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Are some owners better than others in Czech privatized firms? Even meta-analysis can't make us perfectly sure

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Abstract

We use a total of 1171 estimates extracted from 34 previous studies and perform a meta-analysis to examine the relationship between ownership structures and firm performance in the Czech mass-privatized firms. We find that, in contrast to the remarkable effect of foreign ownership on firm performance and restructuring activities, domestic private entities were incapable of outperforming the state as owners of Czech companies. Our assessment of publication selection bias, however, indicates that the collected estimates do not contain genuine evidence for many types of corporate ownership. Further development and improvement in this study area are necessary to capture the true effect. Finally, we also point at the importance to draw (meta-analysis) inferences based on studies that employ adequate methodology.

JEL-Classification: D22; G32; H32; O16; P31

Keywords: voucher privatization; ownership structure; firm performance and restructuring; meta-analysis; publication selection bias; Czech Republic

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1. Introduction and motivation

At the beginning of the transformation process in Central Europe, privatization was largely considered the foundation of the entire transition process. The so-called Washington Consensus emphasized privatization and the belief that private ownership together with market forces would guarantee efficient economic performance. However, it was also often recognized that privatization on its own might not be sufficient, and that systemic changes and policy reforms were a prerequisite for successful transition. The transfer of ownership rights was seen by most academics and policymakers as crucial for the efficient allocation of resources and economic growth (Estrin et al., 2009).

Hence, based on the principal motivation above, in this paper we aim to shed light on how the transfer of property rights via privatization affected the performance of firms in the Czech Republic. Our goal is to provide a comprehensive picture resulting from a meta-analysis performed by employing empirical results of academic research carried out over more than two decades.

Our meta-analysis is unique in that we cover the impact of privatization in a single country and concentrate on microeconomic effects.[1] In this way, we are able to account for various institutional and other relevant factors that otherwise differ among countries. Further, the meta-analysis is performed in such a way as to account for the impact of differences in methodological standards. Specifically, in our meta-analysis we cover all available literature but we also investigate the possible influence on empirical results caused by neglect and/or insufficient treatment of the endogeneity between ownership structure and firm performance; our approach is grounded in a sparse evidence about how problematic this issue is from the meta-analysis perspective.[2]

Besides the above, our meta-analysis is further motivated by specific questions. Based on the large number of studies in hand, do the reported effects of various ownership categories genuinely represent reality? Is there great heterogeneity in the outcomes among the studies? If

[1] For this reason we do not include in our meta-analysis (otherwise excellent) studies with an international coverage that do not provide any exclusive estimates of the foreign ownership on performance of the Czech firms; i.e we do not include Damijan et al. (2015, 2017) among others.

[2] By following the described approach, we avoid the kind of selection bias that meta-analysts heavily criticize today. Hence, in the first step we do not eliminate studies that do not, in a proper way, account for the endogeneity of the ownership structure with respect to corporate performance. In the second step, we do so.

there exist differences in the impact of ownership categories, are these differences (statistically) significant, or do they not matter? How important are the differences due to heterogeneity among studies in terms of numerous factors relevant to specific studies? Further, are the reported effects sensitive to the research quality at which specific studies were executed? Finally, how are the reported impacts affected by the course of the publication process (publication selection bias)? These questions are less then trivial and cannot be answered without being transposed into formal hypotheses that we introduce and test by appropriate techniques, as outlined in Section 3.

We show the remarkable effect of foreign ownership on firm performance, and, at the same time, we see that domestic private entities were incapable of outperforming state ownership of Czech firms. We also document a highly significant impact of insider ownership that is likely produced by specific research conditions in relevant studies other than ownership type. Hence, we should be cautious—we detect a strong publication selection bias, and because of that, we are unable to capture the true effect of many types of ownership categories in privatized Czech firms.

The paper is structured as follows. We intentionally abstain from presenting a formal literature review in a separate section. First, a thorough and condensed account of the literature on the effects of privatization and ownership on firms in transition countries can be found in Estrin et al. (2009). Second, we cover additional relevant literature in Section 2, where we provide a necessary outline of the privatization process in the Czech Republic, along with other related issues pertinent to our analysis. Third, information on individual studies that constitute the grounds for our analysis is reviewed in Section 3, which also introduces tools of the meta-analysis used in our study. In Section 4, we convey results of the meta-analysis, while in Section 5, we assess the extent of publication selection bias. In the last section, we offer conclusions and policy-related interpretations.

2. Overview of Czech privatization and other relevant issues

A massive privatization program was administered in the Czech Republic in the first half of the 1990s under three different schemes: restitution, small-scale privatization, and large-scale privatization. By far the most important scheme was large-scale privatization—it began in 1991, was completed in early 1995, and allowed for various privatization techniques. Small firms were usually auctioned or sold in tenders. Many medium-sized businesses were sold in tenders or to predetermined buyers in direct sales. Most large and many medium-sized firms were transformed into joint stock companies, and their shares were distributed through voucher privatization (almost one-half of the total number of all shares of all joint stock companies were privatized in the voucher scheme), sold in public auctions or to strategic partners, or transferred to municipalities.

The voucher scheme was part of the large-scale privatization process; similar voucher schemes with various modifications were conducted in several European countries during the early stages of their transition process.[3] Two waves of voucher privatization took place, in 1992–93 and 1993–94.[4] Both waves were administered in the same manner as a massive, multi-round auction, and there were no differences in their setups. During the scheme, a total of 1664 firms were privatized: 988 in the first wave and 676 firms in the second wave; of this number, 185 firms were privatized in both waves with various asset proportions.

Any Czech citizen over the age of 18 who resided in the Czech Republic could participate in the voucher process. For each wave, every eligible citizen was authorized to buy a voucher book that contained 1000 investment "points" for 1000 Czech crowns (CZK), about a week's wage. With these points, individuals could place their auction bids for shares in would-be privatized

[3] It is interesting to note that, despite the fact that the concept of the voucher scheme was conceived in Poland even before the transition began in most European countries, Polish authorities conducted the voucher scheme itself relatively late. A version of the voucher scheme was implemented in Poland only in the summer of 1995. A general outline of mass privatization using vouchers emerged in 1988, and a description of the method was published by Lewandowski and Szomburg (1990). Lewandowski (1997) wrote: "Mass privatization was a unique response to the post-communist challenge. The idea of distributing vouchers to promote equitable popular participation in privatization was elaborated by market-oriented advisers to the Solidarity movement in Gdansk, Poland, in mid-1988. Vouchers were intended to make up for insufficient supply of capital; as a special type of investment currency, they would be allocated to all citizens and tradable for shares of privatized companies. The concept was presented at a conference in November 1988—when communists were still in power—in response to a solicitation for proposals on how to transform Polish economy."

[4] The first wave was administered jointly in the Czech and Slovak Republics since, only in 1993, Czechoslovakia split into two independent nations.

firms. Or, before privatization started, individuals had the option of assigning some or all of their points to Privatization Investment Funds (PIFs), newly established financial firms whose scope of activities was vaguely similar to that of closed-end mutual funds.[5] As a summary, Table 1 shows the basic figures related to the two-wave process of voucher privatization.

Table 1: Quantitative overview of the Czech voucher privatization scheme

Subject	Wave 1	Wave 2
Number of state enterprises entering the voucher scheme	988	861
Book value of shares allocated for vouchers in a particular wave (billions of CZK)	212,5	155
Number of participating citizens (in millions)	5,98	6,16
Average book value of assets per participating citizen (CZK)	35.535	25.160
Percentage of voucher points allocated to privatization funds	72,20%	63,50%

Note: Wave 2 includes 185 firms not fully privatized in Wave 1. Source: Kočenda (1999)

The bidding rounds in each privatization wave continued until the privatization authority declared the end of the wave when a negligible proportion of unsold shares, along with disposable investment points, remained. The final stage of voucher privatization was the real transfer of purchased shares. For each participant, a share account at the Central Register was created. Those individuals who allocated part or all of the 1000 points to PIFs obtained shares of the PIFs immediately after issue. Shares of firms obtained by individuals during the bidding process were traded on the capital market after the end of the privatization scheme. Table 2 presents information on the time framework for both waves. A formal description of the voucher scheme as auction rules is presented in Appendix A.

Besides voucher privatization, there are several issues relevant to analyzing the performance of the voucher-privatized firms. We outline them now in no particular order of importance.

When entering the voucher scheme, individuals had two basic strategies from which to choose. The first strategy was to maximize cash revenues from the future sale of shares, receive dividend payments, or a combination of both. The second strategy was to bid for a particular firm to exercise the shareholder's control rights. However, the limited number of voucher points

[5] See Kočenda and Hanousek (2008) for details regarding regulation, investment restrictions, and other PIF issues.

that were available to each individual during the bidding process effectively prevented individual bidders from exercising control over a privatized firm. After the voucher scheme ended, this assumption proved to be accurate. The resulting ownership was simply too dispersed to allow individual shareholders to exercise control, as evidenced in Kočenda and Valachy (2002) and Hanousek et al. (2007).

Table 2: Time framework of the Czech voucher privatization

Steps in voucher scheme	Wave 1	Wave 2
Preparation	January–September 1991	January–September 1993
Voucher book issue	Since October 1991	Since October 1993
Registration	October 1991–February 1992	October 1993–December 1993
0 round (vouchers to funds)	February 1992–April 1992	December 1993–March 1994
1st–5th/6th round	April–December 1994 (5 rounds)	April–December 1994 (6 rounds)
Official end	January 31, 1993	December 31, 1994
Transfer of shares	May–June 1993	February 1995
Trading of shares started	July 1993	March 1995
First PIF shares issued	July 1993–October 1994	April 1995

Source: Ministry of Privatization of the Czech Republic

In the early 1990s (1991–1992), the Czech government managed a swift process of breaking parent firms into smaller units. This process left no original parent firms, and the state remained in control of the smaller units. Following this surge in the breakup of firms, the new units, which had been transformed into joint-stock companies, were privatized from 1992–1993 in the voucher scheme. Kočenda and Hanousek (2012a) showed that, five years after the wave of firm breakups, the effects of firm breakup were positive. However, later, after the post-firm breakup and post-privatization events settled down, the primarily positive effects of firm breakup dissipated very quickly, even becoming negative and often, statistically insignificant. Since breakup was the initial form of restructuring, it is reasonable to assume that the performance-enhancing potential of firm breakup was exhausted quickly. Consequently, factors such as changes in ownership structure and management can be found behind later improvements in the performance of firms.

After voucher privatization ended, the state remained an important shareholder in many companies, and ownership links were present at numerous levels.[6] During the post-privatization decade (1995–2005), the integrated control potential of the state resembled a corporate pyramid, a business structure found worldwide. Thus, integrated state control emerged in the Czech Republic paradoxically as a result of extensive privatization, possibly due to the enormous financial needs associated with transition. However, the control potential that a corporate pyramid offers should not be overstated. Still, Kočenda and Hanousek (2012b) showed that state control resulted in the declining and even negative corporate performance of firms where the state was engaged through various means of control. Integrated state control was shown to be mostly inferior when compared with private types of ownership. A lack of focus and interagency cooperation as well as the simple inefficiency of a state bureaucracy are the most likely reasons for those findings.

The privatization process involved a number of different types of owners: the state, corporate insiders, domestic outside owners, foreign investors, etc. They all differ in terms of their restructuring capability in the post-privatization period and exhibit different degrees of comparative superiority (or inferiority). In this respect, we review several key ownership types: the state, domestic or foreign industrial (i.e., non-financial) companies, banks, investment funds, portfolio companies, and individual owners; insiders have not been important in the Czech Republic (Hanousek et al., 2007).

As an owner, the state may pursue various goals, including economic efficiency and the collection of tax revenues, or social goals, such as employment. The ownership of a firm by an industrial company may be expected to increase profitability through cost cutting, the integration of activities, and expansion aimed at exploiting economies of scale. Bank ownership is expected to impose pressure on a firm's management to improve profitability, while investment (mutual) funds are expected to pursue profitable opportunities and, when desirable,

[6] Privatization schemes in many European emerging economies involved the creation of a special government agency that assumed the role of the administrator of state property. The state often remained the ultimate owner of numerous firms long after privatization was concluded, a situation that has been documented for the Czech Republic already by Kočenda (1999). In the Czech Republic, the National Property Fund (NPF) acted as the governmental administrator of property that remained in the state's possession. The National Property Fund was established on May 24, 1991, to implement privatization decisions and to temporarily control shares that had been owned by the state before being privatized. The NPF was established based on the Act of the Czech National Council No. 171/1991. The NPF terminated its operations on December 31, 2005, based on Act No. 178/2005 from April 28, 2005.

take significant equity positions. Funds may, hence, emphasize sound corporate governance and the restructuring of firms. Portfolio companies in the Czech Republic are diversified investment vehicles that engage in business with both corporate and private customers. Ownership positions of portfolio companies are more limited than those of the funds, but the experience in advanced market economies indicates that portfolio companies often force management to become more profitable. Individual ownership is widely perceived to give the single residual claimant strong incentives to monitor management and achieve superior firm performance. Foreign owners are expected to aim to generate profits and, if the local products can be sold through their global distribution network, also to increase output and, hence, employment.

Ownership structure is also linked to ownership concentration and the level conducive to good corporate performance. Overall, the majority (above 50% of shares) and blocking minority (between 33 and 50% of shares) represent different degrees of concentrated ownership.[7] The legal minority (at least 10% of shares) may be viewed as a form of moderately dispersed ownership.[8] In a situation in which a majority owner is confronted by a minority owner, the monitoring ability of the minority owner might produce a desirable disciplining effect. An ownership structure even more subtle may emerge when two minority owners face a situation where neither can fully control the company and only coordinated steps in a functional coalition would enable them to control the company jointly (Hanousek et al., 2015). Highly dispersed ownership arises when the stake of the largest holder does not reach legal minority. Last, it is also important whether the government keeps a golden share in a given firm that gives it the right to veto certain managerial decisions, such as the subject of business activities and the sale of assets, and to indirectly influence all managerial decisions.[9]

[7] Majority ownership grants the owner the right to manage staff and supervisory boards, alter and transfer firms' assets, and make crucial strategic decisions at general shareholders' meetings. Through management and supervisory boards, majority ownership also facilitates more direct executive control of the company. Blocking minority ownership gives the right to block a number of decisions, such as those related to increasing or reducing assets and implementing major changes in business activities that the majority shareholder may strive to implement at the general shareholders' meeting.

[8] A blocking minority is potentially important because the law entitles the holder of this stake to call the general shareholders' meeting and obstruct its decisions by delaying their implementation through lengthy court proceedings. Effective legal minority shareholders (including the state) may, thus, use their ownership position to delay or completely block the implementation of decisions by stronger shareholder(s).

[9] Institutional evidence suggests that the golden share may be an important mechanism enabling the state to exert a degree of influence over firms in which it no longer holds a sufficient ownership stake. The golden share was

With respect to the ownership distinctions outlined above, an influential survey by Estrin et al. (2009) found that the impact of privatization on the total factor productivity (TFP) level was mostly positive during both the early and later transition periods in Central and Eastern European (CEE) countries; however, the effect of privatization to domestic owners is quantitatively much smaller than that to foreign owners, and it is greater in the later transition period than in the earlier period. Overall, the TFP effect of privatization to domestic owners is weaker than that to foreign owners, and it takes longer to become established. The concentration of ownership is important, with a majority of private ownership having mostly positive effects on the level of the TFP. The overall positive effect is, again, driven primarily by foreign-owned firms. The effect of majority domestic private ownership tends to be positive; however, it is smaller in magnitude. Further, newly created private firms are found to be more productive than, or at least as productive as, former state firms privatized to domestic owners. The effect of employee (insider) ownership on the level of the TFP is found to be mostly statistically insignificant. Estimates of the effects of privatization on TFP growth suggest that, in the CEE, privatization had a positive effect on the rate of change of the TFP in the early transition period and that the effect disappears in the later stage. In terms of the specific results related to the ownership structures and efficiency of the Czech firms, Hanousek et al. (2012) showed that the ownership concentration is positively related to efficiency, but that a simple majority is not necessarily the best structure for improving efficiency and that domestic minority owners form cooperative coalitions to improve the efficiency of their firms. They also found that foreign ownership via foreign direct investment (FDI) has beneficial effects at the microeconomic level.[10]

introduced by Act No. 210/1993, modifying Act No. 92/1991. The act set conditions for the transfer of property from the state to others, with the aim of protecting special interests of the state in firms privatized in large-scale privatization. The veto right associated with the golden share usually relates to the scope and line of business activity and depends on each company's charter. When the state sells its golden share, it gives up its rights in the company, and the golden share ceases to exist. The instrument of the golden share in the Czech Republic did not conform fully to that found in other countries since it was limited to being solely an instrument of state control and did not serve as a means of attracting free or less expensive credit. Golden shares were abolished in the Czech Republic on January 1, 1996, according to Act. No. 178/2005.

[10] Hagemejer and Tyrowicz (2011) provide favorable evidence of the FDI in Polish firms but they also claim that selection effects impact firms' efficiency results.

3. Literature selection and meta-analysis methodology

In this section, we describe our procedure for selecting literature and overview the studies selected for meta-analysis. Then, we briefly explain the meta-analysis methodology to be conducted in this paper.

3.1 Literature selection and relevant facts on selected studies

With the goal of finding studies that empirically examined the impact of post-privatization ownership structure on ex post firm performance and restructuring in the Czech Republic, we first searched the Econ-Lit and Web of Science databases for research works that contained a combination of two terms, including one from *privatization*, *ownership*, *firm performance*, or *restructuring*, and another one from *Czech*, *Central Europe*, *Eastern Europe*, or *transition economies*. The final literature search was carried out in March 2017. Then, we looked at approximately 750 searched works individually and narrowed the literature list to those containing estimates that could be applicable to the goals of this paper. In practice, each study had to (i) contain information on mass-privatized firms, (ii) provide an assessment of firms' performance, and (iii) distinguish (at least basic) ownership categories; all three conditions had to be satisfied. Based on these criteria, we selected 34 studies in total.

In Table 3, we present an overview of the studies selected for meta-analysis: 24 of the 34 studies cover a broad range of industries, while ten focus on the mining and manufacturing industry. Hanousek et al. (2012) also contains an individual study of the service industry. These 34 works cover the 21 years from 1989 to 2009. Eight types of indices were adopted as firm performance variables. 17 and 16 studies adopted the efficiency index and the sales or output volume as a dependent variable, respectively. 11 studies dealt with firm productivity. The firm value index was utilized in 8 studies. The remaining four indices were employed in only one or two research works.

Table 3: List of selected studies subject to meta-analysis and breakdown of collected estimates by target industry, estimation period, firm performance variable, and ownership variable

Author(s) (publication year)	Target industry	Estimation period	Firm performance variable type (dependent variable)[a]	Owernship variable type (independent variable)[b]	Number of collected estimates
Zemplinerová et al. (1995)	Mining and manufacturing	1990–1993	F	1, 4, 12	3
Claessens et al. (1997)	Mining and manufacturing	1992–1995	B, D	1, 6, 9, 12	40
Djankov and Claessens (1997)	Various industries	1993–1997	B–D	2, 4, 6, 13	21
Hingorani et al. (1997)	Various industries	1993	D	1, 12, 13	18
Pohl et al. (1997)	Mining and manufacturing	1992–1995	B, D	1, 6, 9, 12	20
Weiss and Nikitin (1998)	Various industries	1993–1996	B, C	1–3, 8–12	260
Claessens and Djankov (1999)	Various industries	1993–1997	B, C	6, 8, 9, 12	16
Claessens and Djankov (2000)	Various industries	1996	B–D	14	3
Djankov and Hoekman (2000)	Various industries	1992–1996	A	12	4
Kinoshita (2000)	Mining and manufacturing	1995–1998	A	12	3
Makhija and Spiro (2000)	Various industries	1993	D	1, 7–9, 12 ,13	65
Cull et al. (2002)	Various industries	1993–1996	A, B	1, 7–9, 12	73
Harper (2002)	Various industries	1989–1994	A–C, H	12	6
Weiss and Nikitin (2002)	Various industries	1994–1996	B, C	4, 7, 11	30
Damijan et al. (2003a)	Mining and manufacturing	1995–1998	A	12	2
Damijan et al. (2003b)	Mining and manufacturing	1995–1999	A	12	2
Kočenda (2003)	Various industries	1996–1999	A–C	1, 5, 6, 8, 9, 11	36
Kočenda and Valachy (2003)	Various industries	1996–1999	A–C	5, 8, 9, 11	40
Makhija (2004)	Various industries	1993	D	1, 8, 9, 12, 14	21
Torlak (2004)	Mining and manufacturing	1993–1999	A	12	2
Sabirianova et al. (2005)	Various industries	1993–2000	A	12	8
Sabirianova et al. (2006)	Mining and manufacturing	1992–2000	A	12	10
Earnhart and Lízal (2007)	Various industries	1993–1999	B	1, 5–8, 10, 12, 13	8
Grosfeld and Hashi (2007)	Various industries	1996–1999	D	5–7, 10	8
Hanousek et al. (2007)	Various industries	1996–1999	A, B, G	1, 5, 8, 9, 11, 12	80
Hanousek et al. (2009)	Various industries	1995–1996	A–C	1, 5, 7, 11	56
Kosová (2010)	Various industries	1994–2001	A	12	8
Hanousek and Kočenda (2011)	Various industries	1998–2005	B	1, 5, 7, 11	72
Hanousek et al. (2012)	Various industries[c]	1998–2007	A	12	76
Jurajda and Stančík (2012)	Various industries	1995–2005	B, C, G	12	12
Kočenda and Hanousek (2012b)	Various industries	1998–2005	B	1, 5, 7, 11	144
Sabirianova et al. (2012)	Mining and manufacturing	1992–2000	A	12	17
Damijan et al. (2013)	Manfacturing	1995–2005	C	12	6
Cieślik et al. (2015)	Various industries	2002–2009	E	12	1

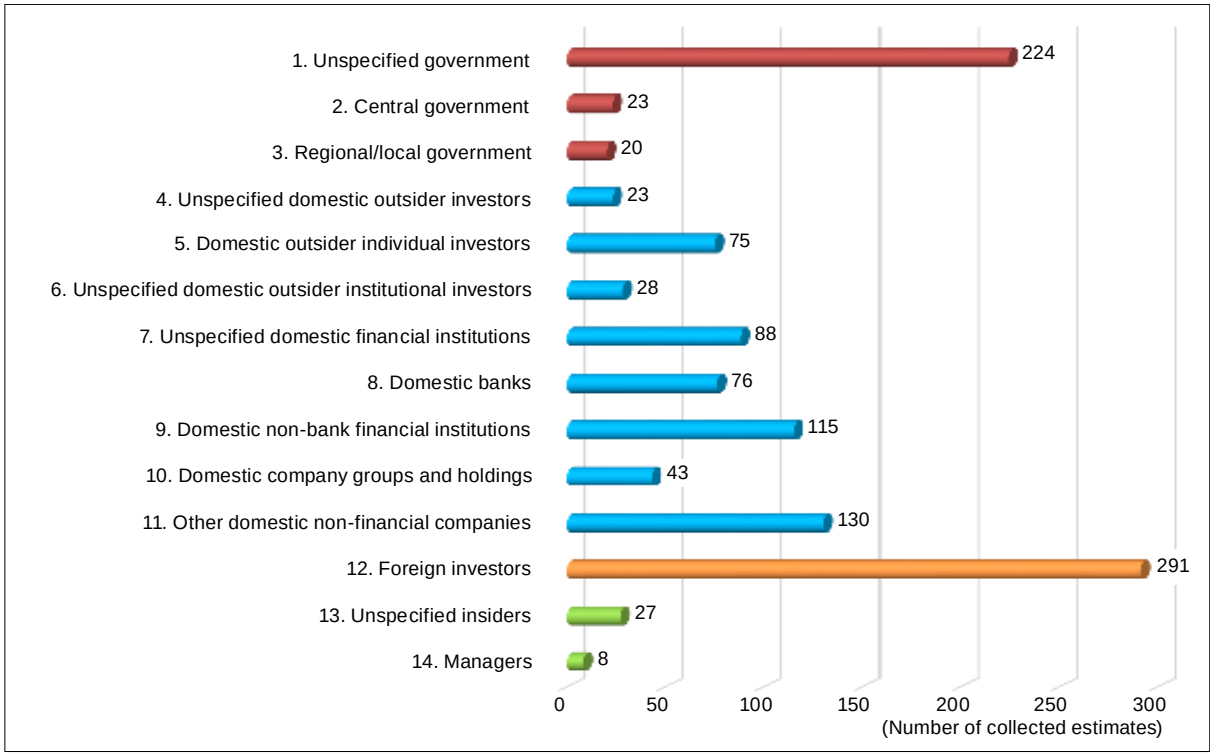
Notes: a A: Sales and output; B: Efficiency; C: Productivity; D: Firm value; E: Export; F: Restructuring; G: Wage; H: Employment; b 1: Unspecified government; 2: Central government; 3: Regional/local government; 4: Unspecified domestic outsider investors; 5: Domestic outsider individual investors; 6: Unspecified domestic outsider institutional investors; 7: Unspecified domestic financial institutions; 8: Domestic banks; 9: Domestic non-bank financial institutions; 10: Domestic company groups and holdings; 11: Other non-financial companies; 12: Foreign investors; 13: Unspecified insiders; 14: Managers; c Including individual studies for mining/manufacturing and service industries. Source: Compiled by the authors.

With respect to post-privatization ownership structure, the 34 works above used 14 types of ownership variables, ranging from state ownership to managerial ownership. In the case of state ownership, we consider four basic categories, distinguishing first between (i) central government and (ii) regional/local/municipal governments. Then, (iii) the label of "unspecified government" is given to the collected estimates of state ownership variables that do not distinguish the level of administration (i.e., central, regional, municipal, or local governments). Finally, (iv) the simple "state" label represents an aggregated category that covers all kinds of estimates related to state ownership (e.g., state = unspecified + central government + regional/local government). As reported later, the same classification method is applied to ownership by domestic outsider investors and insiders.

Reflecting researchers' strong interest in foreign direct investment in the Czech economy, 25 studies examined the impacts of foreign ownership on firm performance and restructuring, while 14 and 10 studies investigated the influence of ownership by unspecified government and domestic non-bank financial institutions, respectively. Other corporate owners were dealt with in fewer than 10 studies. This classification is hereinafter called a basic category of ownership variable.

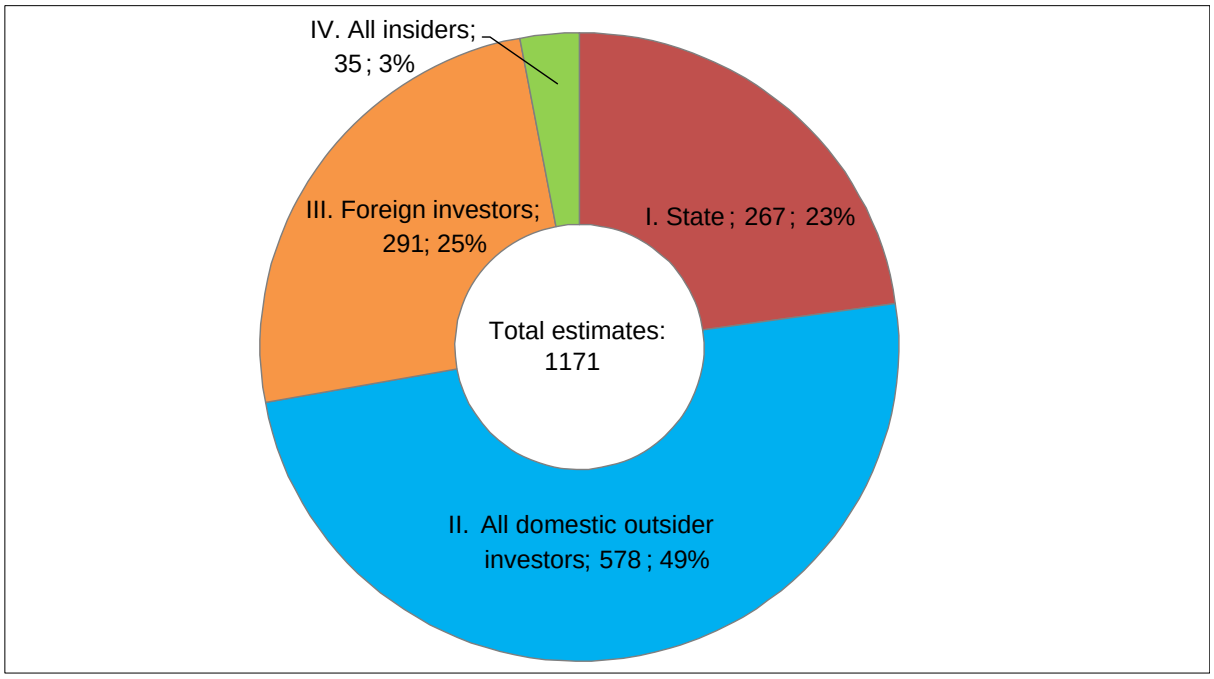
From the 34 studies outlined above, we collected a total of 1171 estimates (34.4 per study, on average). A breakdown of these 1171 estimates by the basic categories of ownership variable is shown in Figure 1. Foreign investors take the largest share (291 estimates). Unspecified government, other domestic non-financial companies, and domestic non-bank financial institutions follow (224, 130, and 115 estimates, respectively). In contrast, estimates of unspecified insiders and managers are very limited (27 and 8 estimates, respectively), due to the weak motivation for research on insider ownership in post-privatized companies in the Czech Republic. Our meta-analysis also uses an aggregated category of ownership variables, which consists of (a) state, (b) all domestic outsider investors, (c) foreign investors, and (d) all insiders. Figure 2 illustrates the breakdown of collected estimates by this aggregated classification. The selected 34 studies provide the largest evidence regarding domestic outside ownership (578 estimates). From these, foreign investors, state ownership, and insider ownership account for 291, 267, and 35 estimates, respectively.

Figure 1: Breakdown of collected estimates by basic categories of ownership variables



Note: The total number of collected estimates is 1171. Source: Authors' illustration

Figure 2: Breakdown of collected estimates by aggregated categories of ownership variables



Note: Values following category names denote the number of collected estimates and their shares of total estimates, respectively. Source: Authors' illustration

3.2 Meta-analysis methodology

Next, we briefly explain the meta-synthesis and meta-regression analysis (MRA) methodology to be conducted in Section 4. Hereinafter, K denotes the total number of collected estimates (k = 1, 2, …, K). The partial correlation coefficient (PCC) and the t value are employed to synthesize the collected estimates. The PCC is a measure of the association of a dependent variable and the independent variable in question when other variables are held constant. The PCC is denoted as r_k and defined as:

$$r_k = \frac{t_k}{\sqrt{t_k^2 + df_k}}, \tag{1}$$

where t_k and df_k denote the t value and the degree of freedom of the k-th estimate, respectively. The standard error (SE) of r_k is given by $\sqrt{(1 - r_k^2)/df_k}$.

The following method is applied to synthesize the PCCs. Suppose that there are K estimates (k = 1, 2, …, K). With respect to the PCC of the k-th estimate (r_k), the corresponding population and standard deviation are labeled as θ_k and s_k, respectively. We assume that $\theta_1 = \theta_2 = \ldots = \theta_K = \theta$, implying that each study in a meta-analysis estimates the common underlying population effect, and that the estimates differ only by random sampling errors. An asymptotically efficient estimator of the unknown true population parameter θ is a weighted mean by the inverse variance of each estimate:

$$\bar{R} = \sum_{k=1}^{K} w_k r_k / \sum_{k=1}^{K} w_k, \tag{2}$$

where $w_k = 1/v_k$, and $v_k = s_k^2$. The variance of the synthesized partial correlation $\bar{R}$ is given by: $1/\sum_{k=1}^{K} w_k$.

This is the meta fixed-effect model. Hereafter, we denote estimates of the meta fixed-effect model using $\overline{R_f}$. In order to utilize this method to synthesize the PCCs, we must confirm that the estimates are homogeneous. H_0: estimates of the meta fixed effect (r_k) are not homogenous. A homogeneity test uses the statistic,

$$Q_r = \sum_{k=1}^{K} w_k \left(r_k - \overline{R_f}\right)^2 \sim \chi^2(K-1), \tag{3}$$

which has a chi-square distribution with N-1 degrees of freedom. The null hypothesis is rejected if Q_r exceeds the critical value. In this case, we assume that heterogeneity exists among the

studies and adopt a random-effects model that incorporates the sampling variation due to the underlying population of effect sizes as well as the study-level sampling error. If the deviation between estimates is expressed as δ_θ^2, the unconditional variance of the *k*-th estimate is given by $v_k^u = \left(v_k + \delta_\theta^2\right)$. In the meta random-effects model, the population θ is estimated by replacing the weight w_k with the weight $w_k^u = 1/v_k^u$ in Eq. (2).[11] For the between-studies variance component, we use the method of moments estimator computed by the next equation using the value of the homogeneity test value Q_r obtained from Eq. (3):

$$\hat{\delta}_\theta^2 = \frac{Q_r - (K-1)}{\sum_{k=1}^K w_k^u - \left(\sum_{k=1}^K w_k^{u^2} / \sum_{k-1}^K w_k^u\right)}. \quad (4)$$

Hereafter, we denote the estimates of the meta random-effects model as $\overline{R_r}$.[12]

Further, we aim to assess whether and how the reported effects vary with the quality level at which a study was conducted. H_0: the quality level does not affect the reported estimates. We combine *t* values using the next equation:

$$\overline{T_w} = \sum_{k=1}^K w_k t_k / \sqrt{\sum_{k=1}^K w_k^2} \quad \sim \quad N(0,1). \quad (5)$$

Here, w_k is the weight assigned to the *t* value of the *k*-th estimate. As the weight w_k in Eq. (5), we utilize the *h*-index of the IDEAS bibliographic database to mirror the quality level of each relevant study (see Appendix B for a detail). Moreover, we report not only the combined *t* value $\overline{T_w}$ weighted by the quality level of the study, but also the unweighted combined *t* value $\overline{T_u}$. As a supplemental statistic for evaluating the reliability of the above-mentioned combined *t* value, we also report Rosenthal's fail-safe N (*fsN*), which is computed as:

$$fsN\ (p = 0.05) = \left(\frac{\sum_{k=1}^K t_k}{1.645}\right)^2 - K.^{13} \quad (6)$$

[11] This means that the meta fixed-effect model is a special case based on the assumption that $\delta_\theta^2 = 0$.

[12] In recent years, some meta-analysts try to construct a "best-practice" estimate conditional on preferred characteristics of empirical methodology if, for instance, data selection and model specification are considered to greatly affect empirical evidence in the research field in question instead of the traditional meta-synthesis. See Havránek and Iršová (2017) as one of the recent attempts. We appreciate the referee for his/her insight into this aspect.

[13] Rosenthal's fail-safe N denotes the number of studies with the average effect size equal to zero that needs to be added to bring the combined probability level of all of the studies to the standard significance level to determine the presence or absence of effect. The larger value of *fsN* in Eq. (6) means a more reliable estimation of the combined *t* value. For more details, see Stanley and Doucouliagos (2012).

Following the synthesis of the collected estimates, we conduct an MRA to explore the factors causing heterogeneity between selected studies. H_0: factors related to specific studies are not relevant to the reported outcomes. To this end, we estimate the meta-regression model specified as:

$$y_k = \alpha_0 + \sum_{n=1}^{N} \alpha_n x_{kn} + e_k \, , k = 1, 2, \cdots, K \, , \tag{7}$$

where y_k is either the PCC (r_k) defined in Eq. (1) or the t value of the k-th estimate; x_{kn} denotes a meta-independent variable that captures relevant characteristics of an empirical study and explains its systematic variation from other empirical results in the literature; α_n denotes the meta-regression coefficient to be estimated; and e_k is the meta-regression disturbance term (Stanley and Jarrell, 2005). To check the statistical robustness of coefficient α_n, we perform an MRA using the following seven estimators: (i) 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 either (ii) the above-mentioned quality level of the study, (iii) the number of observations, (iv) the inverse of the standard error (1/*SE*), or (v) the inverse of the number of estimates reported per study (1/*EST*) as an analytical weight;[14] (vi) the cluster-robust unbalanced random-effects panel estimator; and (vii) the cluster-robust fixed-effects estimator.[15]

The choice of the estimators listed above is grounded in an ongoing debate; however, there is no firm consensus on the choice of estimators in meta-analyses. Therefore, our choice of a range of estimators is motivated by the following arguments. First, there is a good reason that the choice of the estimator in meta-analysis should stem from the nature of the research question.[16] Second, on the other hand, there is an equally valid stance that the choice of a meta-analysis estimator(s) should follow the standard procedure of the panel data model

[14] While Stanley and Doucouliagos (2012) recommend to use 1/*SE* to adjust for possible heteroscedasticity of the literatures subject to meta-analysis, Havránek and Sokolova (2016; p. 11) argue that the use of precision weights may be problematic, because "if the study underestimates the standard error, weighting by precision can create a bias by itself". Accordingly, we use both 1/*SE* and 1/*EST* in our MRA for robustness check.

[15] In addition to these orthodox estimators employed in the MRA, some meta-analysts implement alternative approaches to tackle the issue of model uncertainty. These include a two-way clustering of standard errors (for example, at the level of studies and authors or sectors) or employment of several types of model-averaging approaches, including frequentist model averaging and Bayesian model averaging. For more details on the alternative approaches see for example Ahtiainen and Vanhatalo (2012), Babecky and Havránek (2014), and Havránek and Sokolova (2016).

[16] The argument can be illustrated by the following example. If one wants to run a simple FAT-PET regression, fixed-effects always dominate random effects because they are consistent. In some cases, random-effects may be more efficient; however, readers know that the potential inefficiency of fixed-effects actually plays against the researcher, since it makes the results less significant. More importantly, random effects in meta-analysis are very often correlated with publication bias, which means that the estimator is seldom consistent in the first place.

specification.[17] Third, a choice of several estimators provides valuable information in the form of a robustness check. With regard to readers who are not familiar with meta-analysis, as well as specialists in the field, we follow the three-point strategy above and employ several estimators to provide readers with convincing results. Additionally, in our meta-analysis, we take the endogeneity of standard errors quite seriously.

Furthermore, in Section 5, we will examine publication selection bias, which is a unique and important task of meta-analysis (Stanley and Doucouliagos, 2012). In this paper, we examine this problem by using the funnel plot (Stanley and Doucouliagos, 2010). The funnel plot is a scatter plot with the effect size (in the case of this paper, the PCC) on the horizontal axis and the precision of the estimate (in this case, 1/*SE*) on the vertical axis. In the absence of publication selection, effect sizes reported by independent studies vary randomly and symmetrically around the true effect. Moreover, according to the statistical theory, the dispersion of effect sizes is negatively correlated with the precision of the estimate. Therefore, the shape of the plot must look like an inverted funnel. In other words, if the funnel plot is not bilaterally symmetrical but is deflected to one side, then an arbitrary manipulation of the study area in question is suspected, in the sense that estimates in favor of a specific conclusion (i.e., estimates with an expected sign) are more frequently published.

In addition to the funnel plot, we also report estimates of meta-regression models, which have been developed to examine in a more rigorous manner the two types of publication selection bias and the presence of the true effect.

We can test for publication selection bias by regressing the *t* value of the *k*-th estimate on the inverse of the standard error (1/*SE*) using the following equation:

$$t_k = \beta_0 + \beta_1(1/SE_k) + v_k, \tag{8}$$

thereby testing the null hypothesis that the intercept term β_0 is equal to zero. In Eq. (8), v_k is the error term. When the intercept term β_0 is statistically significantly different from zero, we can interpret that the distribution of the effect sizes is asymmetric. For this reason, this test is called the funnel-asymmetry test (FAT).

[17] Examples of this strategy include using the Breusch-Pagan test for the choice of pooling OLS versus random-effects estimators and the Hausman test for the choice of random-effects versus fixed-effects estimators. The two specification tests enable us to effectively check the orthogonality conditions.

Even if there is a publication selection bias, a genuine effect may exist in the available empirical evidence. Stanley and Doucouliagos (2012) proposed examining this possibility by testing the null hypothesis that the coefficient β_1 is equal to zero in Eq. (8). The rejection of the null hypothesis implies the presence of a genuine (i.e., statistically significant non-zero) effect. This test is called the precision-effect test (PET). Moreover, they also stated that an estimate of the publication-selection-bias-adjusted effect size can be obtained by estimating the following equation, which has no intercept:

$$t_k = \beta_0 SE_k + \beta_1 (1/SE_k) + v_k, \tag{9}$$

thereby obtaining the coefficient β_1. This means that if the null hypothesis of $\beta_1 = 0$ is rejected, then the non-zero effect does actually exist in the literature, and the coefficient β_1 can be regarded as its estimate. Stanley and Doucouliagos (2012) called this procedure the precision-effect estimate with standard error (PEESE) approach. To test the robustness of the regression coefficient, we estimate Eqs. (8) and (9) above using not only the OLS estimator, but also the cluster-robust OLS estimator and the unbalanced panel estimator,[18] both of which treat possible heterogeneity among the studies.[19]

[18] To estimate Eq. (8), we use the cluster-robust random-effects estimator and the cluster-robust fixed-effects estimator. With regard to Eq. (9), which does not have an intercept term, we report the random-effects model estimated by the maximum likelihood method and the population averaged GEE model.

[19] Meta-studies of the transition literature that employ methodology similar to that of this paper include Fidrmuc and Korhonen (2006), Hanousek et al. (2011), Kuusk and Paas (2013), Babecky and Havránek (2014), Iwasaki and Tokunaga (2014; 2016), Iwasaki and Uegaki (2017), and Tokunaga and Iwasaki (2017).

4. Results of the meta-analysis

In accordance with the methodology described in the previous section, we first synthesize the collected estimates and then perform an MRA to compare the impacts of different types of corporate ownership on the performance and the restructuring of Czech mass-privatized firms.

4.1 Meta-synthesis

Table 4 shows the results from the meta-synthesis of the collected estimates. Synthesized PCCs are shown in column (a), and combined *t* values are reported in column (b). With regard to the PCC, we adopt the synthesized effect size of the random-effects model as the reference value. However, we refer to the fixed-effect model in the cases of the central government and the domestic company groups and holdings. For these two types of ownership, we do not reject the null hypothesis of the homogeneity test. In addition, Panel (a) of Figure 3 displays these adopted synthesized effect sizes in a graphical form. Panel (b) then illustrates combined *t* values weighted by research quality.

Evidence shown in Table 4 and Figure 3 indicates that domestic outsider investors perform rather poorly as corporate owners in the post-privatization period, contrary to the expectations of policymakers and researchers (Estrin et al., 2009). Actually, the synthesized effect size of all domestic outsider investors amounts to a mere 0.009, which is lower than that of the entire state ownership category (0.015). In addition, there is only a negligible difference between these two kinds of ownership in terms of combined t value weighted by research quality (1.473 vs. 1.408). The synthesis results, based on the basic category of ownership variables, indicate that domestic outsider institutional investors (and financial institutions in particular) turned out to be incapable of running their invested companies efficiently, while the central government positively affected the performance and restructuring activities of state-owned enterprises.

Foreign ownership outperforms state ownership both in the effect size and statistical significance corresponding to the theoretical prediction. In fact, the synthesized PCCs and the combined t value weighted by the research quality (associated with foreign investors) were 0.028 and 3.097, respectively. Surprisingly, insiders exhibit the largest contributing effect on performance and the restructuring of Czech enterprises. Namely, the synthesized impact of

all insiders is 0.120 in terms of the PCC and 3.176 in terms of the t value. Nevertheless, the integrated statistical significance of managerial ownership does not reach a 10% level, when the research quality of the relevant studies is taken into consideration.

The findings above are quite informative for understanding the relationship between the post-privatization ownership and the performance of Czech firms. However, they do not take into account the possible heterogeneity of the literature. As a next step, we will test whether the results of the meta-synthesis can be reproduced simultaneously while controlling for various study conditions.

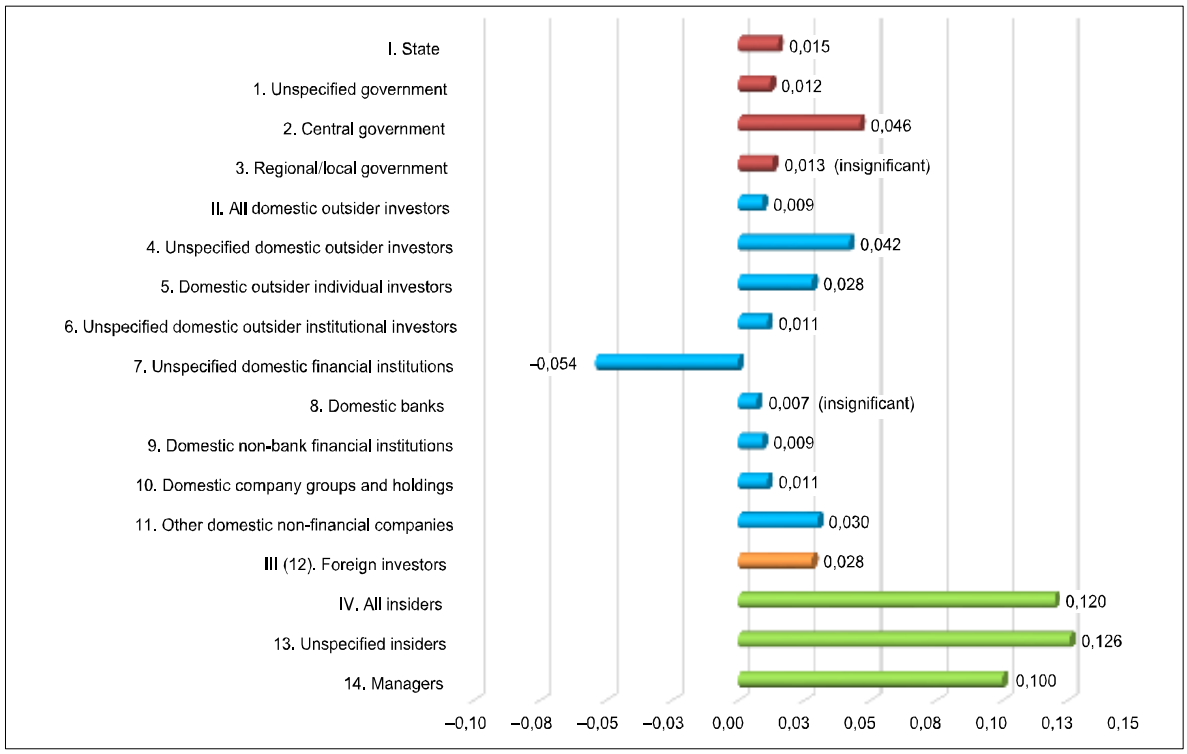
Table 4: Synthesis of estimates

		(a) Synthesis of PCCs			(b) Combination of *t* values			
Ownership variable type[a]	Number of estimates (*K*)	Fixed-effect model (*z* value)[b]	Random-effects model (*z* value)[b]	Test of homogeneity[c]	Unweighted combination (*p* value)	Weighted combination (*p* value)	Median of *t* values	Fail-safe N *(fsN)*
I. State	267	0,012*** (6,47)	0,015*** (2,83)	2179,639***	7,292*** (0,00)	1,408* (0,08)	0,331	4979
1. Unspecified government	224	0,010*** (5,06)	0,012** (2,03)	2102,544***	5,661*** (0,00)	1,004 (0,16)	0,124	2429
2. Central government	23	0,046*** (5,82)	0,046*** (5,25)	26,986	5,798*** (0,00)	5,798*** (0,00)	1,520	263
3. Regional/local government	20	0,013 (1,50)	0,013 (1,18)	30,162**	1,478* (0,07)	1,478* (0,07)	0,235	–4
II. All domestic outsider investors	578	0,010*** (7,78)	0,009*** (3,63)	2062,767***	6,755*** (0,00)	1,473* (0,07)	0,270	9169
4. Unspecified domestic outsider investors	23	0,044*** (4,32)	0,042*** (3,04)	35,335**	3,609*** (0,00)	1,316* (0,09)	0,360	88
5. Domestic outsider individual investors	75	0,026*** (8,14)	0,028*** (3,84)	382,972***	8,439*** (0,00)	1,465* (0,07)	0,444	1899
6. Unspecified domestic outsider institutional investors	28	0,010** (2,13)	0,011* (1,68)	53,281***	2,415*** (0,01)	0,614 (0,27)	0,774	32
7. Unspecified domestic financial institutions	88	–0,041*** (–12,02)	–0,054*** (–6,69)	452,958***	–13,821*** (0,00)	–2,291*** (0,01)	–1,369	6124
8. Domestic banks	76	0,008** (2,35)	0,007 (1,19)	216,932***	2,064** (0,02)	0,438 (0,33)	–0,038	44
9. Domestic non-bank financial institutions	115	0,011*** (4,19)	0,009** (2,13)	263,464***	3,385*** (0,00)	1,001 (0,16)	0,340	372
10. Domestic company groups and holdings	43	0,011* (1,94)	0,011* (1,94)	37,223	2,202*** (0,01)	1,403* (0,08)	0,050	34
11. Other domestic non-financial companies	130	0,027*** (9,93)	0,030*** (6,84)	321,866***	10,538*** (0,00)	2,290*** (0,01)	0,790	5205
III (12). Foreign investors	291	0,005*** (9,36)	0,028*** (8,02)	9388,704***	20,581*** (0,00)	3,097*** (0,00)	0,870	49793
IV. All insiders	35	0,116*** (21,21)	0,120*** (9,44)	179,937***	21,423*** (0,00)	3,176*** (0,00)	4,480	5901
13. Unspecified insiders	27	0,117*** (19,16)	0,126*** (8,89)	134,356***	19,706*** (0,00)	3,169*** (0,00)	4,480	3848
14. Managers	8	0,110*** (9,11)	0,100*** (3,25)	45,305***	8,608*** (0,00)	1,040 (0,15)	4,725	211

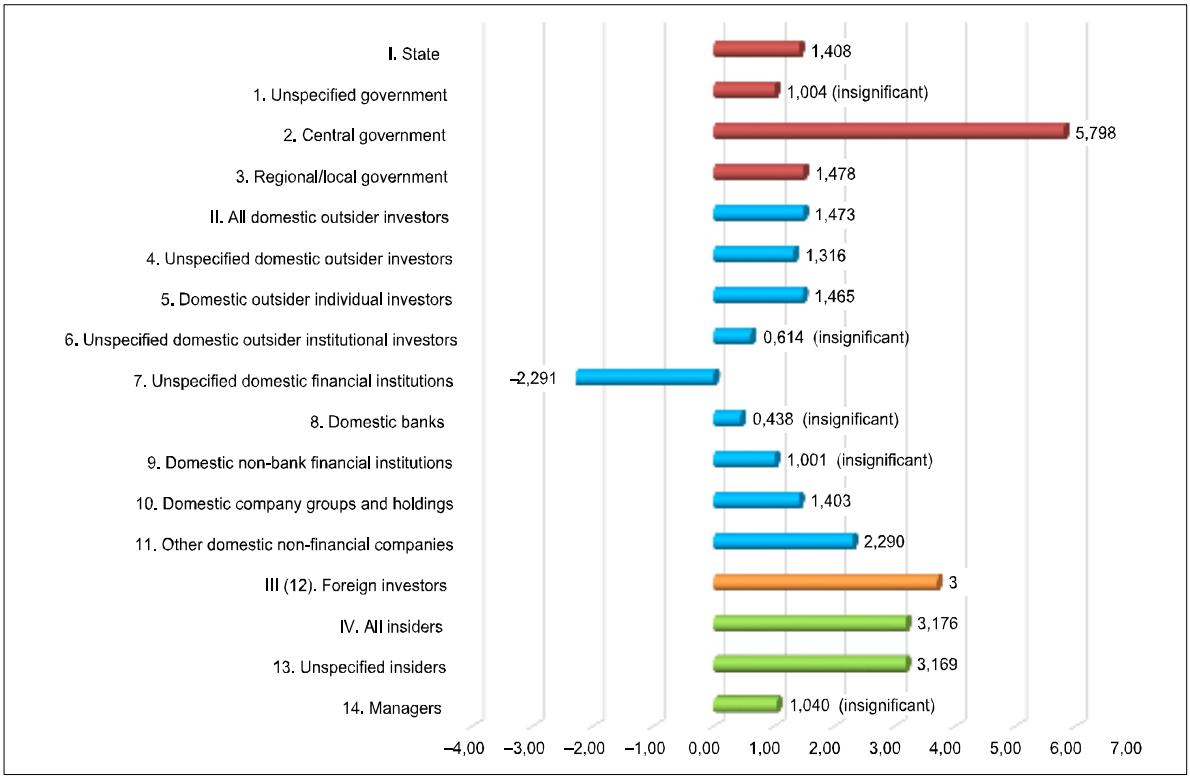
Notes: a Ownership variable types with Arabic numerals belong to the basic category, while those with Roman numerals belong to the aggregated category. b Null hypothesis: The synthesized effect size is zero. c Null hypothesis: Effect sizes are homogeneous. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Source: Authors' estimations

Figure 3: Illustrated comparison of synthesized estimates

(a) Synthesized value of PCC



(b) Combined *t* value weighted by research quality



Note: Ownership variable types with Arabic numerals belong to the basic category, while those with Roman numerals belong to the aggregated category. Source: Authors' illustrations based on Table 2

4.2 Meta-regression analysis

Here, we estimate a meta-regression model designed to control factors that may cause heterogeneity in the extant literature. We introduce the PCC or the *t* value into the left-hand side of the regression equation defined in Eq. (7). On the right-hand side, we employ a total of 47 meta-independent variables. In the course of the MRA, along with the divergence of ownership variable types, we take into consideration differences in other characteristics of ownership variables, the benchmark index of firm performance variables, the target industry, the type and information source of data used for the estimation, the estimation period, the estimator, the treatment for endogeneity between dependent variables and ownership variables, the equation type, and control variables that may strongly influence the estimation results, as well as the degree of freedom and the quality level of the study.[20]

In Table 5, we report the estimation results using the aggregated category of ownership variables. The state is treated as the default category. As shown in this table, the coefficients are sensitive to the choice of the estimator. Therefore, hereinafter, we will interpret the regression results under the assumption that the meta-independent variables that are statistically significant and have the same sign in at least four of seven models constitute statistically robust estimation results.

According to Panel (a) of Table 5, in which the PCC is used as the dependent variable, a meta-independent variable that captures estimates of foreign ownership by a value of 1 is estimated with a positive sign at the 1% or 5% significance level for all seven models. Explained another way, if other research conditions are held constant, the PCC of the foreign investor ownership variable (ranging from 0.0419 to 0.0882) is, on average, higher than that of the state ownership variable. On the other hand, the meta-independent variable, which takes a value of 1 for estimates of the ownership category of all domestic outsider investors, shows a statistically insignificant coefficient in all seven models. The coefficients of all insider ownership variable are also statistically insignificant, suggesting that the large and positive effect of insider ownership demonstrated in Table 4 and Figure 3 is likely to be produced by some specific research conditions in the relevant studies other than ownership variable type.

[20] The names, definitions, and descriptive statistics of these meta-independent variables are listed in Appendix B. Interaction terms with an ownership variable are not included in the collected estimates because they do not indicate any pure effect of the ownership structure itself. However, in the course of the MRA, we examine how simultaneous estimation of an interaction term(s) affects the estimates of the ownership variable.

Table 5: Meta-regression analysis using the aggregated category of ownership variables

(a) Dependent variable—PCC							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
Ownership variable type (State)							
All domestic outsider investors	–0,0061	0,0150	0,0031	–0,0131	0,0157	–0,0061	–0,0054
	(0,019)	(0,018)	(0,014)	(0,018)	(0,026)	(0,019)	(0,020)
Foreign investors	0,0480***	0,0882***	0,0419***	0,0693***	0,0601**	0,0480***	0,0499***
	(0,017)	(0,015)	(0,014)	(0,015)	(0,025)	(0,017)	(0,017)
All insiders	–0,0032	–0,0089	0,0219	–0,0027	–0,0058	–0,0032	–0,0119
	(0,020)	(0,026)	(0,020)	(0,009)	(0,023)	(0,020)	(0,018)
Other characteristics of ownership variables							
Dummy-type variable (Ownership share)	–0,0628***	–0,0545	–0,0378***	–0,0663***	–0,0402***	–0,0628***	–0,0340
	(0,016)	(0,036)	(0,011)	(0,015)	(0,015)	(0,016)	(0,025)
Lagged variable	–0,0130*	–0,0018	–0,0173**	–0,0234***	–0,0075	–0,0130*	–0,0140***
	(0,007)	(0,012)	(0,008)	(0,008)	(0,013)	(0,007)	(0,001)
With an interaction term(s)	0,0055	0,0018	–0,0084	0,0032	0,0026	0,0055	–0,0057
	(0,008)	(0,010)	(0,016)	(0,019)	(0,015)	(0,008)	(0,009)
Firm performance variable type (Sales/output)							
Efficiency	0,0066	–0,0046	0,0021	0,0272	0,0131	0,0066	–0,0052
	(0,008)	(0,006)	(0,012)	(0,021)	(0,017)	(0,008)	(0,005)
Productivity	0,0085	0,0013	0,0119	0,0320*	0,0234	0,0085	–0,0115*
	(0,009)	(0,007)	(0,014)	(0,017)	(0,018)	(0,009)	(0,006)
Firm value	0,0638**	0,1294**	0,0408	0,0865***	0,0752***	0,0638***	–0,0054
	(0,025)	(0,061)	(0,027)	(0,027)	(0,024)	(0,025)	(0,010)
Export	0,2201***	0,2547***	0,2418***	0,1838***	0,2002***	0,2201***	dropped
	(0,041)	(0,057)	(0,037)	(0,050)	(0,032)	(0,041)	
Restructuring	0,1356***	0,1332***	0,0750***	0,1259***	0,0846**	0,1356***	dropped
	(0,028)	(0,025)	(0,025)	(0,045)	(0,034)	(0,028)	
Wage	–0,0022	–0,0064	0,0077	0,0081	0,0140	–0,0022	–0,0134***
	(0,011)	(0,009)	(0,016)	(0,019)	(0,023)	(0,011)	(0,004)
Employment	–0,0751***	–0,0529*	–0,1202***	–0,0799*	–0,0763***	–0,0751***	–0,0973***
	(0,021)	(0,029)	(0,030)	(0,040)	(0,017)	(0,021)	(0,004)
Target industry (Various industries)							
Mining and manufacturing industry	–0,0195	–0,0391	–0,0096	–0,0315	–0,0169	–0,0195	–0,0752**
	(0,021)	(0,028)	(0,020)	(0,032)	(0,024)	(0,021)	(0,037)
Service industry	–0,0382*	–0,0060	–0,0342**	–0,0189	–0,0473*	–0,0382*	–0,0598*
	(0,020)	(0,026)	(0,016)	(0,027)	(0,024)	(0,020)	(0,033)
Estimation period							
First year of estimation	–0,0047*	–0,0014	–0,0068***	–0,0022	–0,0077***	–0,0047*	0,0024
	(0,002)	(0,003)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)
Length of estimation	–0,0009	–0,0023	0,0019	0,0039	–0,0013	–0,0009	0,0133**
	(0,003)	(0,006)	(0,002)	(0,003)	(0,004)	(0,003)	(0,006)
Data type (Panel data)							
Cross-sectional data	0,0074	–0,0014	0,0497**	0,0430*	0,0287	0,0074	0,0572***
	(0,022)	(0,030)	(0,019)	(0,022)	(0,020)	(0,022)	(0,011)
Data source (Official statistics)							
Commercial database	–0,0609***	–0,0449	–0,0459	–0,0842***	–0,0557***	–0,0609***	dropped
	(0,022)	(0,032)	(0,027)	(0,022)	(0,018)	(0,022)	
Original enterprise survey	–0,0753***	–0,1153**	–0,0427	–0,0715	–0,0248	–0,0753***	dropped
	(0,027)	(0,045)	(0,027)	(0,043)	(0,029)	(0,027)	
Estimator (OLS)							
FE	–0,0376**	–0,0023	–0,0099	–0,0230	–0,0199	–0,0376**	–0,0030
	(0,016)	(0,029)	(0,016)	(0,015)	(0,016)	(0,016)	(0,013)
RE	0,0001	–0,0503	0,0087	–0,0008	0,0093	0,0001	0,0121***
	(0,021)	(0,044)	(0,018)	(0,017)	(0,017)	(0,021)	(0,003)

Table 5 (continued)

(a) Dependent variable—PCC							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
Robust	0,0030	–0,0019	0,0007	0,0020	–0,0094	0,0030	0,0083
	(0,003)	(0,006)	(0,006)	(0,014)	(0,011)	(0,003)	(0,005)
GMM	–0,0521**	–0,0744*	–0,0188	–0,0444*	–0,0530***	–0,0521***	–0,0361***
	(0,020)	(0,040)	(0,013)	(0,022)	(0,014)	(0,020)	(0,005)
Other estimators	0,0099	–0,0525	–0,0163	–0,0283	0,0386	0,0099	–0,0384***
	(0,027)	(0,046)	(0,019)	(0,027)	(0,023)	(0,027)	(0,014)
IV/2SLS/3SLS	0,0042	–0,0316*	0,0120*	–0,0080	0,0058	0,0042	–0,0090
	(0,013)	(0,016)	(0,007)	(0,021)	(0,014)	(0,013)	(0,006)
Equation type (Models other than listed below)							
Difference model	0,0107	–0,0178	0,0227	0,0303	0,0169	0,0107	dropped
	(0,015)	(0,019)	(0,014)	(0,018)	(0,027)	(0,015)	
Translog model	0,0328*	–0,0281	0,0280**	0,0299	0,0652***	0,0328*	dropped
Treatment for the selection bias of privatized firms	(0,017)	(0,030)	(0,013)	(0,019)	(0,017)	(0,017)	
Treatment for selection bias	0,0373	0,0748	–0,0108	0,0278	0,0021	0,0373	dropped
	(0,029)	(0,045)	(0,023)	(0,032)	(0,035)	(0,029)	
Control variable							
Market competition	–0,0531***	–0,0394	–0,0407**	–0,0417**	–0,0458**	–0,0531***	0,0126***
	(0,019)	(0,024)	(0,020)	(0,016)	(0,017)	(0,019)	(0,004)
Location fixed effects	0,0108	–0,0576*	0,0071	0,0289*	–0,0114	0,0108	0,0329**
	(0,017)	(0,029)	(0,021)	(0,016)	(0,017)	(0,017)	(0,014)
Industry fixed effects	0,0294	0,0109	0,0441*	0,0244	0,0462***	0,0294*	–0,0102***
	(0,018)	(0,016)	(0,023)	(0,028)	(0,011)	(0,018)	(0,003)
Time fixed effects	–0,0082	0,0042	0,0059	0,0337	–0,0172	–0,0082	–0,0038
	(0,018)	(0,023)	(0,014)	(0,026)	(0,013)	(0,018)	(0,012)
Degree of freedom and research quality							
√ Degree of freedom	0,0002	–0,0001	0,0003***	0,00005	0,00029*	0,0002	–0,0001**
	(0,000)	(0,000)	(0,000)	(0,0001)	(0,0002)	(0,000)	(0,000)
Quality level	0,0040***	–	0,0043***	0,0047***	0,0048***	0,0040***	dropped
	(0,001)	(–)	(0,001)	(0,001)	(0,001)	(0,001)	
Intercept	9,3381*	2,7925	13,5607***	4,3758	15,2843***	9,3381*	–4,8766
	(4,792)	(6,995)	(3,091)	(4,967)	(4,458)	(4,792)	(4,403)
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,450	0,602	0,507	0,790	0,558	0,450	0,015

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Ownership variable type (State)							
All domestic outsider investors	–0,1812	0,5394	–0,1527	–0,4786	0,1962	–0,1812	–0,0970
	(0,605)	(0,599)	(0,543)	(0,494)	(0,656)	(0,605)	(0,594)
Foreign investors	1,3958**	3,0010***	2,1480*	2,2812***	2,7839***	1,3958**	1,4854***
	(0,606)	(0,471)	(1,074)	(0,536)	(0,714)	(0,606)	(0,463)
All insiders	–0,3912	–0,0200	–0,4157	–0,1752	–1,0028	–0,3912	–0,3276
	(0,635)	(0,731)	(0,963)	(0,338)	(0,802)	(0,635)	(0,482)
Other characteristics of ownership variables							
Dummy-type variable (Ownership share)	–2,2985**	–1,4231	–2,3677*	–2,0744	–2,0404**	–2,2985**	–1,1181
	(0,921)	(0,996)	(1,237)	(1,330)	(0,913)	(0,921)	(0,798)
Lagged variable	–0,8860	–0,2108	–2,2933*	–1,1866*	–2,2123*	–0,8860	–0,6754*
	(0,579)	(0,405)	(1,219)	(0,694)	(1,277)	(0,579)	(0,368)

Table 5 (continued)

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
With an interaction term(s)	0,1407	0,0818	–1,7647	0,2489	–0,5697	0,1407	–0,5969
	(0,548)	(0,366)	(1,503)	(0,765)	(1,155)	(0,548)	(0,717)
Firm performance variable type (Sales/output)							
Efficiency	0,0038	–0,2491	–0,4592	0,8315	0,6873	0,0038	–0,3565**
	(0,441)	(0,255)	(1,132)	(1,149)	(0,821)	(0,441)	(0,138)
Productivity	0,0952	0,1507	1,3756	3,1678*	1,1034	0,0952	–0,5438***
	(0,508)	(0,367)	(1,506)	(1,733)	(1,006)	(0,508)	(0,196)
Firm value	0,8288	3,5919*	–1,9695	0,6400	1,8558*	0,8288	–0,5116
	(0,937)	(1,845)	(1,879)	(1,546)	(0,991)	(0,937)	(0,312)
Export	3,7792	5,1292**	11,0759***	1,3508	6,2774**	3,7792	dropped
	(2,451)	(1,967)	(3,663)	(2,617)	(2,396)	(2,451)	
Restructuring	0,4132	–0,7701	1,1723	1,9920	–0,1513	0,4132	dropped
	(1,414)	(1,835)	(2,657)	(2,874)	(1,619)	(1,414)	
Wage	0,3367	–0,1635	0,7793	0,9884	1,8669	0,3367	–0,7983***
	(1,021)	(0,404)	(1,405)	(1,727)	(1,649)	(1,021)	(0,209)
Employment	–2,2649*	–3,1299**	–7,7379**	–2,4991	–1,2409	–2,2649*	–1,8657***
	(1,336)	(1,422)	(3,759)	(2,963)	(1,040)	(1,336)	(0,115)
Target industry (Various industries)							
Mining and manufacturing industry	0,5804	–1,9570**	–1,5457	–2,0027	1,0882	0,5804	0,9298
	(1,510)	(0,901)	(2,094)	(2,566)	(1,559)	(1,510)	(2,187)
Service industry	–4,5554*	–2,0916*	–7,5743***	–4,5387	–8,7535***	–4,5554*	1,4182
	(2,523)	(1,063)	(2,186)	(2,892)	(3,148)	(2,523)	(2,067)
Estimation period							
First year of estimation	–0,3279*	–0,0186	–0,8042***	–0,3905*	–0,4880***	–0,3279**	–0,0885
	(0,165)	(0,120)	(0,190)	(0,218)	(0,141)	(0,165)	(0,144)
Length of estimation	0,0973	0,0306	0,3900**	0,2856	0,1071	0,0973	–0,2929
	(0,192)	(0,192)	(0,185)	(0,241)	(0,178)	(0,192)	(0,371)
Data type (Panel data)							
Cross-sectional data	1,5207**	0,1251	4,4738**	3,3540***	2,4036***	1,5207**	0,6590
	(0,745)	(1,027)	(1,904)	(1,134)	(0,881)	(0,745)	(0,602)
Data source (Official statistics)							
Commercial database	–3,6847*	–0,4399	–5,5032*	–6,3894***	–4,1878**	–3,6847**	dropped
	(1,863)	(1,276)	(2,910)	(2,339)	(1,633)	(1,863)	
Original enterprise survey	–1,5737	–2,8247*	–3,4635	–2,0578	–0,4199	–1,5737	dropped
	(1,516)	(1,574)	(2,852)	(2,531)	(1,812)	(1,516)	
Estimator (OLS)							
FE	–0,8329	0,1057	–0,6264	0,3052	–0,8081	–0,8329	–0,8858
	(0,687)	(0,998)	(2,041)	(0,865)	(1,149)	(0,687)	(1,241)
RE	–0,1422	0,0711	–0,0950	0,1966	0,1636	–0,1422	0,1295
	(1,202)	(1,320)	(1,816)	(1,313)	(1,116)	(1,202)	(0,479)
Robust	0,1861	–0,0762	0,3604	0,4783	0,6445	0,1861	0,1378*
	(0,166)	(0,219)	(0,744)	(0,505)	(0,448)	(0,166)	(0,081)
GMM	–0,4532	–3,0727**	–1,2136	2,8091	–2,5369***	–0,4532	–6,1955***
	(1,610)	(1,315)	(2,293)	(1,953)	(0,560)	(1,610)	(0,528)
Other estimators	0,7304	–1,7510	–2,3857	0,1296	2,1753	0,7304	–5,8625***
	(1,875)	(1,577)	(2,190)	(2,145)	(1,724)	(1,875)	(1,726)
IV/2SLS/3SLS	1,6411	–1,6298*	1,2021	2,9497**	1,5451*	1,6411	–0,6323*
	(1,164)	(0,877)	(0,763)	(1,157)	(0,769)	(1,164)	(0,334)
Equation type (Models other than listed below)							
Difference model	0,6372	–0,4184	0,4674	0,2839	1,2838	0,6372	dropped
	(0,810)	(0,611)	(1,387)	(1,404)	(1,031)	(0,810)	

Table 5 (continued)

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Translog model	1,8818	–3,4098***	3,0088*	3,0475	4,4513***	1,8818	dropped
	(2,150)	(1,114)	(1,540)	(2,375)	(1,556)	(2,150)	
Treatment for the selection bias of privatized firms							
Treatment for selection bias	–0,9813	5,0513***	–0,1654	–3,4673	–1,8432	–0,9813	dropped
	(2,198)	(1,788)	(2,985)	(2,407)	(1,461)	(2,198)	
Control variable							
Market competition	–3,4960**	–0,3475	–2,9247*	–2,2435*	–3,8455***	–3,4960**	1,4979***
	(1,400)	(0,781)	(1,607)	(1,211)	(1,250)	(1,400)	(0,449)
Location fixed effects	0,5356	–0,9112	0,2855	1,5163	0,3813	0,5356	4,3851***
	(1,015)	(0,853)	(1,683)	(1,079)	(1,191)	(1,015)	(1,308)
Industry fixed effects	1,6333	0,3667	4,3062*	1,3343	2,8231***	1,6333	–0,9115***
	(1,167)	(0,680)	(2,188)	(1,531)	(0,603)	(1,167)	(0,276)
Time fixed effects	0,6688	–0,6930	0,8625	3,6953**	–0,4794	0,6688	0,0246
	(1,209)	(0,958)	(1,562)	(1,708)	(0,749)	(1,209)	(0,388)
Degree of freedom and research quality							
√Degree of freedom	0,0167	–0,0043	0,0342***	0,0037	0,0476**	0,0167	–0,0099**
	(0,011)	(0,007)	(0,010)	(0,012)	(0,019)	(0,011)	(0,004)
Quality level	0,1751***	–	0,2878***	0,2224***	0,2260***	0,1751***	dropped
	(0,045)	(–)	(0,073)	(0,069)	(0,059)	(0,045)	
Intercept	653,5104*	38,3569	1599,9800***	776,3919*	969,4583***	653,5104**	179,8913
	(328,718)	(240,184)	(378,227)	(434,291)	(280,592)	(328,718)	(289,255)
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,393	0,478	0,516	0,610	0,545	0,393	0,035

Notes: a Breusch-Pagan test: $\chi2$=0.00, p=1.000. b Hausman test: $\chi2$=142.44, p=0.000. c Breusch-Pagan test: $\chi2$=0.00, p=1.000. d Hausman test: $\chi2$=326.12, 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: Authors' estimations. See Appendix B for definitions and descriptive statistics of meta-independent variables.

Panel (b) of Table 5 provides estimation results based on Eq. (7), which uses the *t* value on the left-hand side. Once again, the meta-independent variable of foreign investors exhibits a positive and significant coefficient in all seven models. In other words, the statistical certainty of the impact of foreign ownership on performance and restructuring of Czech firms is higher than that of state ownership, with a range of 1.3958 to 3.0010. In contrast, the ownership variables of all domestic outsider investors and all insider ownership do not show significant estimates at all. This finding implies that there is no remarkable difference between the state and domestic private owners in terms of the statistical significance of the estimates reported in previous studies.

We also make estimates using the basic category of ownership variables corresponding to Figure 1, and we show the results in Table 6. For brevity, we have omitted estimates for other research conditions and intercepts; otherwise, the table is structured in exactly the same way as

Table 5. In Panel (a) of Table 6, the meta-independent variables, which assign a value of 1 to estimates of central government and other domestic non-financial companies as well as foreign investors, show positive coefficients that are robust across the models. The meta-independent variables associated with the unspecified domestic outsider investors and the unspecified domestic financial institutions exhibit significant coefficients in four of seven models, which is in line with the meta-synthesis results discussed in the previous subsection 4.1. In Panel (b) of Table 6, the categories of domestic outsider individual investors and foreign investors are the variables that demonstrate a robust and positive estimate, whereas that of unspecified domestic financial institutions delivers significant and negative coefficients.[21] These results denote that, most domestic institutional entities and insiders were not able to outperform the state as owners of Czech companies in the post-privatization period.

The above results of meta-regression estimations that control for heterogeneity among the existing studies are largely consistent with the results of the meta-synthesis mentioned in the previous subsection. However, we note that the disappointing empirical evidence regarding domestic outsider ownership may be closely linked with the research quality of the literature. Our claim is based on the evidence shown in Tables 7 and 8. In Table 7, we examine the relationship between estimates of ownership types and research quality using the aggregated category of ownership variables. We see that the interaction term between the ownership variable of all domestic outsiders and quality level produces positive and significant estimates in thirteen of fourteen models. This result implies that the ownership effect of domestic outside investors tends to be empirically verified in higher quality works if other research conditions are kept equal. Furthermore, in Table 8, we show results of the link between research quality and the basic category of ownership variables. The results show that this link is especially strong for domestic outsider individual investors, domestic banks, and other domestic non-financial companies because the coefficients associated with the interaction terms of these three ownership types with research quality level are positive and statistically significant in many models, regardless of the difference in dependent variables used.

[21] With respect to this finding, we must note that it is possible that an ultimate owner of some banks and investment funds is the state—Kočenda (1999) showed that the state was able to effectively control the banking sector even after bank privatization, and Hanousek et al. (2007) showed that this lasted until 2001. However, there is insufficient information in the extant literature to enable us to distinguish financial institutions under state control from others. For an exhaustive overview of state ownership and control in the Czech Republic, see Kočenda and Hanousek (2012b).

Table 6: Meta-regression analysis using basic category of ownership variables

(a) Dependent variable—PCC							
Estimator (Analytical weight in parentheses)	Cluster robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
Ownership variable type (Unspecified government)							
Central government	0,0424**	0,0404**	0,0457***	0,1093**	0,0684**	0,0424**	0,0324**
	(0,018)	(0,018)	(0,015)	(0,054)	(0,033)	(0,018)	(0,015)
Regional/local government	0,0083	0,0091	0,0077	0,0140	0,0546	0,0083	–0,0026
	(0,020)	(0,016)	(0,014)	(0,015)	(0,037)	(0,020)	(0,015)
Unspecified domestic outsider investors	0,0269	0,0125	0,0575*	0,1163***	0,0855*	0,0269	0,0543**
	(0,023)	(0,041)	(0,030)	(0,032)	(0,047)	(0,023)	(0,020)
Domestic outsider individual investors	0,0321	0,0534***	0,0335*	0,0178*	0,0371	0,0321	0,0298
	(0,022)	(0,016)	(0,019)	(0,010)	(0,024)	(0,022)	(0,023)
Unspecified domestic outsider institutional investors	0,0006	0,0140	–0,0053	0,0187	0,0146	0,0006	–0,0039
	(0,016)	(0,017)	(0,012)	(0,014)	(0,021)	(0,016)	(0,015)
Unspecified domestic financial institutions	–0,0669*	–0,0372	–0,0469	–0,0789***	–0,0505	–0,0669**	–0,0563*
	(0,034)	(0,023)	(0,025)	(0,026)	(0,032)	(0,034)	(0,032)
Domestic banks	–0,0047	0,0047	0,0052	0,0011	0,0194	–0,0047	–0,0161
	(0,024)	(0,022)	(0,018)	(0,012)	(0,024)	(0,024)	(0,021)
Domestic non-bank financial institutions	0,0010	0,0025	0,0025	–0,0233	0,0213	0,0010	–0,0062
	(0,020)	(0,024)	(0,013)	(0,016)	(0,023)	(0,020)	(0,018)
Domestic company groups and holdings	0,0068	0,0068	0,0082	0,0084	0,0350	0,0068	–0,0052
	(0,021)	(0,016)	(0,016)	(0,015)	(0,027)	(0,021)	(0,015)
Other domestic non-financial companies	0,0319*	0,0431***	0,0295*	0,0188*	0,0508**	0,0319*	0,0321*
	(0,019)	(0,014)	(0,015)	(0,011)	(0,024)	(0,019)	(0,019)
Foreign investors	0,0475***	0,0826***	0,0443***	0,0639***	0,0607**	0,0475***	0,0470***
	(0,016)	(0,015)	(0,013)	(0,015)	(0,026)	(0,016)	(0,015)
Unspecified insiders	–0,0198	–0,0251	0,0145	–0,0127	–0,0161	–0,0198	–0,0137
	(0,019)	(0,029)	(0,022)	(0,020)	(0,031)	(0,019)	(0,021)
Managers	0,0266	0,0052	0,0257	–0,0020	0,0042	0,0266	–0,0184
	(0,023)	(0,013)	(0,025)	(0,007)	(0,024)	(0,023)	(0,011)
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,524	0,648	0,537	0,823	0,612	0,524	0,100

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Ownership variable type (Unspecified government)							
Central government	0,8828	1,1311*	0,5618	1,8683	1,4723	0,8828	0,7754
	(0,608)	(0,613)	(0,877)	(1,629)	(1,318)	(0,608)	(0,477)
Regional/local government	0,0308	0,3458	–0,3983	–0,4013	1,1685	0,0308	–0,0827
	(0,587)	(0,523)	(0,774)	(0,855)	(1,220)	(0,587)	(0,465)
Unspecified domestic outsider investors	0,0106	–0,0026	–0,1641	1,6429	1,4184	0,0106	0,7433
	(0,931)	(1,469)	(2,037)	(2,073)	(1,023)	(0,931)	(0,572)
Domestic outsider individual investors	1,2812*	1,9243***	1,5718*	0,9701	1,5386*	1,2812*	1,0729
	(0,740)	(0,672)	(0,924)	(0,713)	(0,892)	(0,740)	(0,737)
Unspecified domestic outsider institutional investors	–0,7125	0,3396	–1,4358*	–1,1180	–0,4899	–0,7125	–0,3705
	(0,613)	(0,627)	(0,778)	(0,956)	(0,737)	(0,613)	(0,487)
Unspecified domestic financial institutions	–1,5929*	–1,2622*	–1,3560	–1,8867**	–0,8317	–1,5929*	–1,3975
	(0,879)	(0,699)	(0,922)	(0,717)	(0,873)	(0,879)	(0,853)
Domestic banks	–0,3834	0,1710	–0,7839	–0,1873	–0,1262	–0,3834	–0,4965
	(0,726)	(0,716)	(0,893)	(0,496)	(0,852)	(0,726)	(0,643)
Domestic non-bank financial institutions	–0,3516	0,1555	–0,7498	–1,6001**	–0,3109	–0,3516	–0,2189
	(0,595)	(0,779)	(0,654)	(0,599)	(0,676)	(0,595)	(0,547)
Domestic company groups and holdings	0,0115	0,1369	–0,1902	–0,8829	0,8497	0,0115	–0,1628
	(0,617)	(0,567)	(0,928)	(1,070)	(1,109)	(0,617)	(0,469)

Table 6 (continued)

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Other domestic non-financial companies	0,7991	1,4572***	0,6053	0,5809	1,4298*	0,7991	0,9038
	(0,636)	(0,494)	(0,633)	(0,378)	(0,718)	(0,636)	(0,608)
Foreign investors	1,2890**	2,8005***	2,0404*	2,0561***	2,6633***	1,2890**	1,3691***
	(0,597)	(0,441)	(1,061)	(0,570)	(0,709)	(0,597)	(0,395)
Unspecified insiders	–1,1503	–0,4505	–0,8014	–1,1126	–1,5698*	–1,1503*	–0,4352
	(0,696)	(0,804)	(1,131)	(0,835)	(0,883)	(0,696)	(0,559)
Managers	1,0299	0,1247	–0,2257	–0,0778	–0,5786	1,0299	–0,6713**
	(0,957)	(0,395)	(1,682)	(0,285)	(1,366)	(0,957)	(0,327)
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,426	0,523	0,520	0,621	0,560	0,426	0,059

Notes: a Breusch-Pagan test: $\chi2$=0.00, p=1.000. b Hausman test: $\chi2$=161.08, p=0.000. c Breusch-Pagan test: $\chi2$=0.00, p=1.000. d Hausman test: $\chi2$=354.00, 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: Authors' estimations. Estimates of other meta-independent variables and intercepts are omitted for brevity. See Appendix B for the definitions and descriptive statistics of meta-independent variables.

Table 7: Examination of the relationship between estimates of ownership type and research quality using the aggregated category of ownership variables

(a) Dependent variable—PCC							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust LS [Quality level]	Cluster-robust LS [*N*]	Cluster-robust LS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
Ownership variable type (State)							
All domestic outsider investors	–0,0274	–0,0292	–0,0131	–0,0485	0,0241	–0,0274	–0,0281
	(0,018)	(0,043)	(0,015)	(0,035)	(0,050)	(0,018)	(0,018)
Foreign investors	0,0194	0,0192	0,0152	0,0224	0,0553	0,0194	0,0252
	(0,016)	(0,027)	(0,014)	(0,020)	(0,047)	(0,016)	(0,017)
All insiders	0,0006	0,0090	0,0151	0,0167	0,0179	0,0006	0,0191
	(0,020)	(0,030)	(0,025)	(0,033)	(0,041)	(0,020)	(0,019)
Interaction with research quality							
All domestic outsider investors × Quality level	0,0031***	0,0034*	0,0020**	0,0028	0,0032***	0,0031***	0,0034***
	(0,001)	(0,002)	(0,001)	(0,002)	(0,001)	(0,001)	(0,001)
Foreign investors × Quality level	0,0055***	0,0053***	0,0050**	0,0043***	0,0052***	0,0055***	0,0042***
	(0,002)	(0,002)	(0,002)	(0,001)	(0,003)	(0,002)	(0,001)
All insiders × Quality level	0,0007	–0,0006	0,0014	–0,0007	–0,0022	0,0007	–0,0019
	(0,002)	(0,003)	(0,002)	(0,002)	(0,003)	(0,002)	(0,002)
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,465	0,621	0,515	0,801	0,562	0,465	0,038

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust LS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Ownership variable type (State)							
All domestic outsider investors	–1,0626*	–1,0170	–0,9532	–1,8355*	–0,5096	–1,0626*	–0,8384
	(0,574)	(1,319)	(0,590)	(0,940)	(1,061)	(0,574)	(0,516)
Foreign investors	0,6095	0,9109	1,9103	0,7761	–0,1933	0,6095	0,6495*
	(0,602)	(0,872)	(1,368)	(0,845)	(1,214)	(0,602)	(0,372)
All insiders	0,0026	0,2702	1,3768	0,3009	–0,7287	0,0026	0,4222
	(0,717)	(0,910)	(1,423)	(1,306)	(1,547)	(0,717)	(0,605)

Table 7 (continued)

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust LS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Interaction with research quality							
All domestic outsider investors × Quality level	0,1334***	0,1196*	0,1163***	0,1122**	0,1624***	0,1334***	0,1115***
	(0,032)	(0,061)	(0,039)	(0,050)	(0,035)	(0,032)	(0,027)
Foreign investors × Quality level	0,1335*	0,1557**	0,0032	0,1323***	0,1310*	0,1335*	0,1440***
	(0,073)	(0,059)	(0,202)	(0,044)	(0,071)	(0,073)	(0,041)
All insiders × Quality level	–0,0144	–0,00486	–0,1685	–0,0130	–0,0295	–0,0144	–0,0352
	(0,082)	(0,0755)	(0,141)	(0,069)	(0,097)	(0,082)	(0,056)
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,404	0,494	0,518	0,615	0,549	0,404	0,045

Notes: a Breusch-Pagan test: $\chi2$=0.00, p=1.000. b Hausman test: $\chi2$=151.11, p=0.000. c Breusch-Pagan test: $\chi2$=0.00, p=1.000. d Hausman test: $\chi2$=304.18, 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: Authors' estimations. Estimates of other meta-independent variables and intercepts are omitted for brevity. See Appendix B for the definitions and descriptive statistics of meta-independent variables.

Table 8: Examination of the relationship between estimates of ownership types and research quality using basic categories of ownership variables

(a) Dependent variable—PCC							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
Ownership variable type (Unspecified government)							
Central government	dropped	dropped	dropped	dropped	dropped	dropped	dropped
Regional/local government	dropped	dropped	dropped	dropped	dropped	dropped	dropped
Unspecified domestic outsider investors	–0,0207	dropped	–0,0342	–0,0592***	0,0949	–0,0207	0,0376
	(0,026)		(0,042)	(0,022)	(0,081)	(0,026)	(0,032)
Domestic outsider individual investors	–0,0088	–0,0115	–0,0048	–0,0192	0,0343	–0,0088	–0,0144
	(0,026)	(0,051)	(0,018)	(0,014)	(0,048)	(0,026)	(0,025)
Unspecified domestic outsider institutional investors	–0,0101	–0,0434	–0,0102	0,0149	0,0298	–0,0101	–0,0258*
	(0,018)	(0,034)	(0,016)	(0,021)	(0,038)	(0,018)	(0,015)
Unspecified domestic financial institutions	–0,1107**	–0,0755	–0,0613	–0,1297***	–0,0698	–0,1107***	–0,0959**
	(0,043)	(0,062)	(0,048)	(0,026)	(0,054)	(0,043)	(0,042)
Domestic banks	–0,0273	–0,0569	–0,0153	–0,0372	0,0256	–0,0273	–0,0362
	(0,025)	(0,052)	(0,020)	(0,034)	(0,047)	(0,025)	(0,022)
Domestic non-bank financial institutions	–0,0103	–0,0404	–0,0036	–0,0204	0,0459	–0,0103	–0,0219
	(0,021)	(0,042)	(0,016)	(0,023)	(0,041)	(0,021)	(0,018)
Domestic company groups and holdings	–0,0139	–0,0326	–0,0118	–0,0124	0,0774	–0,0139	–0,0232
	(0,022)	(0,035)	(0,016)	(0,020)	(0,058)	(0,022)	(0,016)
Other domestic non-financial companies	0,0110	0,0061	0,0122	–0,0059	0,0626	0,0110	0,0113
	(0,021)	(0,045)	(0,018)	(0,024)	(0,048)	(0,021)	(0,021)
Foreign investors	0,0167	0,0117	0,0162	0,0145	0,0575	0,0167	0,0207
	(0,017)	(0,025)	(0,015)	(0,015)	(0,050)	(0,017)	(0,016)
Unspecified insiders	–0,0014	–0,0065	0,0297	0,0146	0,0583	–0,0014	0,0224
	(0,021)	(0,025)	(0,035)	(0,027)	(0,044)	(0,021)	(0,028)
Managers	0,0188	dropped	–0,0081	0,0234	0,0013	0,0188	0,0067
	(0,031)		(0,033)	(0,033)	(0,042)	(0,031)	(0,010)
Interaction term							
Central government × Quality level	0,0224	0,0061	0,0252**	0,0706	0,0628*	0,0224	0,0139
	(0,015)	(0,024)	(0,012)	(0,045)	(0,033)	(0,015)	(0,012)
Regional/local government × Quality level	–0,0058	–0,0225	–0,0057	–0,0074	0,0500	–0,0058	–0,0133
	(0,016)	(0,025)	(0,011)	(0,014)	(0,040)	(0,016)	(0,012)
Unspecified domestic outsider investors × Quality level	0,0521**	0,0158	0,0805**	0,1334***	–0,0025	0,0521**	–0,0024
	(0,023)	(0,027)	(0,036)	(0,027)	(0,048)	(0,023)	(0,018)

Table 8 (continued)

(a) Dependent variable—PCC							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[1]	[2]	[3]	[4]	[5]	[6] [a]	[7] [b]
Domestic outsider individual investors × Quality level	0,0046***	0,0048*	0,0046***	0,0032***	0,0005	0,0046***	0,0051***
	(0,001)	(0,003)	(0,001)	(0,001)	(0,003)	(0,001)	(0,001)
Unspecified domestic outsider institutional investors × Quality level	0,0009	0,0044**	–0,0008	–0,0027	–0,0019	0,0009	0,0030***
	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,001)
Unspecified domestic financial institutions × Quality level	0,0056*	0,0028	0,0017	0,0060***	0,0033	0,0056*	0,0052*
	(0,003)	(0,003)	(0,003)	(0,002)	(0,004)	(0,003)	(0,003)
Domestic banks × Quality level	0,0029***	0,0047*	0,0026*	0,0026	–0,0006	0,0029***	0,0026***
	(0,001)	(0,003)	(0,001)	(0,002)	(0,003)	(0,001)	(0,001)
Domestic non-bank financial institutions × Quality level	–0,0006	0,0032	–0,0023	–0,0019	–0,0044*	–0,0006	0,0014
	(0,002)	(0,003)	(0,002)	(0,001)	(0,003)	(0,002)	(0,002)
Domestic company groups and holdings × Quality level	0,0033	0,0022	0,0029	0,0001	–0,0053	0,0033	0,0025
	(0,003)	(0,002)	(0,003)	(0,002)	(0,004)	(0,003)	(0,001)
Other domestic non-financial companies × Quality level	0,0022**	0,0026	0,0019*	0,0021	–0,0019	0,0022**	0,0023**
	(0,001)	(0,002)	(0,001)	(0,001)	(0,003)	(0,001)	(0,001)
Foreign investors × Quality level	0,0050***	0,0053***	0,0044*	0,0044***	0,0083***	0,0050***	0,0038***
	(0,001)	(0,002)	(0,002)	(0,001)	(0,003)	(0,001)	(0,001)
Unspecified insiders × Quality level	–0,0012	–0,0010	–0,0013	–0,0030**	–0,0056**	–0,0012	–0,0036**
	(0,001)	(0,002)	(0,002)	(0,001)	(0,002)	(0,001)	(0,001)
Managers × Quality level	0,0015	0,0012*	0,0035	–0,0010	0,0009	0,0015	dropped
	(0,002)	(0,001)	(0,003)	(0,002)	(0,003)	(0,002)	
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,547	0,667	0,550	0,841	0,627	0,547	0,128

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Ownership variable type (Unspecified government)							
Central government	dropped	dropped	dropped	dropped	dropped	dropped	dropped
Regional/local government	dropped	dropped	dropped	dropped	dropped	dropped	dropped
Unspecified domestic outsider investors	–1,7164*	dropped	–2,8081	–4,3641***	0,6575	–1,7164*	0,0204
	(0,883)		(2,190)	(1,474)	(1,634)	(0,883)	(0,803)
Domestic outsider individual investors	–0,8008	–0,8077	–1,2220	–1,4226**	0,0213	–0,8008	–0,6259
	(0,820)	(1,661)	(0,782)	(0,615)	(1,266)	(0,820)	(0,764)
Unspecified domestic outsider institutional investors	–1,6439**	–1,5096	–1,4488	–1,6239	–1,5989	–1,6439**	–1,1854**
	(0,803)	(1,201)	(1,196)	(1,379)	(1,184)	(0,803)	(0,451)
Unspecified domestic financial institutions	–2,1246*	–2,1995	–0,2636	–2,6934**	–1,0035	–2,1246*	–1,9076*
	(1,124)	(1,841)	(1,339)	(1,006)	(1,342)	(1,124)	(1,093)
Domestic banks	–1,5276*	–1,6588	–1,3803	–2,2851	–1,5384	–1,5276**	–1,2472*
	(0,770)	(1,687)	(1,012)	(1,413)	(1,470)	(0,770)	(0,679)
Domestic non-bank financial institutions	–1,0198	–1,1664	–0,7593	–2,3010*	–0,7310	–1,0198	–0,8436
	(0,668)	(1,373)	(0,786)	(1,137)	(1,178)	(0,668)	(0,559)
Domestic company groups and holdings	–0,8544	–0,8706	–0,9031	–1,2734	1,7137	–0,8544	–0,7971
	(0,649)	(1,131)	(0,759)	(1,020)	(2,204)	(0,649)	(0,489)
Other domestic non-financial companies	–0,3435	–0,1171	–0,5887	–0,8936	0,5933	–0,3435	–0,0495
	(0,725)	(1,426)	(0,777)	(0,816)	(1,202)	(0,725)	(0,620)
Foreign investors	0,4038	0,7136	1,7307	0,4651	–0,2556	0,4038	0,5000
	(0,661)	(0,833)	(1,328)	(0,785)	(1,228)	(0,661)	(0,416)
Unspecified insiders	0,1771	–0,1422	1,9678	0,4852	1,3005	0,1771	0,4198
	(0,617)	(0,798)	(1,589)	(0,979)	(1,530)	(0,617)	(0,856)
Managers	–0,4368	dropped	0,6292	0,1866	–1,9098	–0,4368	0,2739
	(1,914)		(3,529)	(2,491)	(2,026)	(1,914)	(0,335)

Table 8 (continued)

(b) Dependent variable—*t* value							
Estimator (Analytical weight in parentheses)	Cluster-robust OLS	Cluster-robust WLS [Quality level]	Cluster-robust WLS [*N*]	Cluster-robust WLS [1/*SE*]	Cluster-robust WLS [1/*EST*]	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Meta-independent variable (Default)/Model	[8]	[9]	[10]	[11]	[12]	[13] [c]	[14] [d]
Interaction term							
Central government × Quality level	0,1871 (0,481)	0,0711 (0,783)	0,1140 (0,600)	0,8071 (1,380)	1,0060 (1,373)	0,1871 (0,481)	0,2025 (0,378)
Regional/local government × Quality level	–0,5155 (0,447)	–0,6664 (0,814)	–0,6630 (0,539)	–1,1250 (0,773)	0,6646 (1,249)	–0,5155 (0,447)	–0,4968 (0,366)
Unspecified domestic outsider investors × Quality level	1,6251* (0,945)	0,1187 (1,009)	2,2061 (2,770)	4,4337** (2,085)	0,6654 (1,706)	1,6251* (0,945)	0,4384 (0,372)
Domestic outsider individual investors × Quality level	0,2395*** (0,062)	0,2040** (0,093)	0,3499*** (0,073)	0,2144*** (0,066)	0,1674 (0,102)	0,2395*** (0,062)	0,1952*** (0,038)
Unspecified domestic outsider institutional investors × Quality level	0,1301 (0,084)	0,1417* (0,075)	–0,0511 (0,159)	–0,0233 (0,144)	0,1465 (0,117)	0,1301 (0,084)	0,1212*** (0,035)
Unspecified domestic financial institutions × Quality level	0,0470 (0,066)	0,0634 (0,089)	–0,1165 (0,079)	0,0407 (0,068)	–0,0190 (0,087)	0,0470 (0,066)	0,0519 (0,058)
Domestic banks × Quality level	0,1774*** (0,047)	0,1371 (0,086)	0,0518 (0,120)	0,1434* (0,072)	0,1727* (0,102)	0,1774*** (0,047)	0,0985*** (0,030)
Domestic non-bank financial institutions × Quality level	0,0522 (0,067)	0,0999 (0,086)	–0,1311 (0,130)	0,0351 (0,066)	0,0381 (0,104)	0,0522 (0,067)	0,0670 (0,060)
Domestic company groups and holdings × Quality level	0,1130 (0,171)	0,0089 (0,075)	0,1056 (0,266)	–0,1307 (0,149)	–0,1341 (0,203)	0,1130 (0,171)	0,0621 (0,051)
Other domestic non-financial companies × Quality level	0,1462*** (0,046)	0,1156 (0,069)	0,1715** (0,067)	0,1222* (0,067)	0,1000 (0,084)	0,1462*** (0,046)	0,1226*** (0,030)
Foreign investors × Quality level	0,1331* (0,072)	0,1523*** (0,052)	–0,0225 (0,216)	0,1408*** (0,042)	0,1297* (0,074)	0,1331* (0,072)	0,1356*** (0,038)
Unspecified insiders × Quality level	–0,1236** (0,060)	–0,0160 (0,057)	–0,2959*** (0,108)	–0,1679* (0,089)	–0,2047** (0,091)	–0,1236** (0,060)	–0,0746* (0,043)
Managers × Quality level	0,1553 (0,164)	0,0329 (0,022)	–0,0866 (0,295)	0,0041 (0,138)	0,1829 (0,160)	0,1553 (0,164)	dropped
K	1171	1171	1171	1171	1171	1171	1171
R^2	0,445	0,541	0,525	0,629	0,575	0,445	0,076

Notes: a Breusch-Pagan test: $\chi2$=0.00, p =1.000. b Hausman test: $\chi2$=315.24, p=0.000. c Breusch-Pagan test: $\chi2$=0.00, p=1.000. d Hausman test: $\chi2$=175.72, p=1.000. Figures in parentheses beneath the regression coefficients are robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Source: Authors' estimations. Estimates of other meta-independent variables and intercepts are omitted for brevity. See Appendix B for the definitions and descriptive statistics of meta-independent variables.

5. Assessment of publication selection bias

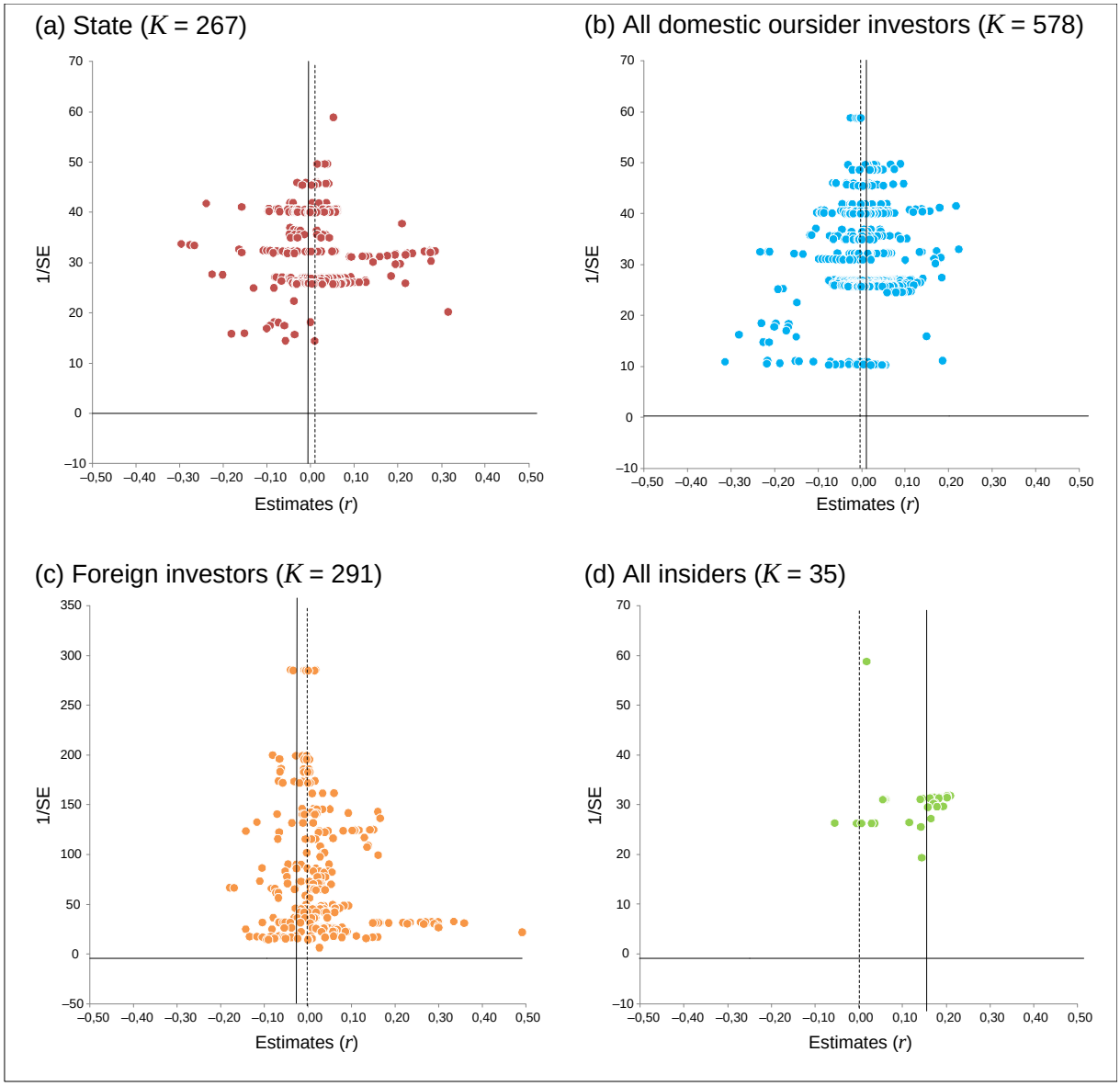
As the final step, we assess the degree of publication selection bias in the literature and examine the presence of genuine empirical evidence in the collected estimates.

Figure 4 illustrates a funnel plot of the PCCs against the respective inverse of the standard errors by the aggregated category of ownership variables. In Panels (a) and (b) of this figure, relatively symmetric and inverted funnel-shaped distributions are shown in both cases when either zero or the mean value of the top 10% most-precise estimates is used as an approximate value of the true effect. This evidence suggests that publication selection bias (favoring results with the expected sign) is less likely to occur in empirical research that assesses the ownership effect of the state and domestic outsider investors on the performance and restructuring of Czech firms.[22] In contrast, Panel (c) displays an asymmetric distribution of PCCs irrespective of the assumption of the true effect, thus, indicating the presence of publication selection bias in the collected estimates of foreign ownership. With regard to insider ownership, it is difficult to judge the presence of publication selection in Panel (d) due to the limited number of collected estimates.

The estimation results of the meta-regression models specially designed to examine publication selection bias and the presence of genuine empirical evidence are reported in Table 9. In Panel (a) of the table, the null hypothesis that the intercept term ($\beta 0$) is zero in Eq. (8) is rejected in the four models from [9] to [12]. This result implies the strong presence of publication selection bias in the empirical evidence of foreign ownership corresponding with Panel (c) of Figure 4. In contrast, the null hypothesis cannot be rejected in two or more models in the case of three other ownership types. This result suggests that an arbitrary manipulation to report evidence in favor of a specific conclusion is unlikely in studies assessing the impact of domestic ownership, including ownership by the state.

[22] In accord with Stanley (2005), we assume that the mean of the top 10% most-precise estimates represents the approximate value of the true effect.

Figure 4: Funnel plot of estimates by the aggregated category of ownership variables



Note: Solid lines indicate the mean of the top 10% most-precise estimates. The values for state, all domestic outsider investors, foreign investors, and all insiders are –0.007, 0.011, –0.017, and 0.157, respectively. Source: Authors' illustrations

Table 9: Meta-regression analysis of publication selection by the aggregated category of ownership variables

(a) FAT-PET test (Equation: $t = \beta_0 + \beta_1(1/SE) + v$)								
Estimates to test	I. State				II. All domestic oursider investors			
Estimator	OLS	Cluster-robust OLS	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV	OLS	Cluster-robust OLS	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Model	[1]	[2]	[3] [a]	[4] [b]	[5]	[6]	[7] [c]	[8] [d]
切片(FAT: H_0: $\beta_0 = 0$)	1,1898**	1,1898	0,8718	0,2912	–0,3689	–0,3689	1,9388	3,6493***
	(0,592)	(1,523)	(0,930)	(0,028)	(0,242)	(0,673)	(1,784)	(0,792)
1/*SE* (PET: H_0: $\beta_1 = 0$)	–0,0228	–0,0228	0,0099	0,0047	0,0205***	0,0205	0,0734***	0,1062***
	(0,017)	(0,037)	(0,020)	(0,028)	(0,008)	(0,017)	(0,024)	(0,025)
K	267	267	267	267	578	578	578	578
R^2	0,004	0,004	0,004	0,004	0,010	0,010	0,010	0,010

Estimates to test	III. Foreign investors				IV. All insiders			
Estimator	OLS	Cluster-robust OLS	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV	OLS	Cluster-robust OLS	Cluster-robust random-effects panel GLS	Cluster-robust fixed-effects panel LSDV
Model	[9]	[10]	[11] [e]	[12] [f]	[13]	[14]	[15] [g]	[16] [h]
切片(FAT: H_0: $\beta_0 = 0$)	2,1655***	2,1655*	3,0359***	2,1053***	2,9085	2,9085	1,3423	–6,9881
	(0,378)	(1,152)	(0,805)	(0,467)	(2,850)	(3,492)	(2,761)	(4,808)
1/*SE* (PET: H_0: $\beta_1 = 0$)	–0,0113**	–0,0113	–0,0086	–0,0105	0,0234	0,0234	0,0447	0,3489*
	(0,005)	(0,017)	(0,008)	(0,018)	(0,094)	(0,111)	(0,093)	(0,158)
K	291	291	291	291	35	35	35	35
R^2	0,016	0,016	0,016	0,016	0,004	0,004	0,004	0,004

(b) PEESE approach (Equation: $t = \beta_0 SE + \beta_1(1/SE) + v$)								
Estimates to test	I. State				II. All domestic oursider investors			
Estimator	OLS	Cluster-robust OLS	Random-effects panel ML	Population-averaged panel GEE	OLS	Cluster-robust OLS	Random-effects panel ML	Population-averaged panel GEE
Model	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
SE	12,3515	12,3515	17,8604	14,9948	–6,1884**	–6,1884	40,9987***	–0,8125
	(8,644)	(22,350)	(17,164)	(12,362)	(2,556)	(6,152)	(12,375)	(8,129)
1/*SE* (H_0: $\beta_1 = 0$)	0,0008	0,0008	0,0217	0,0214	0,0154***	0,0154***	0,0302**	0,0083
	(0,009)	(0,020)	(0,018)	(0,014)	(0,004)	(0,005)	(0,014)	(0,007)
K	267	267	267	267	578	578	578	578
R^2	0,023	0,023	–	–	0,035	0,035	–	–

Estimates to test	III. Foreign investors				IV. All insiders			
Estimator	OLS	Cluster-robust OLS	Random-effects panel ML	Population-averaged panel GEE	OLS	Cluster-robust OLS	Random-effects panel ML	Population-averaged panel GEE
Model	[25]	[26]	[27]	[28]	[29]	[30]	[31]	[32]
SE	31,9225***	31,9225	38,9029*	44,0129**	32,4323	32,4323	8,1836	25,0633
	(7,709)	(26,927)	(20,378)	(20,571)	(55,663)	(67,111)	(48,552)	(48,476)
1/*SE* (H_0: $\beta_1 = 0$)	0,0023	0,0023	–0,0023	0,0027	0,0821	0,0821	0,0755	0,0661
	(0,004)	(0,016)	(0,006)	(0,014)	(0,065)	(0,075)	(0,048)	(0,061)
K	291	291	291	291	35	35	35	35
R^2	0,034	0,034	–	–	0,007	0,007	–	–

Notes: a Breusch-Pagan test: $\chi2$=296.09, p=0.000. b Hausman test: $\chi2$=0.11, p=0.745. c Breusch-Pagan test: $\chi2$=113.14, p=0.000. d Hausman test: $\chi2$=6.58, p=0.010. e Breusch-Pagan test: $\chi2$=627.80, p=0.000. f Hausman test: $\chi2$=1.14, p=0.286. g Breusch-Pagan test: $\chi2$=1.70, p=0.096. h Hausman test: $\chi2$=3.67, p=0.055. Figures in parentheses beneath the regression coefficients are standard errors. Except for models [19], [24], [28], and [32], robust standard errors are estimated. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Source: Authors' estimations

With respect to the presence of genuine empirical evidence in the collected estimates, Panel (a) of Table 9 shows that the null hypothesis that the coefficient of the inverse of the standard error (β_1) is zero in Eq. (8) is rejected in models [5], [7], and [8]. Furthermore, in Panel (b) of the same table, the coefficient of the inverse of the standard error (β_1) in Eq. (9) is estimated with statistical significance at the 1% or 5% level in models [21], [22], and [23]. These results suggest that the existing literature listed in Table 3 may include genuine evidence regarding the ownership effect of domestic outsider investors, and its publication-bias-adjusted effect size may range between 0.0154 and 0.0302. However, as for three other types of ownership, the results from the precision-effect test (PET) and the precision-effect estimate with standard error (PEESE) do not justify the presence of non-zero genuine evidence in the extant literature.

Table 10: Summary of publication selection bias test

Ownership variable type[a]	Number of estimates (K)	Test results[b]		
		Funnel asymmetry test (FAT) (H_0: $\beta_0 = 0$)	Precision-effect test (PET) (H_0: $\beta_1 = 0$)	Precision-effect estimate with standard error (PEESE) (H_0: $\beta_1 = 0$)[c]
I. State	267	Not rejected	Not rejected	Not rejected
1. Unspecified government	224	Not rejected	Not rejected	Not rejected
2. Central government	23	Not rejected	Not rejected	Not rejected
3. Regional/local government	20	Not rejected	Not rejected	Not rejected
II. All domestic outsider investors	578	Not rejected	Rejected	Rejected (0.0154/0.0302)
4. Unspecified domestic outsider investors	23	Not rejected	Rejected	Rejected (0.0551)
5. Domestic outsider individual investors	75	Not rejected	Not rejected	Not rejected
6. Unspecified domestic outsider institutional investors	28	Not rejected	Not rejected	Not rejected
7. Unspecified domestic financial institutions	88	Rejected	Rejected	Rejected (–0.0904/–0.0170)
8. Domestic banks	76	Not rejected	Not rejected	Not rejected
9. Domestic non-bank financial institutions	115	Not rejected	Not rejected	Not rejected
10. Domestic company groups and holdings	43	Not rejected	Not rejected	Not rejected
11. Other domestic non-financial companies	130	Rejected	Not rejected	Not rejected
III (12). Foreign investors	285	Rejected	Not rejected	Not rejected
IV. All insiders	35	Not rejected	Not rejected	Not rejected
13. Unspecified insiders	27	Not rejected	Not rejected	Not rejected
14. Managers	8	Rejected	Rejected	Rejected (0.0597)

Notes: a Ownership variable types with Arabic numerals belong to the basic category, while those with Roman numerals belong to the aggregated category. b The null hypothesis is rejected only when more than 2 of 4 models show a statistically siginificent estimate. c Figures in parentheses are PSB-adjusted estimates. If two estimates are reported, the left and right figures denote a mininum and maxinum estimate, respectively. Source: Authors' estimations

The above findings are summarized in Table 10. This table also reports the test results by the basic category of ownership variables. As reported in the table, the funnel asymmetry test (FAT) rejects the null hypothesis of no bias in only four of seventeen cases. PET and PEESE results indicate that the collected estimates contain non-zero genuine evidence for four cases. Overall, we are unable to grasp the true effect of many types of corporate ownership. In order to account for heterogeneity among studies we re-estimated Eqs. [8] and [9] with controls for various study conditions and found that the multivariate setting does not materially affect the test results already presented in Tables 9 and 10. Further development and improvement in this study area are desirable to capture the true impact of ownership structures on the performance of Czech companies.

6. Conclusions

In this paper, we used a total of 1171 estimates extracted from 34 previous studies and performed a meta-analysis to examine the relationship between ownership structure and firm performance in the Czech Republic in the post-privatization period. The results of meta-synthesis and the MRA conducted in Section 4 revealed that, in contrast to the remarkable effect of foreign ownership on firm performance and restructuring activities, domestic private entities were incapable of outperforming the state as owners of Czech companies.

The results of our synthesis document the large and highly significant impact of insider ownership. The meta-regression estimation, however, indicates that this result is likely produced by a series of specific research conditions in relevant studies other than ownership type. Specifically, with respect to domestic outsider investors, both the meta-synthesis and the MAR demonstrate that their ownership effect is not statistically significantly different from that of state ownership. In this regard, the evidence suggests that domestic financial institutions, including commercial banks, ineffectively managed their own firms. However, the picture changes if we derive our evidence from the (methodologically) higher quality papers only: these studies tend to deliver larger and statistically significant effects of domestic outsider ownership on firm performance. We believe that a proper treatment of the ownership endogeneity and of the omitted variable bias in the methodologically better executed research is behind such a grave discrepancy. Further, this evidence casts some doubts on the widespread approach to include all available studies in a meta-analysis (absence of the selection bias) and not to eliminate those that are methodologically less qualified.

In addition to the main results we also assessed the presence of the publication selection bias in the analyzed literature. We were surprised to find that the collected estimates do not contain genuine evidence for most ownership effects due to presence of strong publication bias. The finding has a direct implication for our main results: the very absence of the genuine empirical evidence in the literature may cause the opaqueness related to many ownership types in the Czech privatized firms. Those would be the cases when “even meta-analysis is not sure” about the true effect between the ownership structures and firm performance as the influence of the publication bias is so strong.

The above key results obtained from the meta-analysis suggest several indirect implications in the context of the Czech privatization policy. The overwhelming positive effect of foreign

ownership suggests that the participation of foreign owners in the post-privatization process might bring additional benefits on top of firms' performance alone. In the case of foreign direct investment, it has been shown that a foreign ownership (through a multinational enterprise) impacts local firms in a host economy via productivity spillovers (Görg and Strobl, 2001). There is no reason to believe that Czech firms should be an exception, and the positive impact of foreign owners might bring secondary benefits in a form of spillovers.

On the other hand, evidence of the relatively good performance effect of state ownership does not resonate well with earlier arguments of state firms' inferior performances (Shleifer and Vishny, 1994; Qian, 1996), lack of innovations and restructuring therein (Frydman et al., 2006), or quest for higher sales prices at the expense of efficiency due to delayed restructuring (Bennett et al., 2005). Hence, our meta-analysis does not offer a black-and-white picture of the state-versus-private domestic ownership privatization policy.

We should be cautious in making any really long-term conclusions, though. First, because of the existence of a strong publication selection bias, we are unable to really capture the true effect of many types of ownership categories in privatized Czech firms. Second, our meta-analysis covers studies targeting firms that were mass-privatized from 1991–1995 and employ economic data from two decades, between 1989 and 2009. Kočenda and Hanousek (2012a) showed that following their initial restructuring, firms that were broken up prior to their further privatization exhibited positive performance effects. However, despite the fact that the initial effects were positive, after a certain point, they disappeared within a short time. We can draw an analogy related to the meta-analysis outcomes. Maybe we have not yet reached the point. For the moment, our analysis brings solid results based on a large number of past studies. However, effects related to privatization and the resulting ownership structures might well be different in future studies that will explore the issue after even more time has elapsed. Finally, broader coverage including other post-transition countries and macroeconomic effects represent a wide opportunity for further meta-analysis research.

Appendix A: Czech privatization auction scheme

Following Aggarwal and Harper (2000), the design of the Czech privatization auction scheme can be described formally by the following simple rules:

1. There are M firms with N shares of each firm for a total of $M \times N$ shares in the auction. These shares are offered in rounds r $(r = 1 \ldots i)$. The number of shares offered in each round is $S_{m,r}$ $(S_{m,1} = N_{m,1})$ at price $p_{m,r}$. In the first round, all prices (but not book values) are equal for all firms. At the beginning of each round, orders are taken for each firm at price $p_{m,r}$ and the number of shares $n_{m,r}$. The sum of shares ordered from all investors in each round for each firm is given by:
   $D_{m,r} = \sum_{n=1}^{N} n_{m,r}$
2. The number of vouchers is known, and no new coupons enter the auction after the first round has begun.
3. Trading occurs when the following condition holds:
   $\alpha S_{m,r} < D_{m,r} < \gamma S_{m,r}$, $\alpha < 1$ and $\gamma > 1$
   $\alpha < \frac{D_{m,r}}{S_{m,r}} < \gamma$, remaining shares, $S_{m,r} - D_{m,r}$, proceed to the next round.

If demand is lower than the boundary condition, $D_{m,r} < \alpha S_{m,r}$, then no shares are sold, and the price is lowered for the next round, $p_{m,r+1} = f(\alpha S_{m,r} / D_{m,r})$. If the demand is greater than the supply, then no shares are sold, and the price is raised for the next round. That is, if $D_{m,r} > \gamma S_{m,r}$, then $p_{m,r} = f(\gamma S_{m,r} / D_{m,r})$. If $S_{m,r} < D_{m,r} < \gamma S_{m,r}$, then shares are prorated. α and γ are constant; however, they are not known initially. The equilibrium price is $D_m / S_m = 1$. After the auction began, these boundary conditions remained constant and were known to be $\alpha = 0$ and $\gamma = 1.25$.

The above auction rules for accepting bids can be translated into the following brief narrative for easy accessibility:

1. Prices in the first round of the wave were equal for all stocks (since the number of shares issued was determined by a firm's book value).

2. In each successive round, prices were adjusted up or down as a function of the excess demand for or supply of the stock in the previous round. Thus, if there was a large excess demand in round *r*, the price was reduced in round *r+1*.
3. The price (number of points per share) was administered by the Pricing Committee, which never publicly revealed its algorithm for adjusting share prices between rounds. It was generally noted and observed that prices would rise for shares in excess demand and fall for shares in excess supply.
4. If bids for a firm did not exceed its supply of shares, the demand was satisfied, and the remaining shares were deferred to the next round.
5. If the demand for a firm's shares exceeded supply by less than 25%, and the clearing of the market could be realized by prorating the demand of the Privatization Investment Funds (PIF), then individual investors had their demand met, while PIFs were rationed in proportion to their bids. In such cases, all shares were sold, and the firm was not available for purchase in succeeding rounds.
6. If demand exceeded supply by more than 25%, then no bids were accepted, and all shares were deferred to the next round. Theoretically, bidding for firms in excess supply means overpricing; however, no bids should be accepted under excess demand.

Appendix B: Name, definition, and descriptive statistics of meta-independent variables

Variable name	Definition	Descriptive statistics		
		Mean	Median	S.D.
All domestic outsider investors	1 = if the ownership variable used for estimation belongs to the aggregated category of all domestic outsider investors, 0 = otherwise	0,494	0	0,500
Foreign investors	1 = if the ownership variable used for estimation belongs to the category of foreign investors, 0 = otherwise	0,249	0	0,432
All insiders	1 = if the ownership variable used for estimation belongs to the aggregated category of all insiders, 0 = otherwise	0,030	0	0,170
Central government	1 = if the ownership variable used for estimation belongs to the basic category of central government, 0 = otherwise	0,020	0	0,139
Regional/local government	1 = if the ownership variable used for estimation belongs to the basic category of regional/local government, 0 = otherwise	0,017	0	0,130
Unspecified domestic outsider investors	1 = if the ownership variable used for estimation belongs to the basic category of unspecified domestic outsider investors, 0 = otherwise	0,020	0	0,139
Domestic outsider individual investors	1 = if the ownership variable used for estimation belongs to the basic category of domestic outsider individual investors, 0 = otherwise	0,064	0	0,245
Unspecified domestic outsider institutional investors	1 = if the ownership variable used for estimation belongs to the basic category of unspecified domestic outsider institutional investors, 0 = otherwise	0,024	0	0,153
Unspecified domestic financial institutions	1 = if the ownership variable used for estimation belongs to the basic category of unspecified domestic financial institutions, 0 = otherwise	0,075	0	0,264
Domestic banks	1 = if the ownership variable used for estimation belongs to the basic category of domestic banks, 0 = otherwise	0,065	0	0,246
Domestic non-bank financial institutions	1 = if the ownership variable used for estimation belongs to the basic category of domestic non-bank financial institutions, 0 = otherwise	0,098	0	0,298
Domestic company groups and holdings	1 = if the ownership variable used for estimation belongs to the basic category of domestic company groups and holdings, 0 = otherwise	0,037	0	0,188
Other domestic non-financial companies	1 = if the ownership variable used for estimation belongs to the basic category of other domestic non-financial companies, 0 = otherwise	0,111	0	0,314
Unspecified insiders	1 = if the ownership variable used for estimation belongs to the basic category of unspecified insiders, 0 = otherwise	0,023	0	0,150
Managers	1 = if the ownership variable used for estimation belongs to the basic category of managers, 0 = otherwise	0,007	0	0,082
Dummy-type variable	1 = if the ownership variable is a dummy variable, 0 = otherwise	0,537	1	0,499
Lagged variable	1 = if a lagged ownership variable is used for estimation, 0 = otherwise	0,146	0	0,353
With an interaction term(s)	1 = if the estimation is carried out with an interaction term(s) of ownership variables, 0 = otherwise	0,089	0	0,285
Efficiency	1 = if efficiency is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,488	0	0,500
Productivity	1 = if productivity is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,168	0	0,374
Firm value	1 = if firm value is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,126	0	0,332
Export	1 = if export probability is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,001	0	0,029
Restructuring	1 = if restructuring intensity is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,003	0	0,051
Wage	1 = if wage is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,022	0	0,147
Employment	1 = if employment is adopted as the benchmark index of firm performance variables, 0 = otherwise	0,001	0	0,029
Mining and manufacturing industry	1 = if the target industry is the mining and manufacturing industry, 0 = otherwise	0,103	0	0,305
Service industry	1 = if the target industry is the service industry, 0 = otherwise	0,017	0	0,130
First year of estimation	First year of the estimation period	1995,499	1994	3,575
Length of estimation	Years of the estimation period	3,722	4	2,154
Cross-sectional data	1 = if cross-sectional data is employed for empirical analysis, 0 = otherwise	0,349	0	0,477
Commercial database	1 = if data employed for empirical analysis are based on a commercial database, 0 = otherwise	0,492	0	0,500
Original enterprise survey	1 = if data employed for empirical analysis are based on an original enterprise survey, 0 = otherwise	0,085	0	0,280
FE	1 = if a fixed-effects panel estimator is used for estimation, 0 = otherwise	0,160	0	0,366
RE	1 = if a random-effects panel estimator is used for estimation, 0 = otherwise	0,074	0	0,262
Robust	1 = if a robust estimator is used for estimation, 0 = otherwise	0,144	0	0,352
GMM	1 = if a GMM estimator is used for estimation, 0 = otherwise	0,003	0	0,058
Other estimators	1 = if an estimator other than OLS and the above estimators is used for estimation, 0 = otherwise	0,016	0	0,126
IV/2SLS/3SLS	1 = if an instrumental variable method or 2SLS or 3SLS is used for estimation, 0 = otherwise	0,104	0	0,306
Difference model	1 = if a difference model is used for estimation, 0 = otherwise	0,328	0	0,470
Translog model	1 = if a translog model is used for estimation, 0 = otherwise	0,150	0	0,358
Treatment for selection bias	1 = if the estimation treats for the selection bias of privatized companies, 0 = otherwise	0,075	0	0,264
Market competition	1 = if the estimation simultaneously controls for the degree of market competition, 0 = otherwise	0,072	0	0,258
Location fixed effects	1 = if the estimation simultaneously controls for location fixed effects, 0 = otherwise	0,067	0	0,249
Industry fixed effects	1 = if the estimation simultaneously controls for industry fixed effects, 0 = otherwise	0,771	1	0,420
Time fixed effects	1 = if the estimation simultaneously controls for time fixed effects, 0 = otherwise	0,494	0	0,500
√ Degree of freedom	Root of the degree of freedom of the estimated model	43,777	31,781	38,567
Quality level	h-index of IDEAS bibliographic database÷100 (https://ideas.repec.org/)	5,309	2,96	6,097

Source: Authors' calculations

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