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The Cost of Climate Change Policy: The Case of Coal Miners

The phasing out of coal is considered a key component of the upcoming energy transition. While environmentally appealing, this measure will have a devastating effect on those working in the coal industry. Using the dissolution of the UK coal industry under Margret Thatcher as a natural experiment, we estimate the long run costs of being displaced as a coal miner. We find that within the first year of displacement, earnings fall by 80-90 percent, relative to the earnings of a carefully matched blue-collar manufacturing worker, while the wages of miners who find alternative employment fall by 40 percent. The losses are persistent and remain significant fifteen years after displacement. Our results are considerably above the estimates provided by other studies in the job displacement literature and may serve as a guide for policy makers when aiming for a just energy transition.

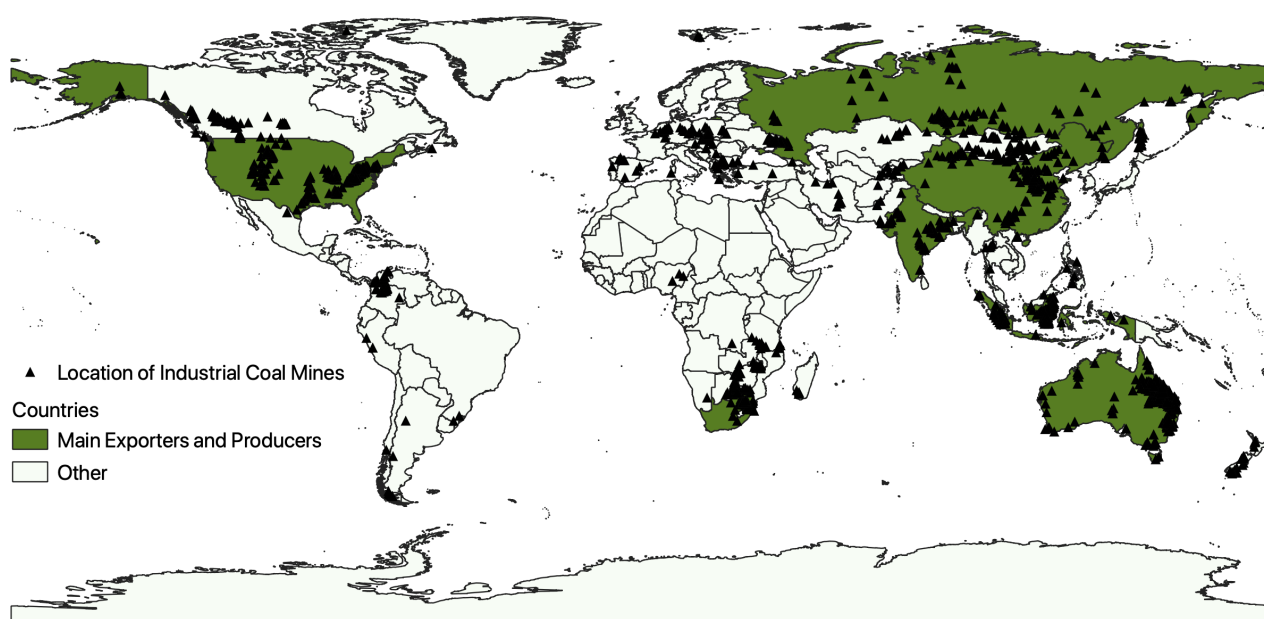


The Coal Mining Industry and Global Warming

According to the recent [IPCC report](#), limiting global warming to 2 degrees Celsius requires a near complete and rapid elimination of coal in the global use of energy. Such a drastic measure is bound to have devastating effects on anybody economically linked to and dependent on the coal industry. Our back-of-the-envelope calculation

suggests that the closure of the currently 2300 active industrial coal mines would translate into more than 5 million displaced coal miners. In Figure 1 we plot the spatial distribution of coal mines, indicating the locations of the upcoming displacements globally.

Figure 1. Location of industrial coal mines. The seven biggest producers and exporters of coal are marked in green.



Source: SNL Energy Data Set produced by S&P Global.

In a [new paper](#) (Rud et al., 2022), we estimate the average loss in the earnings of coal miners who have been displaced following one of the most notorious labor disputes of the 20th century: the dissolution of the coal sector in the UK. When Margaret Thatcher came into power many of the mines were unprofitable (Glyn, 1988). Considering the mines to be ripe for closures, the

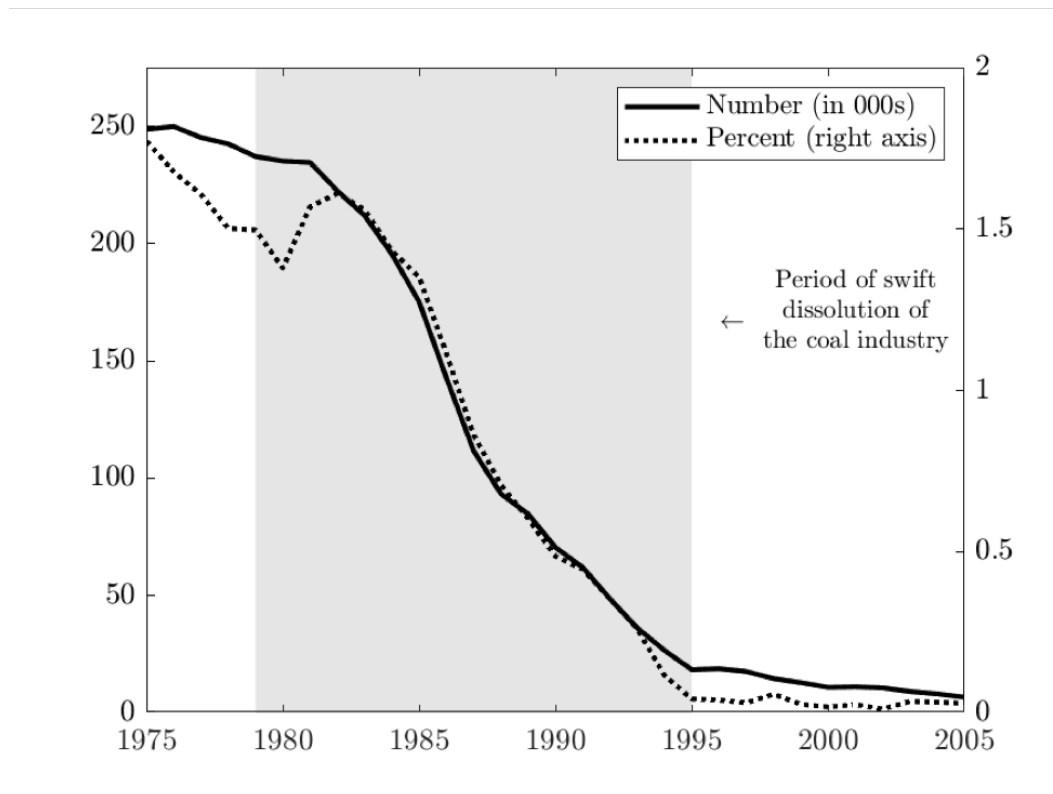
UK government publicly announced the closure of 20 mines in 1984. After additional information on further closures reached the press, the Union of Miners called for a general strike. The strike lasted for nearly a year and ended with a devastating defeat of the miners. From 1985 and onwards, the closure of mines proceeded at such an incredible pace that the dissolution of the UK coal industry is



considered the most rapid in the history of the developed world (Beatty and Fothergill, 1996). As shown in Figure 2, the closures resulted in an

equally rapid displacement of miners, from 250 000 employed miners in 1975 to less than 50 000 by 1995.

Figure 2. Coal Mining Employment in the UK 1975-2005



Note: The number on employed miners is collected from National Coal Board (1970-1993) and used in Aragon et al., (2018). The percent of employment shown on the right axis was calculated from the New Earnings Survey, the main data source used in this paper.

The Effects of UK Coal Mine Closures on Miners

At the heart of our empirical analysis is the New Earnings Survey, a longitudinal dataset covering 1 percent of the UK population since 1975. For the period 1979-1995 (marked in gray in Figure 2), among the 25-55 years old and those who were employed by the same mine for at least two consecutive years, we identify 2152 miners who experienced a final separation from a mine. In our baseline specification, these miners are matched to

a single manufacturing worker using a large array of observables such as age, gender, hours worked, pre-separation employment and earnings, geographical administrative unit (county), as well as whether their respective wage was determined in a collective agreement. By the nature of the exercise we are unable to match on industry and instead match on detailed occupational information. A variety of other matching procedures suggest our results are robust.

In Figure 3 we plot the estimated differences in the evolution of earnings and wages for four years

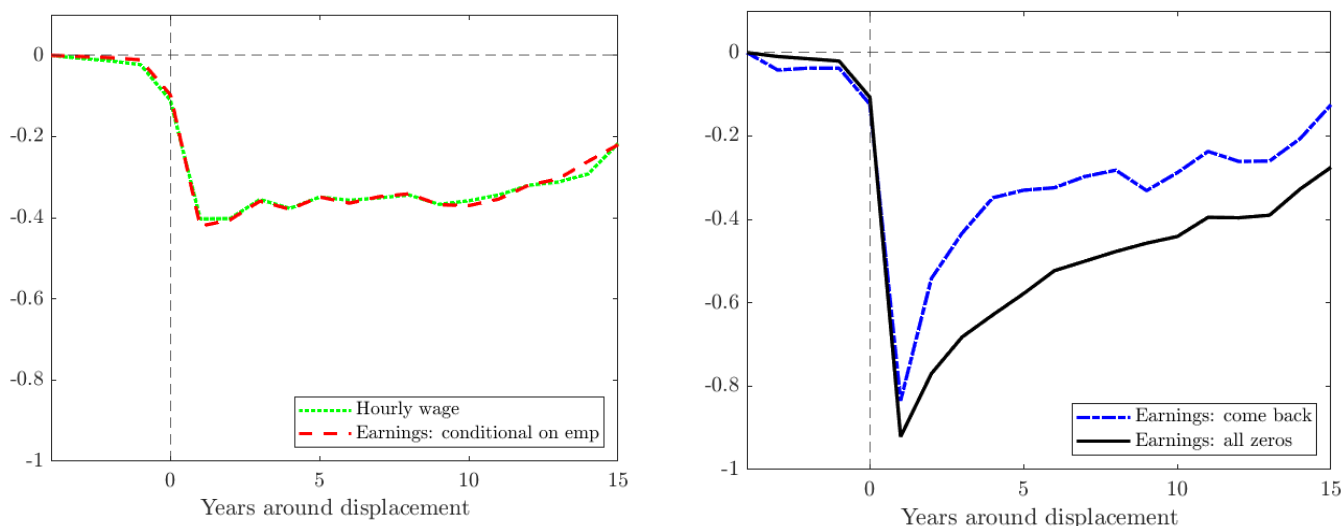


before, and fifteen years after displacement. The coefficients are estimated conditional on time and individual fixed effects. Due to the normalization of the dependent variable, the estimates should be interpreted as the percentage change relative to pre-displacement values. In Panel A of Figure 3 we show that hourly wages and weekly earnings conditional on employment drop by around 40 percent in the year after displacement and recover only slowly. It should be noted that the losses in earnings conditional on employment are not driven by changes in hours since the two series are close to identical.

In Panel B of Figure 3 we show the effect on earnings taking into account the losses of those who have not been successful in finding alternative employment in another industry. To get to these results we need to make some assumptions since the New Earnings Survey neither includes earnings information on the self-

employed, nor on those who are active in the informal sector. Many other studies in the job displacement literature share similar data limitations, so we follow their approach in dealing with these. On the one hand, we assume zero individual earnings for periods without any observed labor earnings in the data, as assumed by Schmieder et al. (2022) and Bertheau et al. (2022). This assumption does not appear too strong since there is some evidence suggesting that ignoring the self-employed only marginally affects the results (Upward and Wright, 2017; Bertheau et al., 2022). On the other hand, we complement our results with an approach inspired by Jacobson (1993) where we keep only individuals who experience positive earnings within four years after displacement. The latter approach provides a more conservative estimate of displacement costs by assuming zero earnings only for individuals who eventually return to work.

Figure 3. The hourly wage and earnings conditional on employment (Panel A), and overall earnings costs of final displacement from a mine (Panel B).



Note: We plot the coefficients of the estimated panel data model with time and individual fixed effects and distributed leads and lags. "Earnings: come back" refers to the treatment group where we only include those who have positive earnings at some point four years after job loss, and impute periods without employment as zeros. "Earnings: all zeros" refers to the treatment in which we replace the earnings of any miner with a zero if the miner is not observed for any year, without restrictions.



Interpreting all periods of missing information as zeros, we find the initial losses to be around 90 percent of pre-displacement earnings within the first year after separation, while the more conservative estimates are only slightly lower at around 80 percent in the short run. In the long run, the losses are persistent and remain significantly depressed even fifteen years after displacement. Over the fifteen years after displacement these numbers amount to the miners losing on average between 4 to 6 times of their pre-displacement earnings. This implies that miners only receive 40-60 percent of the present discounted counterfactual earnings.

Our estimates are considerably above those provided by studies in the job displacement literature that focus on mass layoffs. Couch and Placzek (2010), for instance, report initial losses to amount to about 25-55 percent, while Schmeider et al. (2022) find initial earnings losses to be around 30-40 percent. Davis and Wachter (2012) estimate the long-run effects based on US data and find the present discounted earnings losses to be on average 1,7 times the workers' pre-displacement earnings.

The large estimated individual costs to the displaced miners are likely due to a combination of at least two reasons. First, the complete collapse of the sector forces displaced miners to reallocate and search for another job in other industries, and likely other occupations. Since coal mining is a highly specialized occupation, this greatly reduces miners' ability to transfer the accumulated human capital to another activity (Beatty and Fothergill, 1996; Samuel, 2016). Second, most coal miners are employed in remote and rural areas where mining is often the main employer, something which remains an issue for current miners around the world (see Figure 1). This feature reduces local economies' capacity to absorb displaced miners

after a mine closure and, due to the need to relocate, greatly increases workers' job searching costs.

Conclusion

While it is important to globally transition away from the excessive use of fossil fuels, we should keep in mind the devastating effects such transition will end up having on some groups. And while coal miners are particularly vulnerable to the upcoming energy transition, the ramifications do not stop there. Individuals employed in industries linked to the coal industry are likely to also be affected by its dissolution. Moreover, individuals employed in industries providing local services, such as retail stores, restaurants and pubs are likely to experience a significant drop in demand. Thus, the impact of coal mine closures on coal dependent communities typically goes far beyond the displacement of miners (Aragon et al., 2018). The closure of mines will lead to spikes in local unemployment, often unregistered ("hidden"), as well as an exodus of the population. Estimating and accounting for these effects is important if we aim to provide a just energy transition for all.

Attempts have been made to foster economic recovery of affected communities. Regeneration policies have included re-training of local workers, support of small and medium-sized businesses, and investments in local infrastructure, among others. However, their success has been limited and former mining communities remain among the poorest in the UK (Beatty et al., 2007). Preparing a set of policies which will have the capacity to reduce the costs of the transition, as not to repeat the devastating experience of UK coal miners and their communities, is an important task ahead of current policy makers.



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