INDUSTRIAL POLICY IN DECLINING INDUSTRIES: EVIDENCE FROM GERMAN COAL

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Summary

Industrial policy is on the rise. However, empirical evidence of how industrial policy shapes technological progress and productivity remains scarce. This paper examines a policy that aimed at boosting industry-wide productivity by subsidizing plant closures in the declining German coal mining industry. Based on newly digitized, mine-level production data, my findings indicate that the policy increased long-run productivity in three distinct ways: First, it facilitated the exit of low-productivity mines. Second, it triggered reallocation towards large, productive mines, especially in firms where the subsidy alleviated financial constraints. Third, firms invested parts of the policy-induced subsidies into machinery and infrastructure of surviving mines. The resulting within-mine productivity gains extended mines' lifespan by six years. In total, the associated reduction in marginal cost exceeded the government subsidies.

Motivation and Context

Many Western economies have been facing significant changes in their industry composition, resulting from forces such as rising international trade or the advent of new technologies. Industries that were once highly relevant, such as steel production or car manufacturing, have declined for years. In a laissez-faire scenario, these industries might simply disappear, but for multiple reasons politicians strive to sustain such industries, or at least steer and decelerate their decline. For example, industrial decline and layoffs are typically regionally concentrated and induce (socio-)economic disparities in space as well as political polarization. Further, keeping an industry alive can serve strategic economic goals and ensure geopolitical independence or can help to overcome transitory causes for the decline.

For these reasons, politicians have an interest in supporting certain industries and pursuing industrial policies. Hence, it is crucial to understand which policies can be implemented in this context to meet the policymaker's goals in the most efficient way. However, while a large share of industrial policies is devoted to promoting declining industries, empirical evidence on the effects of such interventions remains scarce. This is due to the just recent resurgence of industrial policy and the focus of research on industrial policy in growing or new infant industries or placed-based policies after industries have declined.

In this paper, I shed light on the question of how industrial policy can enhance industry-wide productivity in declining industries, thereby actively steering the industry's decline. I study a historical episode of a specific industrial policy in the shrinking German coal mining industry in the 1960s and 1970s. At the time of the policy's introduction, the industry accounted for 4.5% of the national GDP, faced severe import competition with oil, and was set to decline considerably. However, rather than commonly subsidizing the industry's production to decelerate the decline, the government pursued the unconventional strategy of offering closure payments. Through this program, firms closed 25% of the industry's capacity.

Empirical Approach and Results

I show that this policy led to considerable productivity gains, by triggering the exit of unproductive mines, within-mine productivity growth, and within-firm reallocation towards more productive mines. This episode may have ramifications for the design of current policies in industries that are declining or hold excess capacities. My findings emphasize that the long-term survival of the industry might be achieved by consolidating industry capacities in more productive plants through targeted policies, rather than maintaining all production capacities in all firms via subsidies.

I study the policy's impact using detailed production data in physical units at the establishment level for the universe of German coal mines, which I newly self-digitized from various archive sources. Employing both reduced-form methods and the structural production approach in the spirit of Ackerberg et al. (2015) and De Loecker & Warzynski (2012), I demonstrate that the consolidation policy led to a significant productivity increase. Relative to Belgian mines that quarried from the same cross-border coal field and had similar development trajectories before the policy, German mines saw an approximately 10% increase in labour productivity over a ten-year time span after the policy on average.

This productivity rise can be attributed to three almost equally important channels. First, the closure subsidy led to positive selection, i.e., the exit of inefficient mines. I observe a negative effect of a mine's labour productivity and total factor productivity (TFP) on its likelihood of exiting under the policy. Since exit depends on many unobserved

factors that possibly correlate with productivity, I use an instrumental variable approach that leverages differences in mines' geology as an exogenous shifter of productivity for the identification of a causal effect. My preferred specification suggests that exit increased labour productivity (TFP) by 3.1% (1.5%).

Second, I show that firms used the closure subsidies to improve the productivity of their remaining mines. I compare the remaining mines of policy uptakers to non-uptakers, that both developed on similar pre-policy outcome trends, in a difference-in-differences design. I find that the subsidies alleviated the financial constraints of treated firms. The policy reduced uptaking coal firms' debt ratios by up to 15 p.p., while simultaneously boosting their stock market values by on average 30% and increasing dividend payouts by on average 20%. As a result, the subsidies induced more investments, which resulted in better infrastructure and technology adoption. Formerly more financially constrained firms responded more strongly to the policy. Overall, these adjustments contributed another 3.3% (4.1%) to industry-wide labour productivity (TFP) gains on average. I further show that estimated marginal costs of mines owned by treated firms fell by around 1.5%, resulting in cost savings that exceeded the government expenditures through the policy. The investments also extended the lifespan of treated mines by six years on average. Workers in treated mines profited through wage increases relative to those in mines of non-uptakers.

Third, by studying heterogeneity in mine characteristics, I show that the policy facilitated within-firm reallocation towards larger, more productive mines in multi-mine firms. This reallocation led to the emergence of a few very large and highly productive mines. Using distribution regressions in the spirit of Chernozhukov et al. (2013), I elicit the full counterfactual mine size distribution absent the policy. I find that absent the policy the largest mine would have been smaller than one-fourth of the treated mines post-policy. This reallocation channel contributed another 3.2% (1.7%) to the industry's labour productivity (TFP) gains.

Whereas the policy increased average industry-wide productivity, it also had significant distributional effects between firms. Recall that the policy's goal was to reduce capacity. In contrast to single-mine firms, multi-mine firms got around this policy target. They earned a premium for mine closures but shifted the full production volume of the closed mines to the remaining mines post-policy. I show that this caused an increasing productivity dispersion in the industry with deteriorating mines at the left tail and improving mines at the right tail of the productivity distribution. Further, I find that policy-uptaking firms revealed higher stock values, dividends, and lower debt ratios after the policy relative to non-uptakers.

The policy also caused a reallocation of output towards mines with cokeries. Cokeries refine coal to coke, a critical input for steel production. Steel production had been a reliable source of demand for coal, consuming around 40% of produced coal. As coke cannot be substituted with oil, the steel industry did not reduce its demand for coal and coke. Hence, the policy led to a shift in mines' business model along the value chain towards more stable customer markets. Thus, reallocation led mines to adapt to and insure themselves against the upcoming decline in household demand for coal. As a side effect of this reallocation, I show that the policy increased employment in vertically integrated cokeries owned by coal firms. While the policy laid off or retired 29,000 workers in the short-run (accounting for employment spillovers), it ultimately induced a higher survival rate of mines. A careful back-of-the-envelope calculation suggests that the extended longevity of these mines saved about 20,000 jobs per year over the post-policy horizon. I neither find positive nor negative employment spillovers to other industries in counties where mine closures took place, i.e., mine closures do not cause a deindustrialization outside of the narrowly defined coal industry.

I also thoroughly illustrate that the policy was cheaper than common alternative interventions. First, I show that price subsidies of the same volume as the implemented closure subsidies would have only sustained demand for excess coal production for two years. Moreover, wage subsidies or increased government consumption of excess coal would have quickly been more expensive policies than closure subsidies. I also demonstrate that promoting within-firm mine mergers would not have achieved similar productivity and efficiency gains as the closure subsidy.

My results are informative to policymakers about how to conduct industrial policy in declining industries, in industries with (temporary) costly overcapacities (e.g., milk production), or in which the decline of aggregate output is a policy goal (e.g., phase-out of non-renewables).

References

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