - 2009	20	20
Magda et al. (2016)	✓	✓	✓				2002 - 2006	12	12
Grotkowska et al. (2018)			✓				2012 - 2012	8	4
Mysíková and Večerník (2019)	✓	✓	✓	✓	✓		2004 - 2013	0	45
Vasilescu and Begu (2019)					✓		2016 - 2016	0	1
Grabowski and Korczak (2020)			✓				2010 - 2016	4	4
Liwiński (2020)			✓				2001 - 2005	6	6

Appendix Table A2. Bayesian model averaging analysis of model uncertainty

Target study area	Secondary education studies				Higher education studies			
Meta-independent variable/model	[1]				[2]			
	Coef.	S.E.	*t*	PIP	Coef.	S.E.	*t*	PIP
Focus regressors								
Average estimation year	-0.0041	0.0006	-6.38	1.00	-0.0034	0.0009	-3.64	1.00
Czech Republic	-0.0186	0.0136	-1.37	1.00	0.0261	0.0166	1.57	1.00
Poland	-0.0034	0.0107	-0.32	1.00	-0.0453	0.0140	-3.24	1.00
Bulgaria	-0.0349	0.0175	-2.00	1.00	-0.0131	0.0228	-0.57	1.00
Romania	-0.0596	0.0136	-4.39	1.00	-0.1089	0.0166	-6.58	1.00
Russia	-0.0736	0.0142	-5.19	1.00	-0.0994	0.0222	-4.47	1.00
SE	0.9886	0.2091	4.73	1.00	1.6776	0.3199	5.24	1.00
Auxiliary regressors								
Urban region	-0.0028	0.0093	-0.30	0.14	-0.0023	0.0099	-0.23	0.09
Rural region	0.0015	0.0091	0.17	0.07	0.0940	0.0866	1.09	0.62
Male	-0.0003	0.0023	-0.13	0.07	-0.0022	0.0062	-0.35	0.15
Female	-0.0073	0.0077	-0.94	0.54	-0.0001	0.0025	-0.04	0.05
Panel data	-0.0235	0.0176	-1.34	0.72	-0.1008	0.0182	-5.53	1.00
Original household survey	-0.0063	0.0102	-0.61	0.33	0.0075	0.0129	0.58	0.31
Non-OLS	-0.0013	0.0053	-0.25	0.11	0.0001	0.0044	0.02	0.06
IV/2SLS/3SLS	0.0541	0.0204	2.65	0.95	-0.0620	0.0328	-1.89	0.86
Regular wage	-0.0262	0.0071	-3.67	0.99	-0.0009	0.0049	-0.18	0.08
Control for selection bias	-0.0104	0.0148	-0.71	0.40	-0.0790	0.0154	-5.14	1.00
Control for endogeneity	-0.1125	0.0300	-3.75	0.99	-0.0028	0.0143	-0.20	0.09
Occupation	-0.0020	0.0054	-0.38	0.17	-0.0078	0.0127	-0.62	0.34
Age/age group	0.0114	0.0113	1.00	0.58	0.0007	0.0039	0.19	0.08
Health condition	0.0002	0.0061	0.04	0.05	-0.0028	0.0179	-0.16	0.06
Firm size	0.0168	0.0155	1.08	0.62	0.0546	0.0135	4.03	1.00
Location fixed effects	0.0139	0.0142	0.98	0.57	0.0557	0.0122	4.56	1.00
Industry fixed effects	-0.0442	0.0146	-3.02	1.00	-0.0568	0.0119	-4.79	1.00
Time fixed effects	-0.0194	0.0247	-0.79	0.45	0.0000	0.0062	0.00	0.06
Quality level	0.0012	0.0014	0.84	0.49	0.0029	0.0018	1.65	0.81
K	448				400			
Model space	524288				524288			

Notes: S.E. and PIP denote standard errors and posterior inclusion probability, respectively. See Table 3 for the definitions and descriptive statistics of independent variables. The variables of target countries, average estimation year, and standard errors of partial correlation coefficients are included in estimations as focus regressors. Therefore, the PIP of these key variables is 1.00.