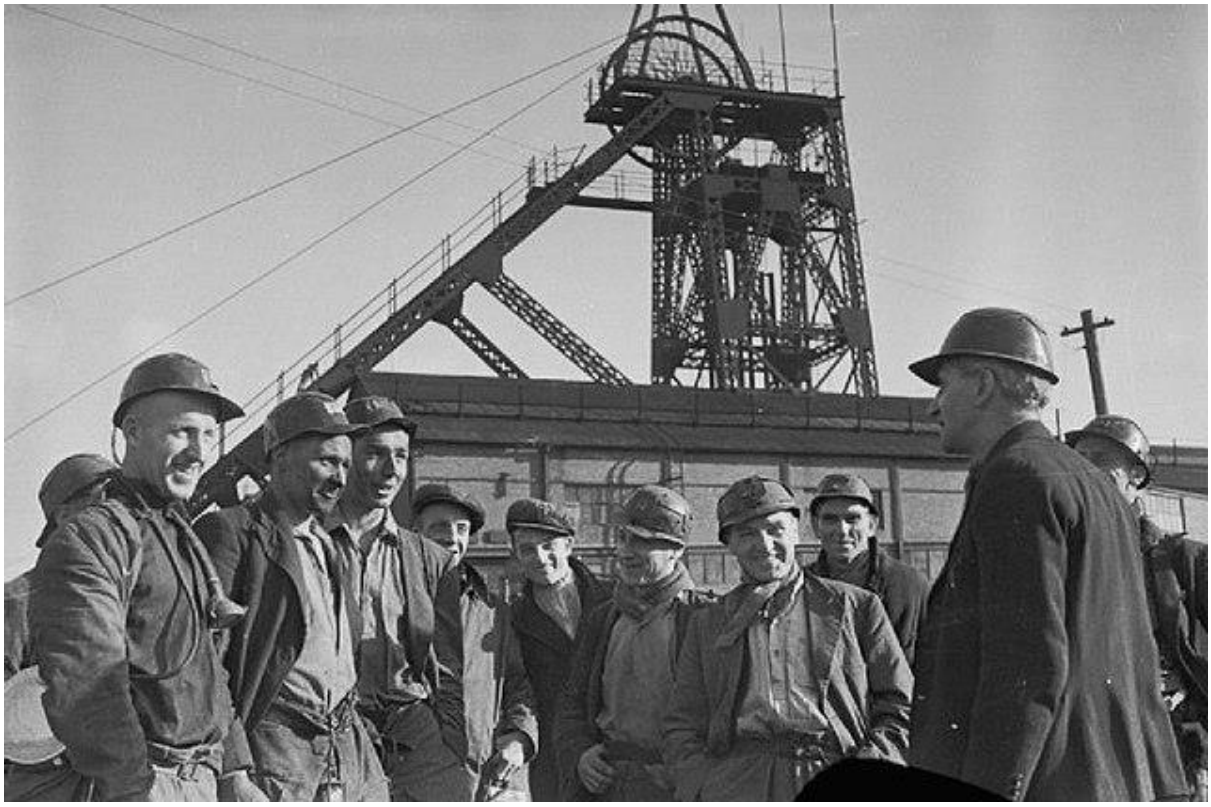

Coalminers outside a colliery in Nottinghamshire. Available at Wikimedia Commons.

The death of king coal: industrial decline during childhood and lifetime well-being

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Can deindustrialization durably impact well-being? On the one hand, it may represent a severe shock, leading to the loss of jobs and income. On the other hand, it may lead to the disappearance of polluting industries and hazardous jobs, potentially replaced by better opportunities.

The decline of coal mining in Great Britain from the 1950s until the 1990s is one of the most striking periods of deindustrialization. The enduring memory of the 1984 miners' strike in Great Britain, who were protesting Thatcher's pit closure policies, illustrates how much the end of the coal industry is collectively associated to the end of industrial Britain. At its height, in the 1930s, coal mining provided employment for more than 1 million individuals; and these jobs had almost completely disappeared by the 1990s (see Figure 1). Particularly severely affected areas were the Midlands, Yorkshire, areas around Newcastle and Manchester as well as parts of Scotland and Wales (see Figure 2). Today, these communities still register among the worst socio-economic indicators in the UK. For instance, life expectancy there is one year shorter than the national average (Foden, Fothergrill, and Gore 2014). Can we trace back this deprivation to the demise of the industry?

In this paper, we exploit the differential timing of coal mine closures to study the effect of growing up in times of industrial decline on individual health development throughout life. To do this we combine data from the two fist cohorts of the UK Longitudinal Studies (National Childhood Development Study 1958 and British Cohort Study 1970) with information on coal mine operations and closures from the Northern Mine Research Society.

As Figure 2 highlights, the timing of closures varied considerably. Among coal mining regions, the timing of pit closures was plausibly exogeneous. The National Coal Board indeed decided upon these closures by considering whether geological factors allowed for productivity improvements. Conditions such as the thickness and accessibility of seams, access to water, and the friability of the coal, dictated the possibility of productivity improvements with the introduction of new machines, economies of scale, or new organisation techniques. These conditions were therefore the ultimate determinant of which mines survived and which ones closed (Allen 1981; Burns et al. 1985). We exploit this variation by comparing individuals according to the number of mine closures they were exposed to during their childhood years. This variable proxies for the extent of the local economic hardship experienced by these individuals.

The longitudinal nature of our data allows us to overcome a number of key empirical challenges in evaluating the effect over an individual's lifetime. We can estimate the following regression equation

$$y_{is\ell c} = \lambda_{s\ell} + \sum_{\ell} \beta'_{\ell} \text{Mines } 0-10_{sc} + \sum_{\ell} \gamma'_{\ell}(X_i + \eta_c) + \varepsilon_{is\ell c}$$

The outcome $y_{is\ell c}$ is a measure of health and wellbeing (such as zScore height, BMI, etc) for individual i in survey s at life stage ℓ in county c. $\text{Mines } 0-10_{sc}$ is our variable of interest measuring the effect of the number of coal mine in the county during childhood (age 0-10). This term decreases when mines close. As we aim to measure the effect throughout life, β_{ℓ} is allowed to vary over life stage ℓ.

A key problem is that areas with more coal mines are likely different from areas without coal mines in terms of initial socio-economic composition, which in turn might influence the life trajectories of individuals. Coal mine closures, by definition, happen in the coalfields, which are regions that may have intrinsically different potential for individual well-being. To deal with this confounding problem, the term $\sum_{\ell} \gamma'_{\ell} (\eta_c + X_i)$ is added. η_c is the county of birth, and the effect of time invariant county characteristics is allowed to vary by life stage. To account for potential individual different socio-economic characteristics in mining counties, we also control for household characteristics at birth, and allow the effects to vary over life stage. The vector of controls X_i includes gender and measures of whether an individual's mother was educated, a smoker, and her marital status, as well as whether an individual's father was in the household, and of the highest social classes. Finally, the term $\lambda_{s\ell}$ absorbs the average difference in outcome between surveys (1958 or 1970 cohort) for each life stage.

Our findings suggest considerable negative and persistent effects of growing up in times of de-industrialization. We observe that when the number of mines in the county decreases during a person's childhood, they have lower height throughout life (Figure 3) and worse health (Figure 4). Individuals are also both more likely to be overweight in their late teens to 20s or underweight throughout life (Figure 5). People report worse overall health until their late teens, but the indicator recovers afterwards. It may be that individuals get accustomed to worse health, as a focus on more objective measures shows that in their 30s, they are more likely to have suffered from cancer, diabetes, eating disorders, migraine and breathing problems.

Interestingly, we do not observe the effect of coal mine closures to be stronger in mining families (those where the father is a miner). This suggests that the economic downturn was broader than just affecting miners. This seems little surprising considering that coal mining was the dominant industry and employer in many communities (e.g. Easington, Mansfield etc) with the closure of coal mines creating a broader economic downturn in areas. Similarly, mines employed many occupations, from cooks to accountants. In support of this, we observe that fathers from all occupations are more likely to be unemployed during the individuals' early childhood when there are more mine closures.

We do not observe that individuals that grew up in times of de-industrialization display clearly worse economic outcomes later in life. A possible interpretation is that while people may recover economically through migration and the switch to more future-proof industries, the health penalty of hardship throughout childhood is one that is harder to recover from.

References

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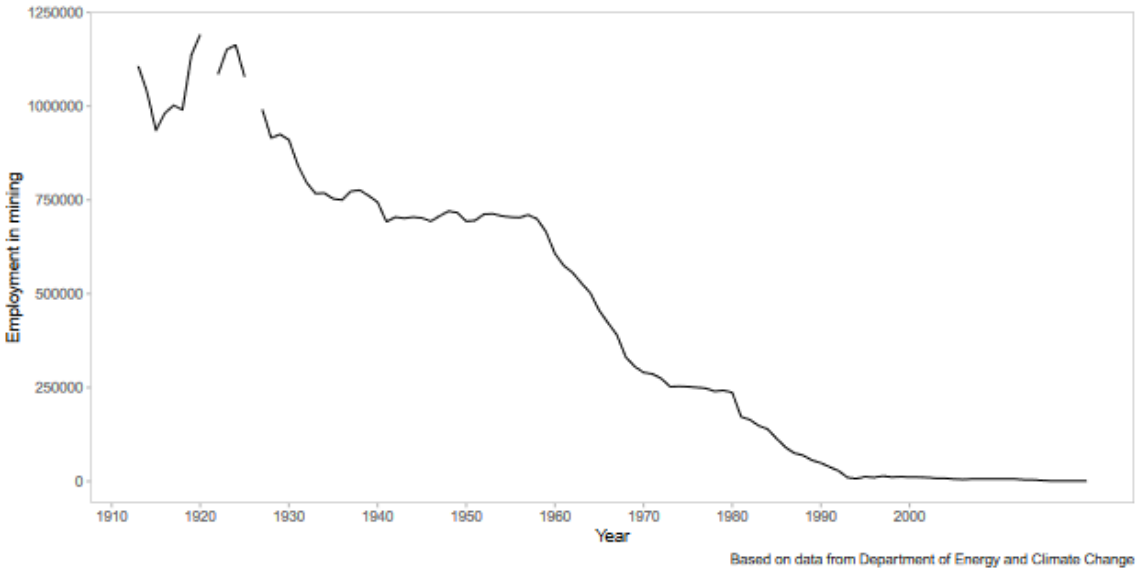
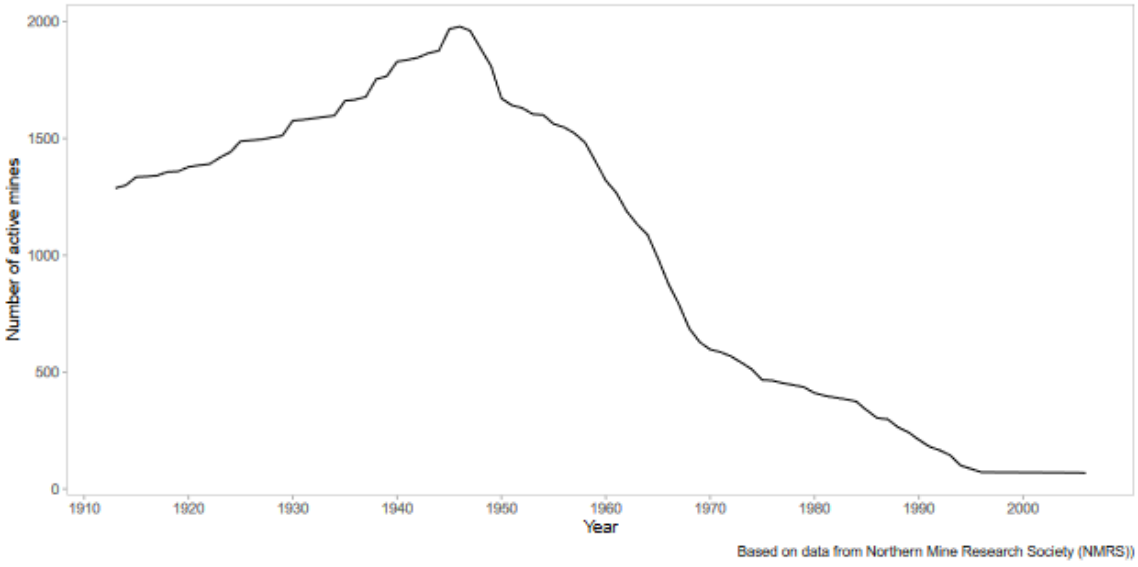
Appendix

Figure 1: The decline of British coal mining



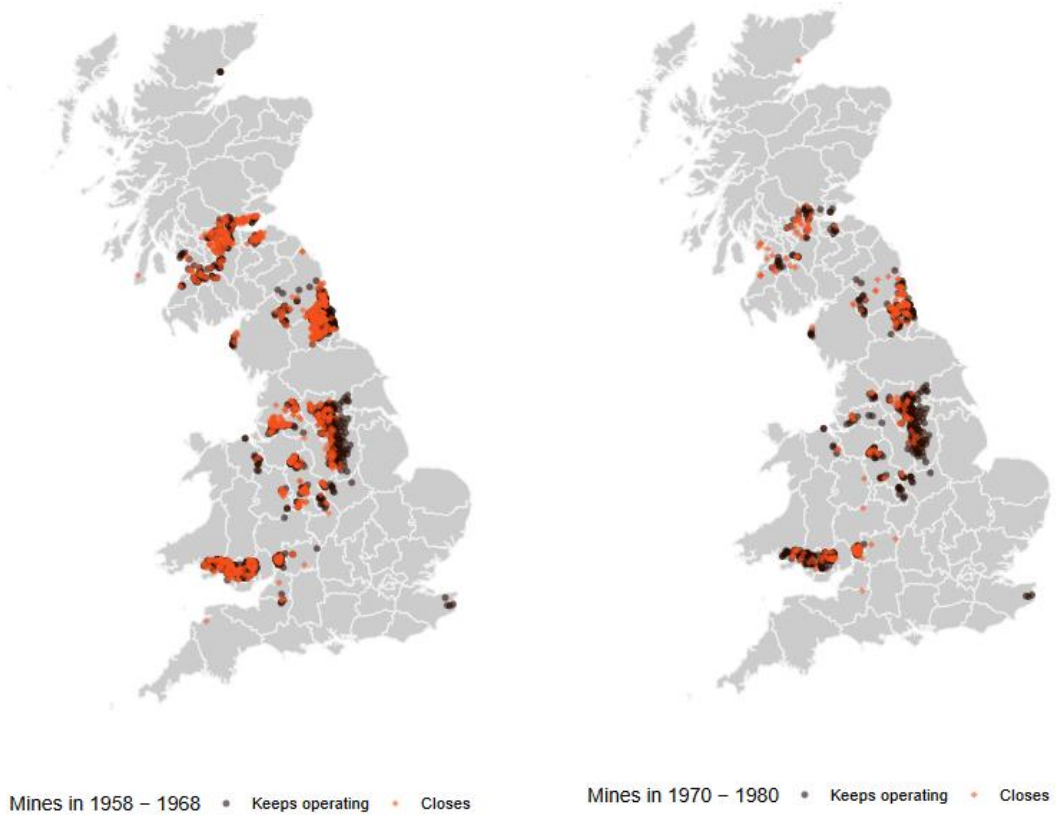
(a) Employment in mining



(b) Number of active mines

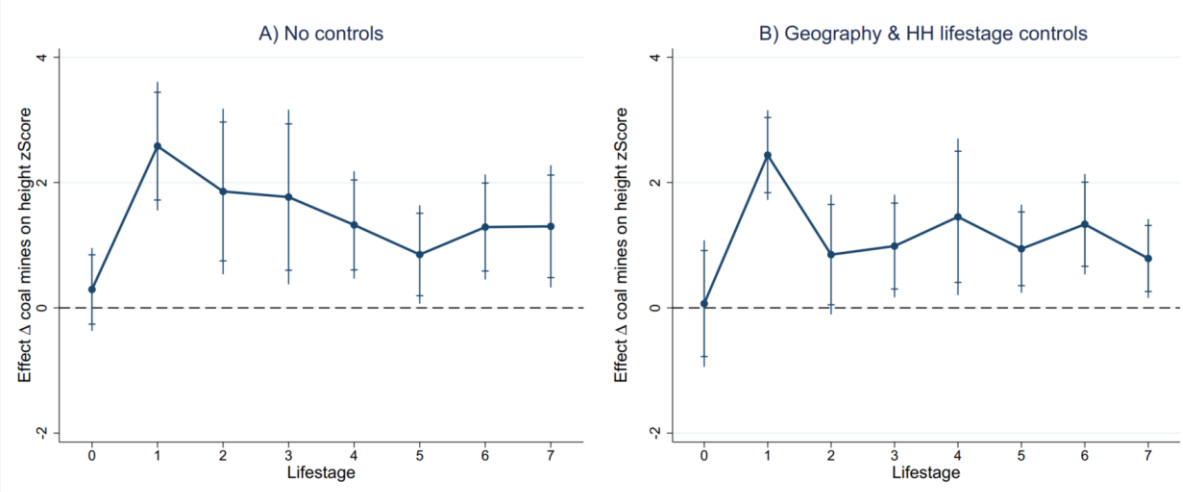
Notes: The figure depicts the employment in mining and mines (nearly exclusively coal) for the period 1910-2010.

Figure 2: Mine closures in 1958-68 and 1970-1980



Notes: The map depicts the mines that closed (red) and continued operating (black) across Britain. The left-hand side panel looks at the period 1958-68 and the right-hand side one depicts 1970-80. The period of early childhood (age 0-10) in our two longitudinal studies.

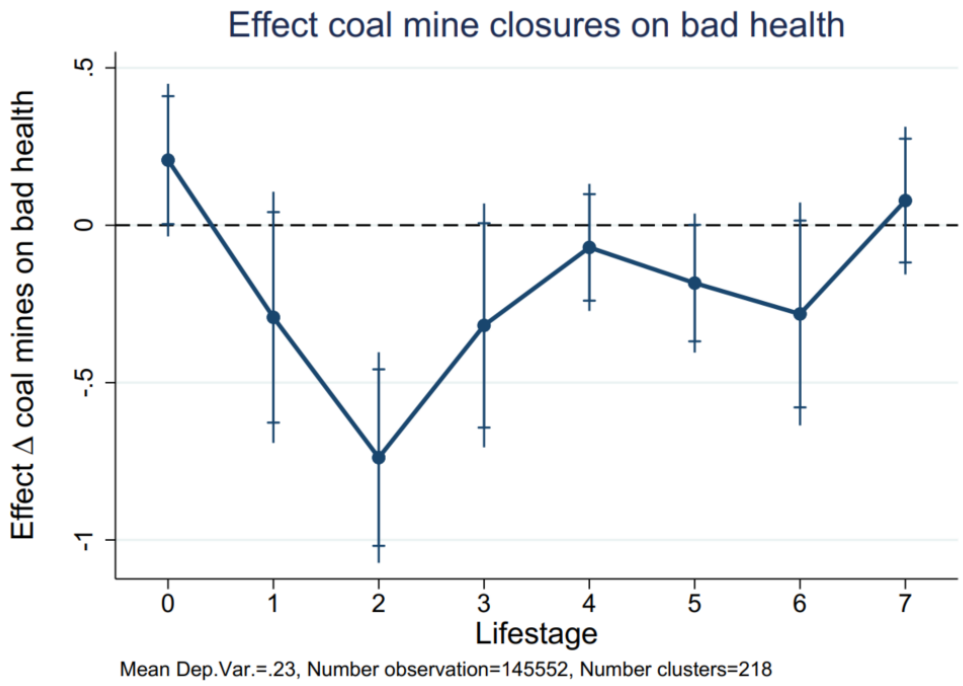
Figure 3: Coal mine closures and height



Notes: Estimates for the effect of change in mines per 1000 inhabitants during childhood (age 0-10) on height z-Score over an individual's lifestages. Panel A) includes only survey-lifestage fixed effects. Panel B) includes survey-

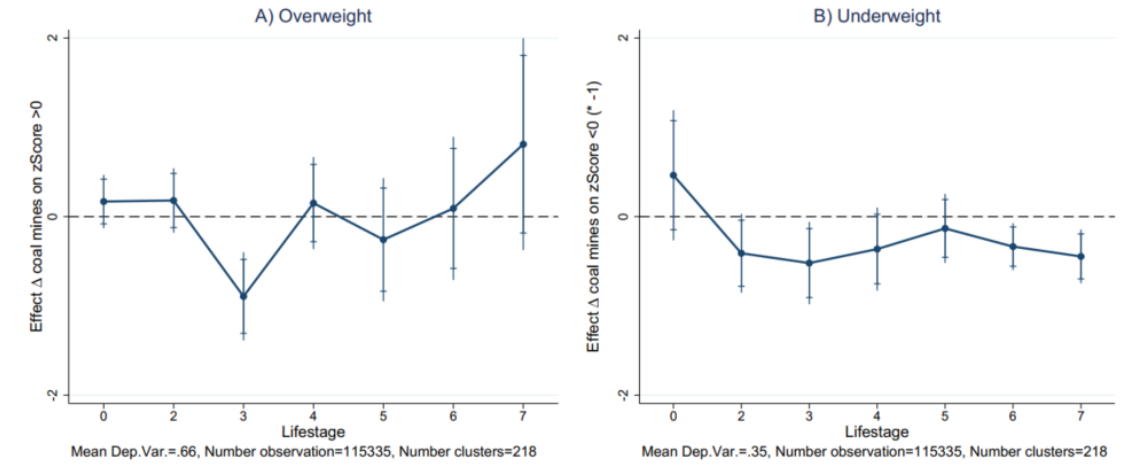
lifestage fixed effects, county-lifestage fixed effects and controls for initial household characteristics interacted with lifestage fixed effects. Initial characteristics are mother educated, smoker, and married as well as father household member, and social class. 90% & 95% confidence intervals depicted.

Figure 4: Coal mine closures and bad health



Notes: Estimates for the effect of change in mines per 1000 inhabitants during childhood on bad health over an individual's lifestages. Baseline controls included. 90% & 95% confidence intervals depicted. Standard errors clustered on county-survey.

Figure 5: Coal mine closures and over- & underweight



Notes: Estimates for the effect of change in mines per 1000 inhabitants during childhood (age 0-10) on weight z-Score (based on age) by overweight and underweight. Panel A) shows the effect on individuals z-Score weight for values > 0 (z-Scores below are set to 0). Panel B) shows the effect on the inverse individuals z-Score weight for values < 0. Baseline controls included. No weight data available at age 5 in BCS (1 lifestage). 90% & 95% confidence intervals depicted. Standard errors clustered on county-survey