

The health effects of wage setting institutions: How collective bargaining improves health but not because it reduces inequality

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Abstract

Do wage-setting institutions, such as collective bargaining, improve health and, if so, is this because they reduce income inequality? Wage-setting institutions are often assumed to improve health because they increase earnings and reduce inequality and yet, while individual-level studies suggest higher earnings improve well being, the direct effects of these institutions on mortality remains unclear. This paper explores both the relationship between wage-setting institutions and mortality rates whether income inequality mediates this relationship. Using 50 years of data from 22 high-income countries ($n \sim 825$), I find mortality rates are lower in countries with collective bargaining compared to places with little or no wage protection. While wage-setting institutions may reduce economic inequality, these institutions do not appear to improve health because they reduce inequality. Instead, collective bargaining improves health, in part, because they increase average wage growth. The political and economic drivers of inequality may not, then, be correlated with health outcomes, and, as a result, health scholars need to develop more nuanced theories of the political economy of health that are separate from but in dialogue with the political economy of inequality.

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INTRODUCTION

The rules governing employment relations between employers and their employees, such as wage-setting institutions, vary considerably between contexts and can have a profound influence on both working conditions and how economic resources are distributed within society. For example, wage bargaining can occur between an employer and employee without any direct oversight from the government or other stakeholders.¹ But sometimes constraints are placed on these negotiations. Minimum wage policies, for example, attempt to restrict the lowest amount someone can be paid for their work (Brown, 1999), while collective bargaining arrangements stipulate the actors that should be involved and the processes that should be used in negotiations between firms and employees (often represented by unions) (Visser et al., 2015).

Employment institutions are clearly instantiated in quite different ways, and this paper seeks to understand how one part of the institutional architecture governing working conditions – namely, wage-setting institutions – affects health. In doing so, this paper asks two broad questions. First, are wage-setting institutions, such as collective bargaining, correlated with the health of populations? Second, do wage-setting institutions influence health because they reduce income inequality? Both of these questions have been the subject of debate in recent years. While some argue that work, wages and poverty are all critical social determinants of health (Marmot et al., 2012), others suggest there is little causal evidence underpinning these associations (Mackenbach, 2019). Not only does this debate raise doubts about whether altering wage-setting institutions would improve health, but the evidence in support of this more macro claim about the health effects of wage-setting institutions is also far weaker than is sometimes supposed (Avendano & Berkman, 2014). In part, this is because ‘the determinants of population health may be different from the determinants of health of individuals’ (McCartney et al., 2019). Indeed, some have raised questions about whether health researchers actually do know how to improve population health (Mackenbach, 2019).

This ongoing debate about the health effects of various wage-setting institutions has been hampered by a number of empirical issues that have meant the relationship between these institutional arrangements and health remains uncertain. First, existing work on the relationship between wage-setting institutions and health has either focussed on welfare regimes (Conley & Springer, 2001) or particular policies in specific countries (Cylus et al., 2014). The welfare regime approach lacks methodological specificity, however, because it is difficult to identify precisely whether any given policy contributes to mortality differentials between countries. The country-specific approach, by contrast, lacks generalizability because it is rooted in case studies that are not always applicable to other contexts. Second, the problem of selection bias plagues estimates of the health effects of institutions. Social democratic welfare states may have lower mortality rates than other welfare regimes (Conley & Springer, 2001), but it is unclear whether mortality rates are lower because of the welfare regimes themselves or because of some other factor. Third, the mechanisms through which wage-setting institutions affect health remain opaque. One of the commonly proposed causal pathways linking wage setting and health is income inequality (Pickett & Wilkinson, 2015). Certainly, wage-setting policies appear to reduce economic inequality (Wallerstein, 1999) but, given scepticism about whether income inequality affects health (Beckfield, 2004), it is an open question whether wage-setting institutions improve health because they reduce income inequality rather than because they improve wages or

working conditions (Visser et al., 2015). These empirical issues mean that we simply do not know whether wage-setting institutions affect health let alone whether they affect health through their impact on inequality (Avendano & Berkman, 2014).

This paper adopts a political economy approach to addressing these gaps in our understanding (McCartney et al., 2019). Theoretically, this approach implies focussing on the institutions and policies which structure the more proximate social determinants of health (Beckfield et al., 2015), a move which allows scholars to focus on ‘upstream factors’ that ‘set the “rules of the game” [and] that organize the political economy’ of health (Bakhtiari et al., 2018). To move these debates forward, I draw on a data set combining mortality rates, wage-setting institutions and other covariates for 22 countries between 1960 and 2010. First, I examine whether institutional rules around wage setting are correlated with mortality rates across countries and over time. Second, I document how sensitive these estimates are to omitted variable bias and adjust for selection bias into particular wage-setting institutions. Finally, I explore whether income inequality or wage growth mediates the association between wage-setting institutions and health.

Taken together, the results indicate that countries with collective bargaining have lower mortality and higher life expectancy than countries with minimal wage-setting regulations. However, the health effects of collective bargaining do not appear to be mediated by their effect on economic inequality; rather, wage-setting institutions appear to improve health by increasing average wage growth across the distribution. These results have both theoretical and policy implications. Theoretically, the results highlight the explanatory power of a political economy approach for understanding the health of populations but they also uncover a tension between the political economy of health and the political economy of inequality. These results reveal that one cannot assume that the political economy of inequality can be neatly extended to health outcomes. Health inequalities do not simply mirror economic inequalities, and health scholars therefore need to develop more nuanced theories of the political economy of health that are separate from but in dialogue with the political economy of inequality. From a policy standpoint, these results suggest reinvigorating both collective bargaining and the organizations which make such institutions meaningful, for example unions, may have important implications for ensuring longevity and reducing infant mortality.

How wage-setting institutions shape the social determinants of health

Employment institutions, such as wage-setting policies, may influence health because relations between employers and employees affect the conditions in which people ‘live, work and die’ (Marmot et al., 2012). Wage-setting institutions affect (a) material circumstances, such as wages, (b) health behaviours, such as the regularity of exercise, and (c) psychosocial processes, such as autonomy or job control. These are all social determinants of health, or what Geoffrey Rose called the ‘causes of the causes’ (Rose, 1993). The distribution of these social determinants is not equal across individuals, however, but is instead ‘a function of institutional arrangements that vary systematically across societies’ (Beckfield et al., 2015: 235). Employment institutions, in this view, may act as one of the ‘causes of the causes’ of ill health (Avendano & Berkman, 2014; Barlow et al., 2019; Reeves et al., 2021) and so variation in wage-setting institutions may partially explain differences in mortality and life expectancy across countries and over time.

How, then, do different wage-setting institutions affect the social determinants of health? Countries with collective bargaining, for example, tend to have higher earnings than countries that use minimum wages or do not regulate earnings at all (Pontusson et al., 2002). In the United States, wage growth has been stronger in sectors where union membership – one possible source of collective bargaining – has

remained relatively high (Lin & Tomaskovic-Devey, 2013). Similarly, collective bargaining delivers wage growth because it ensures labour and capital are able to benefit 'equally' or more 'similarly' from economic growth (Beramendi & Rueda, 2007; Iversen & Stephens, 2008). Often, 'slow income growth for workers implies faster income growth for capital' (Kristal, 2010: 733), but in countries with strong collective bargaining (or corporatist institutions), governments are able to ensure wage growth for labour and capital (Huo, 2015).

Wages and other fringe benefits are not the only aspect of working conditions that are affected by employment institutions, and here, again, differences in how wage-setting institutions are organized may have implications for health. Collective bargaining leads to greater safety within the workplace (Betcherman, 2012), which may lead to fewer deaths at work. Wage-setting institutions could also alter the psychosocial components of work by increasing worker's sense of autonomy or even reducing envy among workers (Calmfors & Driffill, 1988), weakening the pernicious social comparisons that are central to many of the psychosocial explanations of health inequalities (Pickett & Wilkinson, 2015).

Crucially, wage-setting institutions alter the living conditions of households not just workers and so the health benefits of collective bargaining may be felt by employees, their partners, and their children, even if they are not directly attached to the labour market. More concretely, by improving the situation of workers, wage-setting institutions may affect child mortality too. For example, improved material conditions and reductions in parental stress both improve the survival prospects of children (Conley & Springer, 2001).

In sum, how labour market interactions are regulated by employment institutions has a profound effect on wages and working conditions and may therefore affect health. To be more precise, one hypothesis that emerges from this literature is that countries with collective bargaining will have lower mortality and higher life expectancy than countries with other kinds of wage-setting institutions, such as those without any regulation around wage negotiations or possess a minimum wage without a fixed rule (hypothesis 1).²

Wage-setting institutions, income inequality and health

There is another aspect to debates regarding how wage-setting institutions, such as collective bargaining, affect health and this is concerned with the role of income inequality. Collective bargaining, as mentioned above, constrains income inequality by ensuring wage growth at the bottom and at the middle of the income distribution (Hope & Martelli, 2017). Given the distributional consequences of wage-setting institutions, it is reasonable to ask: if collective bargaining is associated with better health, is this because collective bargaining reduces income inequality which in turn improves health and well being (Pickett & Wilkinson, 2015)?

Here, there is little consensus. Wilkinson and Pickett have argued that 'narrowing the gap [between rich and poor] will improve the health and well being of populations' (Pickett & Wilkinson, 2015). Others remain unconvinced, however. Part of the scepticism is empirical: that is, the association between income inequality and health is far weaker when heterogeneity between countries is directly addressed (Beckfield, 2004). But others question the mechanisms, suggesting that not all variation in income inequality will affect health and that it is poverty not inequality that is the primary driver of the income inequality and health association (Rambotti, 2015).

This debate matters because some seem to assume that the political economy of inequality can be simply applied to health outcomes. In other words, the drivers of income inequality, such as wage-setting institutions, and the drivers of population health are sometimes assumed to be the same. Hence, collective bargaining and similar wage-setting institutions are one of the policy recommendations

advocated by those who want to improve health by reducing income inequality. It may be true, as Pickett and Wilkinson (2015) argue, that ‘narrowing the gap [between rich and poor] will improve the health and well being of populations’ but it may not be because of any change in the distribution of incomes. To put it another way, collective bargaining may improve health and reduce income inequality, but it may not improve health *because* it reduces income inequality. To date, not only is there little comparative work on how wage-setting institutions affect health but there is even less work testing whether income inequality is a mediator of the association between wage-setting institutions and health, if there is any correlation at all. Given this debate about the role of income inequality, I aim to test the hypothesis that income inequality is a mediator of the association between wage setting and health (hypothesis 2).

This discussion has illuminated two important gaps in our understanding of the relationship between wage-setting institutions and health. First, while wage-setting institutions are correlated with some of the social determinants of health, we do not know whether specific wage-setting institutions, such as collective bargaining, are indeed correlated with better health outcomes. Second, the vast literature on the health effects of income inequality often assumes that the drivers of inequality, such as wage-setting institutions, will affect health too, but we currently have little evidence to support this assumption. In this paper, then, I explore two research questions (and their attendant hypotheses): are specific types of wage-setting institution associated with better population health and, if wage-setting institutions and health are correlated, is that association mediated by income inequality or by some other mechanism?

DATA AND METHOD

To address these questions, I draw on an unbalanced panel of 22 high-income countries between 1960 and 2010. Data come from Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States (Brady et al., 2014).

Data on health are taken from the World Bank (2019). The main dependent variables are as follows: age-standardized adult mortality rates per 100,000, life expectancy at birth and infant mortality, operationalized as under 5 mortality rates per 1,000 live births. All dependent variables are measured on a log-scale. These measures are often used as broad indicators of population health within societies, and infant mortality is viewed as a proxy for the degree of health equity or the health of vulnerable groups (Baker et al., 2018). Of course, wage-setting institutions would not be expected to affect every specific cause of mortality in the same way and so I conduct a falsification analysis where the dependent variable is two cause-specific outcomes that theoretically should not be correlated with wage-setting institutions. These measures are age-standardized mortality (per 100,000) due to transport accidents and from falls (WHO, 2018).

The base data set is the Comparative Welfare States database collated by Brady et al., (2014). This dataset contains the key independent variable on wage setting, originally derived from Visser (2016), and which I split into 3 categories. The baseline category (coded 0) contains observations in which countries have no regulations regarding wage setting or have a minimum wage but without a fixed rule for uprating the real value of that wage. These are then compared with countries that: 1) instituted a minimum wage through some form of consultative process or 2) have implemented collective bargaining.

Other employment institutions may be correlated with health outcomes and the structure of the wage-setting institutions, either as confounders or as mediators. Rather than overlook these complex

associations, I explore how they influence the main results by estimating regression models which both include and exclude these other employment institutions. These variables include the following: union density, measured as the percentage of the labour force; union centralization, which measures who is allowed to pick union leaders, and is measured linearly on a scale ranging from 0 (least centralization) to 7 (most centralization); centralization in wage bargaining, which measures union authority and union concentration (i.e. derived from Iverson's centralization index and ranges from 0 – no centralization – to 1 – full centralization); and, lastly, wage coordination, which measures the degree of sectoral fragmentation in negotiations, with 1 representing the least coordinated (firm-level) to 5 representing the most coordinated (economy-wide). All measures are available in Brady et al., (2014).

Wage-setting institutions and health may also be correlated with other macro-economic and socio-demographic features of the society, such as GDP per capita adjusted for purchasing power parities (logged) (Pritchett & Summers, 1996); public expenditure on social benefits other than social transfers in kind (%GDP) (Stuckler et al., 2010); share of seats in parliament won by parties classified as left in the most recent election (Navarro et al., 2006); total health expenditure (%GDP) (Reeves et al., 2015); total general government expenditure (%GDP) (Baker et al., 2018); share of population with total medical coverage, either through public programmes or primary private insurance (Avendano & Kawachi, 2014); population size (logged); proportion of the population aged 15 years or younger; and the proportion of the population aged 65 years. All models also adjust for time dummies to control for temporal correlation in mortality trends.

The analytic sample varies across models, but the smallest number of observations is 812 and so there are missing data for some country-years. I conduct a series of sensitivity analyses to check whether and how this missingness affects the overall results.

Statistical analysis

To examine whether wage-setting institutions are associated with health outcomes, I estimate a multi-level, linear regression model with random intercepts. Failing to account for the hierarchical structure of the data (years nested within countries) would lead to an underestimation of the standard errors. Wage-setting institutions vary across countries but very little within countries and so I use countries as the contextual units ($n = 22$). However, multi-level models with the control variables mentioned above do not entirely remove the possibility that omitted variable bias may explain any observed association between collective bargaining and health. To address this possibility, I take three approaches.

First, I conduct a sensitivity analysis to explore how violations of the assumption of no omitted variables may alter model estimates using an approach developed by Blackwell (2014).³ This method allows me to estimate the degree of residual confounding necessary to eradicate the observed difference between intervention and non-intervention groups and then to compare it with the degree of explained variance attributable to the control variables. In other words, it tells us how big – relative to other observed confounders – the joint correlation between any possible unobserved confounders would need to be with both collective bargaining and health outcomes to entirely remove any correlation between the independent variable and the dependent variable.

Second, I formally model selection into collective bargaining using a two-stage Heckman selection model. Heckman selection models use a binary variable in the first stage and so I have created a new measure of wage-setting institutions which compares collective bargaining to all other wage-setting institutions.

Third, I also estimate models with country fixed effects which adjust for the impact of time-invariant confounders. However, they are less than ideal in settings where there is little variation over

TABLE 1 Association between wage-setting institutions and health outcomes

Covariates	Mortality rate		Life expectancy		Infant mortality	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Baseline = No minimum wage or without a fixed rule</i>						
Minimum wage (consultation)	-0.054** (0.0093)	-0.049** (0.010)	0.014** (0.0014)	0.0082** (0.0016)	-0.11** (0.020)	0.0020 (0.019)
Collective bargaining	-0.080** (0.012)	-0.076** (0.013)	0.022** (0.0018)	0.015** (0.0020)	-0.24** (0.026)	-0.094** (0.024)
Control variables	N	Y	N	Y	N	Y
Time dummies	Y	Y	Y	Y	Y	Y
Variance of the random intercepts	0.013 (0.0038)	0.025 (0.012)	0.00023 (0.00007)	0.0003 (0.00006)	0.039 (0.012)	0.0287 (0.0091)
Variance of the year-level residuals	0.0037 (0.00016)	0.0022 (0.0001)	0.00008 (0.000004)	0.00006 (0.000002)	0.017 (0.00074)	0.0077 (0.00038)
Countries	22	22	22	22	22	22
Country-years	1074	812	1107	844	1095	836

Notes: Standard errors in parentheses. Controls include the following: Union density, Union centralization (who picks leaders?), Centralization in wage bargaining (authority), Wage-setting coordination (firms or economy-wide), GDP per person (PPP), Social security transfers (%GDP), Share of seats in parliament won by left-leaning parties, Health spending (%GDP), Government spending (%GDP), Health coverage (%Pop), Population (logged), % of young people, % of older people, time dummies.

p* < 0.05, ** *p* < 0.01, * *p* < 0.001.

time, as is the case here. For example, there are only 21 transitions between these categories in the analytic sample and 14 countries see no variation at all (see Appendix S1). In such circumstances, fixed effects actually remove much of the variation that is of most interest to researchers and ‘can lead to misleading interpretations’ (Bell & Jones, 2015).

The final component of the analysis is to test whether income inequality sits on the pathway between wage-setting institutions and health. To test this, I use a technique that borrows from the classic framework of Baron and Kenny but which is more appropriate for variables that are not normally distributed, such as binary treatments (Imai et al., 2011).⁴ I test three possible mediating variables. The first two test whether income inequality sits on the pathway between wage setting and health. Inequality is measured using (a) the GINI coefficient (post-transfers) (taken from SWIID) (Solt, 2016) and (b) top income shares of the 1% (Alvaredo et al., 2018), a now common measure of the share of national income captured by the richest percentile. I also use a measure of wage growth as a possible mediator, measuring the average percentage change in wages across the economy, to capture the more direct benefits of collective bargaining on wages discussed above.

RESULTS

Are wage-setting institutions associated with health outcomes?

First, I test whether, on average, mortality rates are lower and life expectancy higher in country-years where collective bargaining structures negotiations between employees and employers as opposed to country-years where minimum wages are active or where no fixed wage-setting regulations are in place. Table 1 includes models with and without control variables. Details of the full model are reported in Appendix S2.

The multi-level regression models indicate that, with or without adjusting for the control variables mentioned above, collective bargaining is associated with better health outcomes (Table 1). For example, after adding control variables to the model, countries enforcing a minimum wage that has been set through a consultative process have a standardized mortality rate 4.91% ($\beta = -0.0491$, 95% CI: -0.0286 to -0.0696) lower than countries with little or no wage-setting institutions. The difference between countries with no regulation or only a fixed minimum wage and those countries with collective bargaining is even larger ($\beta = -0.0758$, 95% CI: -0.0498 to -0.1018). In fact, countries with collective bargaining have a standardized mortality rate that is 2.67% ($\beta = -0.0267$ 95% CI: -0.0058 to -0.0476) lower than countries with only a minimum wage set through consultative procedures.⁵

How big is the association between wage-setting regulation and health? For comparison, a 1%-point increase in the level of social security transfers (as a proportion of GDP) is associated with a reduction in the adult mortality rate by 1.15% ($\beta = -0.0115$, 95% CI: -0.0143 to -0.0088). Therefore, according to this model, a country without any regulation of wage setting would need to spend an additional 6.56% of GDP on social security transfers to offset the difference created by collective bargaining. In other words, for the average country in this sample, a rise of this magnitude would represent a 50% increase in their social security transfers. Recall that these estimates come from models controlling for other covariates and for time dummies, which capture the underlying improvements in health over time, and so the strength and robustness of these associations suggests collective bargaining is an important predictor of the health of populations.

Beyond the mortality rate, our models suggest collective bargaining is also associated with higher life expectancy than countries that regulate contract negotiations through minimum wages or who do

not deploy any wage-setting regulations at all. Finally, infant mortality is also lower in country-years when collective bargaining is active.

Of course, these results may simply represent spurious correlations and so to test this formally I re-estimate the main models reported in Table 1 but with different dependent variables. These alternative health measures represent falsification tests because existing theory would predict that these alternative health outcomes should *not* be affected by wage-setting regulations. If they are correlated, then this may indicate that the results in Table 1 should be treated with caution. The two new health outcomes are the standardized mortality rate due to transport accidents and also falls (per 100,000). Data for these measures are only available from 1979 forward and so these estimates may be less precise than those reported in Table 1, potentially favouring the null hypothesis of no association. To address this, I re-estimate the standard mortality rate model but restrict the sample to only those years for which we have data on transport accidents. Results are reported in Table 2. Despite reducing the sample size by ~40%, I still find that collective bargaining is associated with lower mortality rates. In contrast, I find no clear evidence of an association between wage-setting regulation and transport accidents or falls. It seems there is simply far more variation in these cause-specific mortality rates within each category of wage-setting regulation than there is for all-cause mortality as a whole.

How sensitive are these results to residual confounding?

So far, the evidence points in a clear direction: countries with collective bargaining have lower mortality rates and higher life expectancy than countries without this kind of wage-setting regulation. However, despite the large range of possible confounders included in the regression models, it is still possible that these differences in health are due to selection into collective bargaining rather than the effect of these wage-setting institutions on health. Further, unobserved differences between countries may explain these differences over time.

TABLE 2 Falsification test of the association between wage-setting institutions and health outcomes

Covariates	Mortality rate (Restricted) (1)	Transport-related mortality rate (2)	Falls-related mortality rate (3)
<i>Baseline = No minimum wage or without a fixed rule</i>			
Minimum wage (consultation)	−0.0098 (0.0094)	−0.033 (0.027)	−0.041 (0.060)
Collective bargaining	−0.036** (0.012)	−0.041 (0.034)	−0.11 (0.076)
Time dummies	Y	Y	Y
Variance of the random intercepts	0.0223 (0.0071)	0.1556 (0.0527)	0.1217 (0.0419)
Variance of the year-level residuals	0.0009 (0.00006)	0.0078 (0.0005)	0.0411 (0.0027)
Countries	22	22	22
Country-years	475	477	477

Notes: Standard errors in parentheses. Controls include the following: Union density, Union centralization (who picks leaders?), Centralization in wage bargaining (authority), Wage-setting coordination (firms or economy-wide), GDP per person (PPP), Social security transfers (%GDP), Share of seats in parliament won by left-leaning parties, Health spending (%GDP), Government spending (%GDP), Health coverage (%Pop), Population (logged), % of young people, % of older people, time dummies.

p* < 0.05, ** *p* < 0.01, * *p* < 0.001.

I explore how sensitive these models are to unobserved confounders using Blackwell's (2014) 'selection bias approach to sensitivity analysis'. Figures 1-3 show the results. The black line represents the simulated point estimate of the difference between collective bargaining and, in this instance, a reference group which combines countries with either no regulations around wage setting or a fixed minimum wage. This point estimate is simulated across a range of scenarios which each assume that a proportion of the variance in the dependent variable is explained by an unobserved confounding factor by a specified amount. The point at which the vertical line crosses the 0 line on the horizontal axis is the main estimate from model 1 in Table 1 as it is modelled under the assumption of zero confounding ($\beta = -0.0758$).

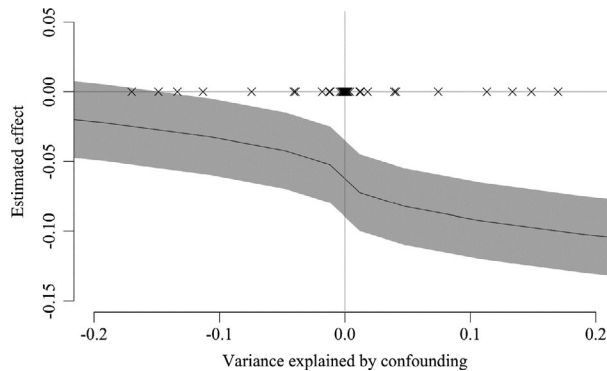


FIGURE 1 Causal sensitivity analysis of the association between wage-setting regulation and adult mortality rate. *Notes:* The dark line is the simulated point estimate under different assumptions regarding the degree of confounding between an unmeasured variable, the primary independent variable and the outcome variable. The shaded band is the simulated confidence intervals for these new models. The point at which the shaded band crosses the 0 line on the vertical axis is the point at which the association would be rendered 'insignificant' at the $\alpha = 0.05$ level. The \times symbols are the partial R^2 for the covariates. There are four \times symbols near the point at which the shaded band crosses the vertical axis is as follows: union density, population size, social security transfers and health spending

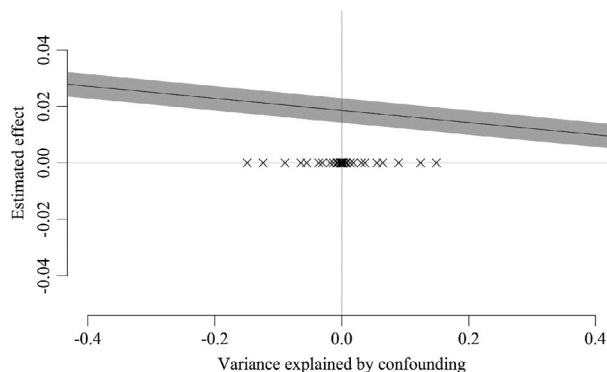


FIGURE 2 Causal sensitivity analysis of the association between wage-setting regulation and life expectancy. *Notes:* The dark line is the simulated point estimate under different assumptions regarding the degree of confounding between an unmeasured variable, the primary independent variable and the outcome variable. The shaded band is the simulated confidence intervals for these new models. The point at which the shaded band crosses the 0 line on the vertical axis is the point at which the association would be rendered 'insignificant' at the $\alpha = 0.05$ level. The \times symbols are the partial R^2 for the covariates

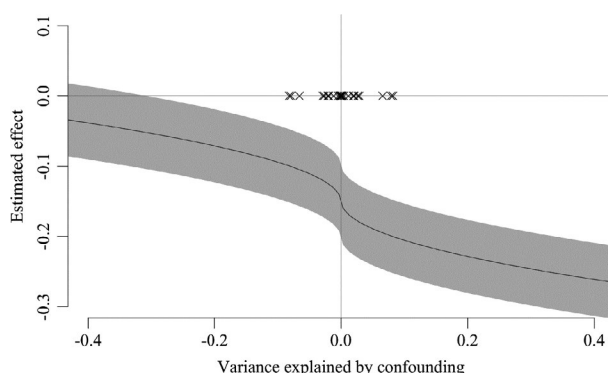


FIGURE 3 Causal sensitivity analysis of the association between wage-setting regulation and infant mortality.

Notes: The dark line is the simulated point estimate under different assumptions regarding the degree of confounding between an unmeasured variable, the primary independent variable and the outcome variable. The shaded band is the simulated confidence intervals for these new models. The point at which the shaded band crosses the 0 line on the vertical axis is the point at which the association would be rendered 'insignificant' at the $\alpha = 0.05$ level. The \times symbols are the partial R^2 for the covariates.

There are two key messages to draw from Figure 1. First, selection accounting for ~15% of the residual unexplained variance in the dependent variable would remove the mortality differences between collective bargaining and no consultative wage-setting institutions. Second, if we compare this to the degree of variance in the dependent variable attributable to our control variables (see the \times symbols in the figure), we observe that removing this association entirely would require quite a substantial degree of confounding, larger than almost any single variable included in the analysis. There are four \times symbols near where the shaded band intersects with the 0 line on the vertical axis – the point at which the point estimate of the model would become insignificant at traditional levels – and these variables are all highly correlated with mortality rates, namely union density, population size, social security transfers and health spending.

Looking at Figure 2, we see a far stronger picture. Selection into treatment would need to explain more than 40% of the unexplained variance in the dependent variable, and there is no other variable in the model that comes close to doing that kind of work. In Figure 3, we see similar results to Figure 1.

In these three cases, the association observed between collective bargaining and health is larger than almost any other variable included in these models, suggesting any possible unmeasured confounding would need to be more powerful than any of these other variables to entirely remove the associations observed here. This is possible but unlikely, since almost all of the major predictors of mortality rates and life expectancy at the population level are already included in the model, and so these sensitivity analyses add weight to a causal interpretation.

Next, I report the results of a Heckman selection-type analysis that formally attempts to model selection into these different forms of wage-setting institutions. Results are reported in Table 3 (for first-stage results, see Appendix S8). In each of the three models, the results are the same. The main results are not changed after adjusting for selection into wage-setting institutions using the Inverse Mills Ratio from a first-stage model predicting whether countries have collective bargaining or not. Countries with collective bargaining have lower mortality rates and higher life expectancy than countries without collective bargaining.

The final set of results attempting to address the problem of omitted variable bias use fixed-effect models (see Table 4). As noted above, fixed-effects models should be treated with some caution when there is limited variation within countries over time, as is the case here. And yet, they potentially

TABLE 3 Association between wage-setting institutions and health outcomes adjusting for selection into wage-setting institutions

Covariates	Mortality rate	Life expectancy	Infant mortality
	(1)	(2)	(3)
<i>Baseline = Minimum wage or no regulations</i>			
Collective bargaining	−0.036** (0.011)	0.0093** (0.0016)	−0.088** (0.019)
Inverse Mills Ratio	−0.000030 (0.00067)	0.00045** (0.00010)	0.0068** (0.0012)
Time dummies	Y	Y	Y
Variance of the random intercepts	0.0399 (0.0297)	0.0003 (0.000003)	0.0374 (0.0119)
Variance of the year-level residuals	0.0023 (0.0001)	0.000056 (0.000003)	0.0074 (0.0004)
Countries	22	22	22
Country-years	812	847	836

Notes: Standard errors in parentheses. Controls include the following: Union density, Union centralization (who picks leaders?), Centralization in wage bargaining (authority), Wage-setting coordination (firms or economy-wide), GDP per person (PPP), Social security transfers (%GDP), Share of seats in parliament won by left-leaning parties, Health spending (%GDP), Government spending (%GDP), Health coverage (%Pop), Population (logged), % of young people, % of older people, time dummies.

The first stage of the Heckman selection model (see Appendix S8) also includes measures of (1) the proportion of the population killed during World War II, (2) whether the country adopted a common or a civil law system, and (3) whether the country has proportional representation.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE 4 Fixed-effect models of the association between wage-setting institutions and health outcomes.

Covariates	Mortality rate	Life expectancy	Infant mortality
	(1)	(2)	(3)
More regulation of wage setting	−0.041 (0.021)	0.0080* (0.0029)	−0.056** (0.019)
Time dummies	Y	Y	Y
Constant	5.98** (0.60)	4.16** (0.095)	5.10** (1.15)
Countries	22	22	22
Country-years	812	847	836

Notes: Standard errors in parentheses. Controls include the following: Union density, Union centralization (who picks leaders?), Centralization in wage bargaining (authority), Wage-setting coordination (firms or economy-wide), GDP per person (PPP), Social security transfers (%GDP), Share of seats in parliament won by left-leaning parties, Health spending (%GDP), Government spending (%GDP), Health coverage (%Pop), Population (logged), % of young people, % of older people, time dummies.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

provide some indication of whether the relationships observed between countries are also observed within countries. The coefficients in Table 4 are all in the same direction as Table 1 and are of similar magnitudes too. I still find that changes within countries that relax regulation around contract negotiation (e.g. a move away from collective bargaining) have lower life expectancy and higher infant mortality in the future. However, the association between adult mortality and weaker wage-setting institutions (Model 1: Table 4) is less precise and no longer statistically significant ($p = 0.063$). This

is what we would anticipate given the small number of changes within countries over this period, but even this result is still broadly consistent with the results documented above.

It is important to be clear about what these additional model specifications can and cannot tell us about the key relationship being tested here. These cannot entirely rule out the possibility of omitted variable bias but they can offer some confidence regarding the primary results from Table 1. Viewed together, these additional models suggest that omitted variable bias is unlikely to explain the findings and that our model of selection into the intervention did not substantially alter our findings. Moreover, even when this theory is subjected to a difficult test – by including country fixed effects in the model – the evidence points in a consistent direction.

Does income inequality explain the association between wage setting and health?

Wage-setting institutions – such as collective bargaining – are, in general, associated with life expectancy, adult mortality rates and infant mortality rates. But an important question remains unexamined. Does income inequality explain part of the relationship between wage-setting institutions and health? Here, I conduct mediation analysis for three possible mediators. Two of the mediators measure income inequality, using the GINI coefficient and the top 1% share, and the other mediator measures increase in wages generally across the income distribution. The main comparison in these models is between collective bargaining and those country-years in which there is little or no regulation on wage setting.

Figure 4 shows the results of the mediation analysis for the standardized adult mortality rate for each of the three mediators. The total effect of collective bargaining on mortality varies somewhat from model to model but is consistently negative and overlaps with the earlier estimate reported in model 1 in Table 1. Partly these shifts are due to changes in the sample size for the mediation analysis compared with the models reported above.

However, the average mediation effect varies considerably. Both measures of income inequality do not appear to sit on the causal pathway between wage-setting institutions and health. As discussed above, there is a large literature demonstrating that these wage-setting institutions are correlated with income inequality and so this is not where the causal mechanism breaks down. Rather, the variation

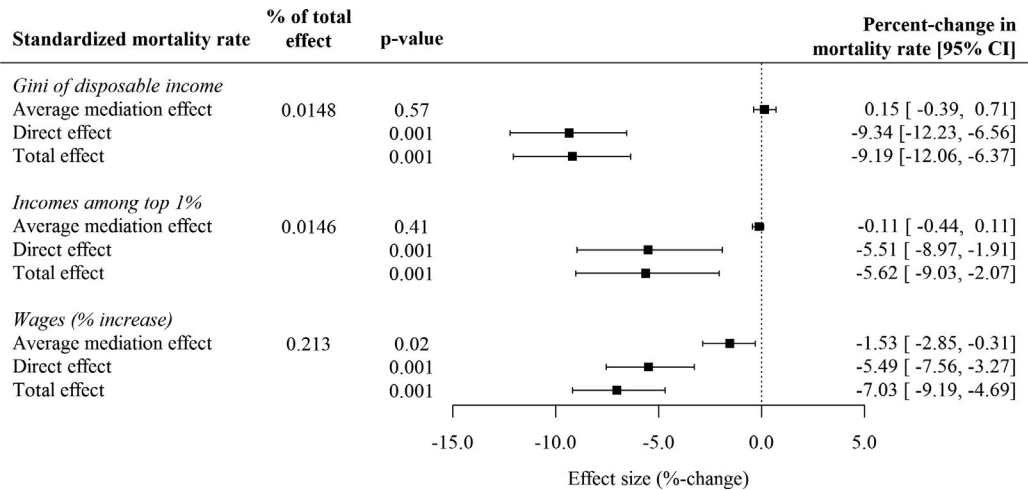


FIGURE 4 Mediation analysis of the association between wage setting and adult mortality rate

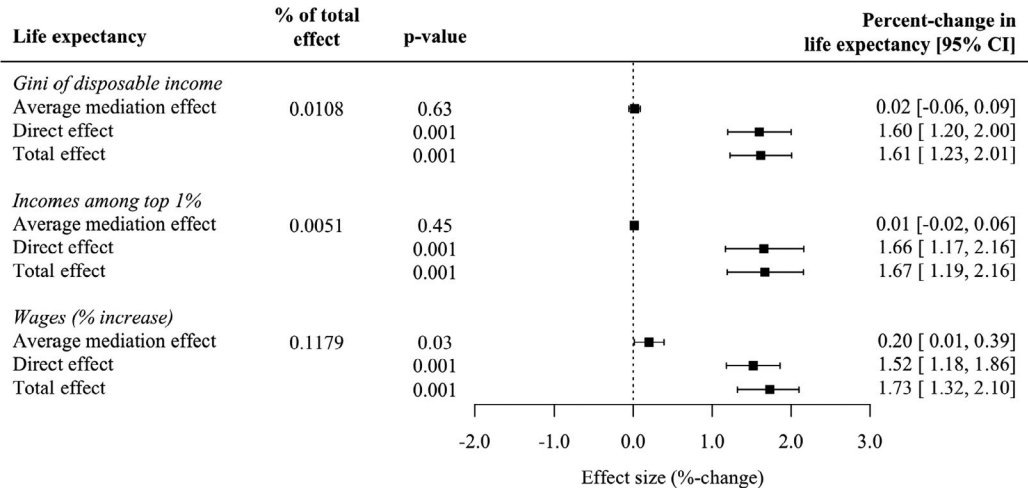


FIGURE 5 Mediation analysis of the association between wage setting and life expectancy

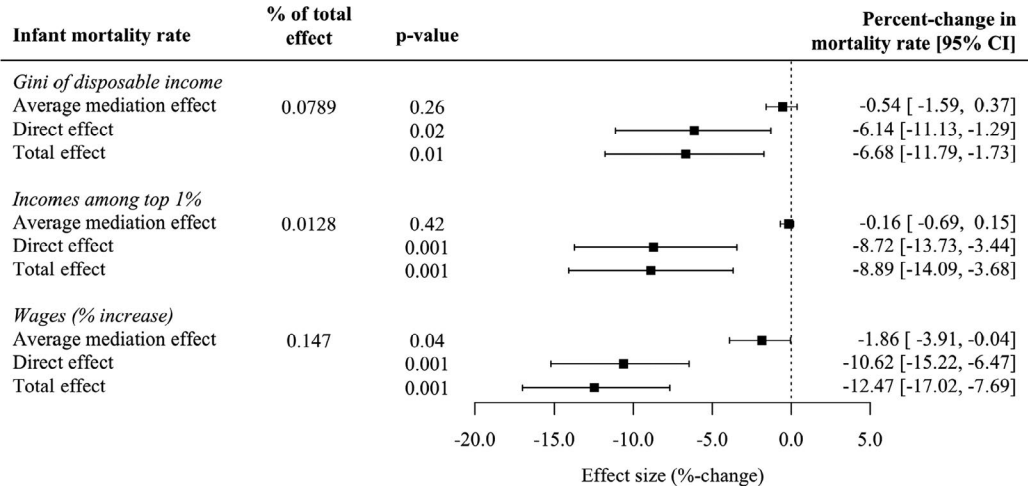


FIGURE 6 Mediation analysis of the association between wage setting and infant mortality

created in income inequality by differences in wage-setting institutions does not seem to be correlated with variation in adult mortality rates.

In contrast, when I examine whether the annual growth rate in average wages for the whole income distribution there appears to be a strong association. Wages do appear to sit on the causal pathway between wage-setting institutions and mortality. In fact, around ~20% of the total effect of wage-setting regulation on health is explained by wage growth. I also re-estimated these models without taking the logarithm of the dependent variable and find qualitatively similar results (Appendix S9).

Turning next to the results for life expectancy and infant mortality in Figures 5 and 6, the results are almost identical. In every case, these two measures of income inequality do not appear to sit on the causal pathway between wage-setting institutions and health, whereas variation in wage growth is associated variation in mortality. The degree to which wages mediate wage-setting institutions and health varies (it is ~12% in the model examining life expectancy and ~15% in the model examining infant mortality) but it always accounts for a substantial portion of the variation.

Limitations

Future research should seek to address the limitations of this paper. First, there are other important aspects of wage-setting regulation that have not been analysed directly here or have only been treated as control variables. These may be important in their own right and need to be examined carefully with that specific goal in mind. While recognizing their importance, a paper examining all of these dimensions would have been unwieldy. Second, despite exploring various statistical fixes for the problem of omitted variable bias, it is not impossible that some other unmeasured confounder may explain the associations documented here. Given the sensitivity analyses conducted above, I believe such a confounder or confounders are unlikely but future work should seek to use alternative identification strategies to test the claims made in this paper. Third, the countries included in this analysis are all high-income countries and it is not clear whether the results could easily be generalized to other contexts. For example, it is far less likely collective bargaining would improve health in contexts where corruption is rife or where there is a large informal economy (Reeves et al., 2021). Fourth, although the findings reported here are precise – in that they are not correlated with theoretically unrelated health outcomes, such as falls – more work is needed to unpack which causes of mortality are most closely associated with wage-setting regulation. Fifth, I do not have complete data for all countries and years. In Appendix S10, I explore whether and how this may influence the results. Although I find largely consistent results, it is impossible to rule out precisely how these missing data might influence these findings.

DISCUSSION

This analysis draws on a cross-national data set of 22 high-income countries to answer two questions, namely whether wage-setting institutions are associated with better population health and whether this association is mediated by income inequality or some other variable. Two key findings emerge from the analysis.

First, collective bargaining is associated with lower mortality rates and higher life expectancy than contexts where there is little or no regulation around wage setting. Of course, this evidence does not prove causality but the association is robust and has a high degree of specificity. Any alternative explanations would need to account for a large portion of the unexplained variance in health across countries to remove entirely the associations documented here. On top of this, the relationship is theoretically plausible. Institutions clearly affect where people work, for how much, and how often (Hope & Martelli, 2017; Kristal, 2010; Pontusson et al., 2002) and, building on this literature, there are strong theoretical reasons to expect institutional rules governing wage-setting relations between employers and employees affect the health of populations (Bakhtiari et al., 2018; Beckfield et al., 2015). Wage-setting institutions, in short, appear to be one of the ‘causes of the causes’ of ill health (Rose, 1993).

The second main finding from the analysis is that, assuming there is a causal relationship between wage-setting institutions and health, there is little evidence income inequality mediates this relationship, and this is true across the two different measures of economic inequality deployed in this analysis. It is important to be clear about what these results do not say. They do not, for example, prove that income inequality is *not* associated with health or health inequality. Rather, what these results do suggest is that wage-setting institutions do not appear to improve health *because* they reduce inequality. Or, to put it more precisely, the portion of the variation in income inequality between countries created by variation in wage-setting institutions seems largely unrelated to variation between these same countries in health.

Together, these two findings build on the ‘institutional theory of health’ described by Beckfield et al. (2015) but the results also add new theoretical insight into the political economy of health. Wage-setting institutions constitute one of the ‘rules of the game’ that organize who has power in societies. When countries remove or weaken collective bargaining arrangements, they are instantiating new power relations between firms and their employees. Changing these institutions (or rules) can create winners and losers, and the durability of those rules – manifest here in the stability of wage-setting institutions over time – suggests that when groups find themselves in a structurally weaker position they are likely to remain in that position over the long-run. This paper, then, extends this institutionalist way of thinking about the production of population health by illuminating how workers may experience poorer health when structurally disadvantaged in contract negotiations with employers.

As such, these results, if read through this political economy lens, may help explain cross-national differences in life expectancy, such as the U.S. health disadvantage relative to other high-income countries. Over the period analysed here, ‘life expectancy gains in the US have not kept pace with gains in other high-income countries’ (Avendano & Kawachi, 2014: 308). The United States does not have a strong history of robust labour regulation, and, to counteract the health consequences of this lack of wage-setting policy, it would need a very generous social safety net, but even here it falls short of other high-income countries (Beckfield & Bambra, 2016). The UK too has also drifted away from the principles of collective bargaining and now relies on a fixed minimum wage which is uprated through a consultative process. These are both countries that have experienced long periods of wage stagnation and which saw the labour share of national income decline relative to the capital share (Huo, 2015). The erosion of collective bargaining and minimum wages may have contributed to both of these economic shifts (Beramendi & Rueda, 2007; Iversen & Stephens, 2008), suggesting that the capital share is more likely to increase at the expense of the labour share of income in contexts where these institutions are absent. Weakening wage-setting regulation may therefore have implications for improvements in health over the long-run, especially if they rebalance power between labour and capital.

These results also uncover a tension within some of the work on the political economy of health. These findings reveal that one cannot assume that the political economy of inequality can be neatly extended to health outcomes. Population health may be correlated with economic inequalities (Pickett & Wilkinson, 2015), but it is not entirely determined by them. By testing whether income inequality sits on the causal pathway between institutions and health, these results do more than simply provide empirical estimates of cross-national relationships. They also illuminate a potentially fruitful approach to developing debates in this area by investigating whether or not the political economy of health mirrors the political economy of inequality. In other words, this approach examines whether the political and economic drivers of inequality, for example, wage-setting institutions, are the same as the political and economic drivers of health?

This paper has taken one step in that direction, but it also opens up new avenues for future enquiry. The models reported here reveal that wage growth – a central focus in the literature on the political economy of inequality – only explains one-fifth of the relationship between wage-setting institutions and health. This raises a number of important questions regarding how institutions like collective bargaining may produce better health and suggest that more attention should be given to working conditions (safer working environments) or other fringe benefits (such as health insurance or maternity leave). Only ‘a relatively small set of institutions’ have been examined with the political economy of health literature thus far, and most of these have focussed on ‘economic goods’ (McCartney et al., 2019). These results, therefore, should push health scholars to think more seriously about how the influence of employment regulations on social outcomes may be linked with non-economic goods and may be moderated by other political and economic factors, such as the size of the public sector and the

presence of inter-sectoral productivity gaps (Lee et al., 2011). This approach, then, is important because it requires health scholars to develop more nuanced theories of the political economy of health that are separate from but in dialogue with the political economy of inequality.

Over the last four decades, there has been a gradual shift away from collective bargaining across many high-, middle- and low-income countries. This weakening of employment regulation may have had the unintended consequence of undermining efforts to achieve the Sustainable Development Goals (SDGs). Some countries have seen dramatic declines in the coverage of collective bargaining agreements in recent years, and this erosion of worker's rights may have contributed to rising suicides, greater levels of unmet medical need, and may be partly implicated in the stagnation of life expectancy in some countries since 2010. Reinvigorating collective bargaining – and the organizations which make such institutions meaningful, for example unions – could accelerate both the creation of decent work and economic growth (Sustainable Development Goal 8) and improvements in longevity and infant mortality (Goal 2). By taking the opposite course, and allowing the gradual erosion of employment institutions, countries may be inadvertently making it harder for their societies to 'ensure healthy lives and [to] promote well being for all at all ages' (Goal 3).

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DATA AVAILABILITY STATEMENT

All data and code are available on Github: <https://github.com/asreeves/collective-bargaining-mortality>.

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ENDNOTES

- ¹ Japan is a country that has traditionally rejected all forms of intervention into the wage-bargaining process, and, in these settings, workers are often perceived to have much less power than the firm, especially in low-skill sectors and when unemployment is high.
- ² Minimum wage policies also affect earnings but they do so in quite different ways, and may therefore have quite different implications for health. Minimum wages are primarily intended to boost wages at the very bottom of the income distribution and there is evidence they are successful, especially when they are regularly uprated to account for inflation (Brown, 1999). Of course, minimum wage policies may have little impact on earnings if the threshold is low and they could have a negative effect on earnings for some if unemployment rises after minimum wages go up (Neumark and Wascher, 2002). The compositional effects of minimum wage policy are also gendered, with women tending to benefit more in high-income countries (Fortin and Lemieux, 1997). Minimum wages do influence earnings but their impact is weaker and often more targeted.
- ³ The intuition behind this technique is simple: the coefficient of interest is re-estimated under different simulated scenarios which assumes the presence of unmeasured confounding. In each iteration of the simulated analysis, the unmeasured confounder(s) is hypothesized to possess a different correlation with both the intervention (i.e. collective bargaining) and the outcome (mortality rates).
- ⁴ Mediation analysis aims to parse both the direct effect of X on Y and the indirect effect of X on Y through another variable M. If the indirect effect of X on Y through M (e.g. income inequality) is 0, then there is no evidence of mediation through that variable, whereas if the indirect effect of X on Y through M is different from 0, then there is evidence of mediation. This implies that X changes M which in turn changes Y. The mediation analysis moves

forward in two steps. First I specify two statistical models, the mediator model (which predicts the mediator given the treatment variable and other covariates) and the outcome model (which predicts the outcome given the mediator, the treatment variable and the covariates). These models are initially fitted separately but then, in the second step, they are used together to calculate the average causal mediation effect (ACME). The ACME gives us some indication of whether the association between X and Y is transmitted through the mediating variable.

- ⁵ The results are unchanged if the models are estimated without taking the logarithm of the dependent variable (see Appendix S3), and I also explore whether the results are stable after excluding the United States, which might be an outlier because it has high income inequality, no wage coordination and public health deficiencies. Even after excluding the United States, the results are qualitatively the same (Appendix S4). I also explore what would happen to the findings if I excluded Germany because the data for Germany before 1989 is largely available for West Germany only (Appendix S5). The associations documented here may also have been driven by changes associated with the Great Recession, given that life expectancy has stagnated in some countries and the large changes to wage-setting institutions since then. However, even when we run the model from 1960 to 2006, the results are the same (Appendix S6). Finally, I estimate a series of models in which I remove and then add sequentially the other measures of employment institutions, finding a high degree of robustness in the coefficient (Appendix S7).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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