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# The gendered effects of foreign investment and prolonged state ownership on mortality in Hungary: an indirect demographic, retrospective cohort study



Gábor Scheiring\*, Dénes Stefler\*, Darja Irdam, Mihaly Fazekas, Aytalina Azarova, Irina Kolesnikova, János Köllő, Vladimir Popov, Ivan Szelenyi, Michael Marmot, Michael Murphy, Martin McKee, Martin Bobak†, Lawrence King†



## Summary

**Background** Research on the health outcomes of globalisation and economic transition has yielded conflicting results, partly due to methodological and data limitations. Specifically, the outcomes of changes in foreign investment and state ownership need to be examined using multilevel data, linking macro-effects and micro-effects. We exploited the natural experiment offered by the Hungarian economic transition by means of a multilevel study designed to address these gaps in the scientific literature.

**Methods** For this indirect demographic, retrospective cohort study, we collected multilevel data related to Hungary between 1995 and 2004 from the PrivMort database and other sources at the town, company, and individual level to assess the relation between the dominant company ownership of a town and mortality. We grouped towns into three ownership categories: dominant state, domestic private, and foreign ownership. We did population surveys in these towns to collect data on vital status and other characteristics of survey respondents' relatives. We assessed the relation between dominant ownership and mortality at the individual level. We used discrete-time survival modelling, adjusting for town-level and individual-level confounders, with clustered SEs.

**Findings** Of 83 eligible towns identified, we randomly selected 52 for inclusion in the analysis and analysed ownership data from 262 companies within these towns. Additionally, between June 16, 2014, and Dec 22, 2014, we collected data on 78 622 individuals from the 52 towns, of whom 27 694 were considered eligible. After multivariable adjustment, we found that women living in towns with prolonged state ownership had significantly lower odds of dying than women living in towns dominated by domestic private ownership (odds ratio [OR] 0.74, 95% CI 0.61–0.90) or by foreign investment (OR 0.80, 0.69–0.92).

**Interpretation** Prolonged state ownership was associated with protection of life chances during the post-socialist transformation for women. The indirect economic benefits of foreign investment do not translate automatically into better health without appropriate industrial and social policies.

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## Introduction

In 2016, events such as the election of Donald Trump, the Brexit vote in the UK, and growing electoral support for authoritarian parties in continental Europe have placed the social impact of globalisation high on the political agenda. The collapse of communism in Europe in the late 1980s and early 1990s is one of the greatest socio-economic disruptions in recent history,<sup>1</sup> acting as a natural experiment providing opportunities for research on the association between globalisation and health. State-owned enterprises were exposed to global markets and those that survived were integrated into the capitalist economy. These changes were accompanied by dramatic demographic upheavals.<sup>2</sup> Although the transition to a market economy resulted in an initial decrease in economic activity in every country making the transition, the economic strategies pursued by these countries and the social outcomes that followed differed substantially.<sup>3</sup>

Researchers have investigated the effect of privatisation and foreign investment on health for several decades. Public health researchers have focused on the opening of markets to harmful products such as tobacco.<sup>4</sup> Economic nationalists have claimed that foreign direct investment extracts resources from host countries by destroying domestic production networks, repatriating profits, and relying on exploitative low-skilled jobs, and, as a result, has a harmful effect on the life expectancy of the host country's population.<sup>5–7</sup> However, the positive statistical association between mortality and foreign investment penetration is not equal to an association between present foreign capital inflows and mortality, which has led to misunderstandings among sociologists.<sup>8</sup> Empirical studies<sup>9–11</sup> published in the past two decades have found a beneficial health effect of foreign investment because it promotes economic development.

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**Research in context****Evidence before this study**

We reviewed the existing evidence published in Hungarian and English in social sciences, public health, and epidemiology journals available through PubMed, Science Direct, Scopus, Sociological Abstracts, Web of Science, and Google Scholar. We used the following search terms: “post-communist mortality”, “post-socialist mortality”, “Eastern-Europe mortality”, “social determinants of mortality”, “foreign investment mortality”, “privatisation and mortality”, “globalisation and mortality”. The search process happened through several iterative phases, starting on Nov 2, 2015, and was finally closed on Oct 18, 2016, and included articles published after Jan 1, 1990. Research by epidemiologists on the subject mostly focuses on the proximate causes of mortality and the most common social determinants. However, the factors that lead to the level and distribution of the main social determinants are much less well understood. Sociologists and political economists have investigated the effect on mortality of foreign investment but this strand of research was implicated in several methodological problems. Most of the related research is done on the cross-country level. To our knowledge, no research has been done analysing the association between mortality, gradual privatisation, and foreign investment using multilevel data (individual-level, company-level, and town-level data) simultaneously.

**Added value of this study**

The most important strength of our study is the scope of company ownership, individual health, and town-level data. This range of data allowed us to analyse the mortality effect of foreign investment and prolonged state ownership using data from multiple levels for the first time. We were able to eliminate the most important individual-level and ecological-level confounders. Our approach has the potential to be replicated in other countries experiencing rapid integration into the global capitalist economy and has a direct potential to improve evidence-based policies to secure human development and health for all.

**Implications of all the available evidence**

Countries embarking on privatisation in the future should opt for a carefully planned privatisation strategy. Prolonged state ownership not only allows time to effectively restructure state-owned enterprises but also helps to preserve health. Foreign investment should not be treated as a substitute for well designed institutions, social policies to develop human capital, and industrial policies to support domestic enterprises and reduce uneven development.

In a controversial article, Stuckler and colleagues<sup>12</sup> argued that rapid mass privatisation increased mortality by increasing unemployment and the stress associated with large-scale organisational change. They suggested that a more gradual approach to privatisation and foreign direct investment might protect against these effects because they promote the emergence of strategic investors facilitating successful firm restructuring.<sup>13,14</sup> A 2017 article<sup>15</sup> using company-level, town-level, and individual-level data in Russia also reports results showing that rapid mass privatisation was associated with increased mortality. However, the role of foreign investment and prolonged state ownership remains unexamined.

As one of the first former Soviet-style economies to open to global competition, Hungary has attracted substantial foreign investment from the early 1990s on. Hungarian policy makers were committed to building the institutions of a market economy but they also kept state ownership in several sectors of the economy to cushion the effect of rapid economic change. However, while some other central and eastern European countries saw a steady improvement in life expectancy during the 1990s, mortality in Hungary increased until 1993.<sup>16</sup> The early and large flows of foreign direct investment into Hungary and the parallel fluctuations in the level of mortality allow us to test the long-term health effect of varying privatisation strategies.

A large body of scientific literature exists on the proximate, biomedical, and behavioural causes of

mortality, and research on the social determinants of mortality in the region is growing.<sup>17</sup> The factors that lead to the level and distribution of the main social determinants are not well understood. To our knowledge, no research has been done analysing the association between mortality and gradual privatisation and foreign investment using multilevel data (individual-level, company-level, and town-level data) simultaneously.

The aim of our study is to increase knowledge of the political and economic determinants of mortality. We test the hypothesis that prolonged state ownership protected against premature death relative to settings experiencing rapid privatisation. Similarly, we investigate whether foreign direct investment affects death rates.

**Methods****Study design**

For this indirect demographic, retrospective cohort study, we collected multilevel data at the town, company, and individual level from the Hungarian arm of the PrivMort database for the time period between 1995 and 2004.<sup>18</sup> PrivMort is a multidisciplinary project investigating the post-communist mortality crisis using multilevel data, including individual surveys conducted in Russia, Belarus, and Hungary, in addition to annual company ownership, socioeconomic, and demographic indicators from the surveyed settlements.

### Town-level data

In the first round, we selected Hungarian towns of between 5000 and 100 000 inhabitants with an industrial employment exceeding 30%. We excluded towns close to Budapest and those for which data on the largest companies could not be obtained. We then randomly selected towns to be included in the analysis from among the eligible towns. We applied no stratification, each town had the same probability to get in the sample, and sampling took place without replacement. Random numbers for sampling were generated by Stata. We collected town-level data from the Hungarian Central Statistical Office and various other state institutions. Information is available for several indicators, including population size, unemployment rate, income per capita, dependency rate, number of general practitioners, and number of deaths in the 15–64 years age group, for each year between 1990 and 2006.

### Company-level data

We collected data on the identified companies from the Company Information Service of the Ministry of Justice, the Hungarian Privatisation Agency, local courts of registry, and various private digital company information archives. For analytical purposes, we treated the original parent company and their successors as a single company. In cases with multiple successors, we included the biggest company that was the closest to the original parent company in its economic profile. For the present analysis, we included data on the five largest companies in each town measured by their mean number of employees between 1992 and 2004. In towns for which the difference between dominant ownership categories was less than 3%, we used the six largest companies to improve the information base.

The main exposure variable in our analysis was the dominant form of company ownership in a particular town between 1995 and 2004. Three categories of this variable were specified: towns dominated by foreign ownership; towns dominated by domestic private ownership; and towns dominated by state ownership. To allocate towns to the appropriate category, we applied the following procedure. In the first step, we calculated the mean proportion of company shares owned by foreign or private investors or the state between 1995 and 2004. In the second step, we calculated weighted means of the proportions of foreign, private, and state ownership across the five companies in each town. Weighting was based on the mean number of employees between 1992 and 2004. Finally, we decided on the dominant type of ownership in each town by comparing the proportions of foreign, private, and state ownership at the town level and identifying the largest of the three. Foreign investment might have important economic spill-over effects<sup>19</sup> beyond the employment channel by creating local demand or via transferring advanced production technology managerial techniques to firms; as such, we

also present results using non-weighted company ownership data in the appendix (pp 2, 9).

See Online for appendix

### Individual-level data

We collected individual-level data in all towns included in the analysis. Randomly selected inhabitants who were at least 42 years old completed a questionnaire and provided information on their socioeconomic circumstances, employment history, lifestyle, and health.<sup>18</sup> In addition to reporting on themselves, respondents also answered questions about their relatives (mothers, fathers, siblings, and partners of female respondents), including their year of birth and death (if not alive). The relatives form the retrospective cohort analysed in this report. This indirect approach, which uses mortality data from relatives (also known as Brass techniques), was successfully applied previously to study adult mortality in Russia.<sup>20</sup> The present study used data on relatives only. Relatives were considered eligible for the present analysis if they were aged 20–70 years in 1995 and lived in the same town during the 1990s and 2000s where the questionnaire was completed by the respondent. We excluded individuals with missing data on smoking, alcohol intake, education, and experience of material deprivation from the analysis. Individual-level surveys were done by Tarki Social Research Institute, Budapest.

### Statistical analysis

The individual-level outcome variable was death of the relative between 1995 and 2004. We analysed the relation between dominant company-ownership status of a town and individual-level mortality rates using the discrete-time survival analysis method.<sup>21</sup> We used the time in years since 1995 as the underlying time variable, and we censored in 2004 individuals who died after 2004 or were still alive at the date of the questionnaire (2014 or 2015). We used robust standard errors in view of the clustering of participants in the towns included in the analysis.

The association was examined in three multivariable logistic regression models.<sup>22,23</sup> In model 1, we tested our core privatisation strategy variable adjusted for age in 1995 and for the relative's relationship to the respondent (ie, whether they were fathers, mothers, siblings, or partners). The relative's relationship to the respondent was important to adjust for to eliminate information bias related to this characteristic. In model 2, the relationship was also controlled for town-level, socioeconomic, and health-related variables: mean number of inhabitants in 1995–2004, mean dependency ratio in 1995–2004, mean number of general practitioners per 100 000 inhabitants in 1995–2004, mean number of sex-specific deaths in the 15–64 year age group per 100 000 inhabitants in 1990–94, and mean unemployment rate in 1995–2004. Finally, in model 3, we also included individual-level variables: smoking, alcohol intake, education, and experience of material deprivation.

	Mostly private company ownership	Mostly foreign company ownership	Mostly state company ownership
Western Transdanubia (n=10)	4 (40%)	5 (50%)	1 (10%)
Central Transdanubia (n=8)	4 (50%)	2 (25%)	2 (25%)
Southern Transdanubia (n=6)	1 (17%)	3 (50%)	2 (33%)
Northern Hungary (n=7)	2 (29%)	3 (43%)	2 (29%)
Northern Great Plain (n=15)	9 (60%)	4 (27%)	2 (13%)
Southern Great Plain (n=6)	5 (83%)	0	1 (17%)
Overall (n=52)	25 (48%)	17 (33%)	10 (19%)

**Table 1: Dominant company ownership of towns by geographical region**

We deemed associations to be significant if the p value obtained was less than 0.05. We assessed and confirmed the adequacy of the multivariable logistic regression models using Pearson's goodness-of-fit test: the obtained p values were above 0.05, which suggests that the models fit adequately. Results were presented separately for men and women. All statistical analyses were done using Stata version 13.1 (StataCorp, TX, USA).

#### Role of funding source

The funding body had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

#### Results

Of 83 eligible towns identified, we randomly selected 52 for inclusion in the analysis because of limited available financial resources. Overall, we analysed ownership data from 262 companies. The mean company size in the sample was 564 employees per company between 1992 and 2004 (range 17–3829). The total number of employees (in the period of 1992–2004) in the five largest companies per town represents a mean of 57.9% of the town-level industrial employment in 1989. As such, the five largest companies on average capture most of the pretransition industrial labour force. Most of the examined towns were dominated by privately owned companies (25 of 52 towns; table 1). The proportion of towns dominated by foreign ownership was particularly high in South and Western Transdanubia, near to the Austrian border.

Between June 16, 2014, and Dec 22, 2014, we collected individual-level data in all 52 towns. The response rate of the randomly selected inhabitants was 85%. We collected data on 78 622 relatives, of whom 26 779 were considered eligible. We excluded individuals with missing data on smoking (n=186), alcohol intake (n=179), education (n=180), and experience of material deprivation (n=496) from the analysis. As the proportion of eligible participants with any missing data was 3.3% (n=915), we applied the listwise deletion approach and did a complete case analysis.<sup>24</sup> The analyses included 15 773 male and 11 006 female relatives who fulfilled these criteria.

We found no significant difference in the magnitude of reductions in unemployment between towns dominated by foreign ownership and towns dominated by private or state ownership, or between towns dominated by private ownership and towns dominated by state ownership (table 2).

We found that a large increase in income per capita during the observed 10-year period was significantly more likely to occur in towns dominated by foreign ownership than in towns dominated by domestic private ownership (table 3). The strength of this association weakened somewhat after we adjusted for baseline economic development of the towns. Remarkably, state-owned companies seem to be contributing more to absolute income growth than domestic private ownership. However, the strength of this association weakened substantially when we adjusted for baseline economic development of the towns.

Both men and women were better educated in towns dominated by foreign or state ownership compared with those in towns where private investments were dominant (appendix p 1). Although the differences were not large, the prevalence of smoking in men and alcohol intake in both sexes were the highest in towns with prolonged state ownership (appendix p 1).

For the period of 1995–2004, living in towns where state ownership was dominant was associated with a 26% lower relative chance of mortality among women in the fully adjusted model compared with women living in towns dominated by domestic private capital (table 4). The association grew in strength and significance as we eliminated town-level and personal-level potential confounders. Using the weighted ownership measure, we found no significant differences in mortality rates between foreign ownership dominated and domestic private ownership dominated towns. There was no significant association among men.

To check the robustness of our results we re-estimated our regression models using non-weighted ownership data. Disregarding the size of the company decreased the number of towns dominated by foreign investment from 17 to ten and towns dominated by state ownership from ten to seven, suggesting that domestic private ownership is over-represented among smaller companies whereas foreign investors concentrated on the largest companies.

In the non-weighted models, there was still no association between company ownership and mortality among men (appendix p 2). Prolonged state ownership remained significant in the non-weighted model for women only when fully adjusted for all variables.

We also did an analysis using a 10% cutoff rate for company assets owned by foreign investors. This is often used in economic research to measure the economic effect of foreign direct investment.<sup>25</sup> Foreign investment had no clear effect on mortality (appendix p 3). We received similar results using a 25% cutoff rate (appendix p 4).

	Quartiles of towns according to change in unemployment				Ordered logistic regression			
	Q1 (range -0.4% to 1.7%)	Q2 (range -1.3% to -0.5%)	Q3 (range -2.3% to -1.4%)	Q4 (range -6.3% to -2.4%)	Model 1*		Model 2†	
					OR (95% CI)	p value	OR (95% CI)	p value
Private	7 (28%)	8 (32%)	5 (20%)	5 (20%)	1 (ref)	..	1 (ref)	..
Foreign	3 (18%)	4 (24%)	4 (24%)	6 (35%)	2.07 (0.67-6.35)	0.205	2.37 (0.73-7.69)	0.152
State	3 (30%)	1 (10%)	4 (40%)	2 (20%)	1.34 (0.36-5.00)	0.666	1.42 (0.38-5.36)	0.607

Data are n (%) unless stated otherwise. OR=odds ratio. \*Crude analysis. †Analysis adjusted for baseline unemployment rate (mean in 1995-97).

**Table 2: Relation between dominant company ownership of towns and change in unemployment between 1995 and 2004**

	Quartiles of towns according to change in income per capita*				Ordered logistic regression			
	Q1 (range 150.0-252.4)	Q2 (range 257.0-310.1)	Q3 (range 312.7-359.1)	Q4 (range 363.3-493.7)	Model 1†		Model 2‡	
					OR (95% CI)	p value	OR (95% CI)	p value
Private	9 (36%)	10 (40%)	4 (16%)	2 (8%)	1 (ref)	..	1 (ref)	..
Foreign	3 (18%)	1 (6%)	5 (29%)	8 (47%)	7.84 (2.21-27.85)	0.001	4.12 (0.97-17.48)	0.055
State	1 (10%)	2 (20%)	4 (40%)	3 (30%)	4.98 (1.28-19.43)	0.021	1.33 (0.25-7.08)	0.735

Data are n (%) unless stated otherwise. OR=odds ratio. \*Personal income tax base in 1000s of Hungarian forints. †Crude analysis. ‡Analysis adjusted for baseline income per capita (mean in 1995-97).

**Table 3: Relation between dominant company ownership of towns and change in income per capita between 1995 and 2004**

	Deaths/n (%)	Model 1*		Model 2†		Model 3‡	
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
<b>Men</b>							
Private	1810/7543 (24%)	1 (ref)	..	1 (ref)	..	1 (ref)	..
Foreign	1270/5162 (25%)	0.97 (0.87-1.09)	0.604	0.99 (0.89-1.10)	0.853	1.00 (0.91-1.09)	0.963
State	771/3065 (25%)	0.97 (0.91-1.04)	0.401	0.98 (0.89-1.09)	0.739	0.98 (0.89-1.08)	0.748
<b>Women</b>							
Private	910/5323 (17%)	1 (ref)	..	1 (ref)	..	1 (ref)	..
Foreign	562/3469 (16%)	0.98 (0.85-1.14)	0.831	0.93 (0.78-1.12)	0.446	0.93 (0.78-1.12)	0.454
State	337/2214 (15%)	0.85 (0.73-0.98)	0.027	0.76 (0.63-0.93)	0.006	0.74 (0.61-0.90)	0.002

Analyses use weighted company-ownership data. OR=odds ratio. \*Adjusted for age and relation to the respondent. †Adjusted for all variables in model 1 and town-level, socioeconomic, and health-related variables: mean number of inhabitants in 1995-2004, mean dependency rate in 1995-2004, mean number of general practitioners per 100 000 inhabitants in 1995-2004, mean number of sex-specific deaths in the 15-64 year age group per 100 000 inhabitants in 1990-94, and mean unemployment rate in 1995-2004. ‡Adjusted for all variables in model 2 and individual-level variables: smoking, alcohol intake, education, and experience of material deprivation.

**Table 4: Relation between dominant company ownership of towns and mortality between 1995 and 2004**

To test the protective effect of state ownership, we also measured it against towns dominated by foreign investment and against privatised towns that combined foreign and domestic private ownership. State ownership remained significantly associated with lower mortality in women in both models (appendix pp 5-6).

To check the sensitivity of our results to missing data, we re-ran the analysis on multiple imputed data, which showed very similar results to our main findings (appendix p 7).

To mitigate possible selection bias, we also constructed a separate dataset using participants who lived in the 52 towns during the 1980s, and investigated individual-level odds of mortality for the 1989-95 period predicted by the town-level ownership categories measured for the

1995-2004 period. We found no significant pre-existing mortality differences for women using employment-weighted ownership data and using non-weighted data (appendix p 8). For men who lived in state ownership dominated towns, there appears to be a very weak association with mortality in model 1, but this is non-significant in models 2 and 3.

Using the main dataset covering the 1995-2004 period, we checked further potential sources of selection bias. We included baseline unemployment, income, and age structure into model 3, but the inclusion of these variables left the main association between dominant form of ownership and mortality unchanged (results not reported).

## Discussion

Shock therapists claimed that rapid privatisation might bring short-term reductions in wellbeing but would be superior to gradualism in the long term, with “enormous scope for increases in living standards in a few years”.<sup>26</sup> Our findings contradict the theory favouring rapid privatisation and support the state-centred gradualist perspective of the post-socialist transformation.<sup>27</sup> Women living in Hungarian towns dominated by prolonged state ownership had a significantly lower chance of dying between 1995 and 2004 than women living in towns dominated by domestic private or foreign ownership. Our results suggest that, compared with Russia, which implemented mass privatisation, the lower increase in mortality in Hungary during the transition might partly be attributable to a more active state involvement. For people working in state enterprises versus private or foreign owned businesses, the security and quality of jobs, lower levels of associated stress, and better remuneration might be the most relevant health-protective mechanisms related to prolonged state ownership. The weakness of regulation, such as in relation to health and safety practices and workers’ rights, might also attribute to the difference in the health impact of privatised companies.

The effect of foreign investment on health is more complicated than that of domestic private ownership. Our results do not support the claims of economic nationalists.<sup>5</sup> We did not find a large negative impact of foreign investment on health compared with domestic investment. In fact, domestic private ownership seems to be less beneficial than foreign ownership for income growth, unemployment reduction, and mortality. However, the positive health effects of foreign direct investment seem also to be constrained. The economic benefits of foreign investment might be counter-balanced by the stress and social shock of privatisation in general. The weakness of the foreign direct investment effect might also be related to regional concentration of foreign investment in the historically wealthier and healthier parts of the country. However, the indirect effects of foreign investment, which cannot be captured by our design, might also be important (eg, by affecting macro-economic stability and cultural change). Additional analysis is needed to measure precisely the scope of the protective effect of foreign investment.

Our results also support a gendered perspective on the transition from state to private ownership and on globalisation.<sup>28–30</sup> Our finding is in accordance with the proposition in the scientific literature that multinational companies offer better employment opportunities for men than for women.<sup>31</sup> Prolonged state ownership seems to be significantly more beneficial for women than for men. Former socialist enterprises had several emancipatory gender implications (increased female employment, lower gender pay gap, better career chances for women, and generous family policies),<sup>32</sup> and the

preservation of former socialist enterprises carried some of these emancipatory effects further throughout the transition and thus helped to reduce the shock of privatisation. Our estimates are conservative because we have excluded public service companies, such as hospitals or schools, from our sample (sectors that are dominated by state ownership and usually have a heavily feminised labour force). Although initially men were more vulnerable to rapid socioeconomic change, as shown by previous research,<sup>33,34</sup> our research suggests that through their gender-specific assets men might have been able to better reap the advantages of globalisation than women.

We were able to significantly reduce the potential of selection bias by checking pre-existing mortality differentials between 1989 and 1995 predicted by dominant ownership categories for the period from 1995 to 2004. The results show that towns were not likely to have been selected into different privatisation outcomes by their pre-existing health conditions, therefore we can rule out that the protective effect of state ownership would be based on the better health at the baseline of state ownership dominated towns than private ownership dominated towns. However, the nature of the study design does not fully preclude the possibility of pre-existing conditions affecting the associations, warranting caution when interpreting the results.

Our approach has some limitations. The availability of information on company ownership and employment has been curtailed in recent years in Hungary, making it hard to obtain data. To overcome this limitation, we spent 2 years collecting ownership information manually from non-digital archives. We also discovered some faults in the Company Information System of the Hungarian Ministry of Justice, so we checked every company on a case by case basis to correct for errors using multiple sources. Although we controlled for some of the most important town-level and individual-level confounders, some further characteristics of the privatised companies or towns might exist that we could not account for and could potentially affect the association between privatisation and health. However, the protective health effect of prolonged state ownership is not likely to be due to worse performing companies being privatised first. Securing state revenues to pay off public debts was an important aim of privatisation policies in Hungary, leading to a significant share of large and valuable companies privatised to strategic investors with the hope of large one-off budgetary incomes.<sup>35</sup> Existing research also shows that both domestic and foreign ownership were associated with increased company-level productivity during the privatisation period.<sup>36</sup> The retrospective convenience cohort approach has several limitations, as discussed in detail elsewhere.<sup>17</sup> Perhaps the most important is the reduced precision of individual-level data because these are reported by a proxy informant. However, this imprecision is most likely to lead to underestimation of

the underlying association, and our effect estimates are likely to be conservative.

The most important strength of our study is the combination of an unprecedented scope of company ownership, individual health, and town-level data. This allowed us to do statistical analyses of the mortality effect of foreign investment and prolonged state ownership using data from multiple levels for the first time. We were able to eliminate the most important individual-level and ecological-level confounders. Our approach has the potential to be replicated in other countries experiencing rapid integration into the global capitalist economy and has a direct potential to improve evidence-based policies to secure human development and health for all.

Countries embarking on privatisation in the future should opt for a carefully planned privatisation strategy. Although in some cases state-owned companies might be mismanaged, the Hungarian results suggest that prolonged state ownership not only allows time to effectively restructure state-owned enterprises but also helps to preserve health and high levels of human capital that are in turn important factors for successful economic development and are also valued by foreign investors. Foreign investment promotes income growth and unemployment reduction but privatisation also increases stress levels and, together with badly managed fiscal decentralisation reforms or ineffective development policies, might also contribute to regionally uneven development. Choosing development led by foreign direct investment instead of mass privatisation should not lead policy makers to forget that the long-term and indirect effects of foreign investment on the domestic economy are not automatic. Foreign investment should not be treated as a substitute for well designed institutions, social policies to develop human capital, and industrial policies to support domestic enterprises and reduce uneven development.

#### Contributors

GS and DS, as joint first authors, developed the key variables for the Article, did the scientific literature search, prepared the data for analysis, analysed the data, interpreted the results, and prepared the first and final drafts of the Article. DI, AA, MMu, MB, MMc, and LK made substantial contributions to the conception and design of the study and the analysis and interpretation of data; and were involved in the preparation of the manuscript and its critical revision for important intellectual content. LK, DI, AA, MF, GS, IK, JK, and VP have made substantial contributions to the acquisition of data. IS and MMA read and approved the version to be submitted for publication and agreed to be accountable for all aspects of the study in ensuring that questions related to the accuracy or integrity of any part of the study are appropriately investigated and resolved.

#### Declaration of interests

We declare no competing interests.

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