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Article

The Impact of Environmental Policies on Job Creation

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Abstract: By rerouting labor, investment and innovation toward resource-efficient and emission-free endeavors, environmental policies (EPs) transform economies. Although their impacts on employment vary by sector, time horizon and location, there is growing agreement that well-designed EPs may increase net employment while enhancing job quality-as long as there are supplementary measures for mobility, skills and a fair transition. Conceptual approaches, measuring techniques, sector-specific and global evidence and case studies from both developed and emerging economies are all covered in this study. In addition to highlighting distributional consequences (such as gender and informality) and identifying research gaps pertaining to data, assessment and long-term dynamics, it suggests a policy design checklist that optimizes job creation and reduces displacement.

Keywords: Carbon Pricing, Environmental Policies, Green jobs, Job Creation, Renewable Energy

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INTRODUCTION

Pollution, biodiversity loss and climate change all carry significant risks and financial implications. The goals of environmental policies (EPs), such as carbon pricing, regulatory standards, green public investment and industrial policy are to protect natural capital, internalize externalities and speed the proliferation of clean technologies. Whether these measures create or destroy jobs is a key concern for policymakers. In political discussions, particularly those pertaining to environmental policy, the impact on employment is a significant consideration. To encourage the integrated growth of the environment and employment, several developed nations have created a number of environmental control programs.

For instance, Renewable Energy Policies, Climate Change & Carbon Reduction Policies, Energy Efficiency & Technology Policies, Pollution Control & Waste Management, Agriculture, Land & Biodiversity Policies and Industrial & Regional Policies and other laws and regulations have been in place in response to the manufacturing sector's excessive resource consumption and environmental harm. Proponents of regulation contend that it would lead to the creation of "green jobs," while opponents criticize the Environmental Protection Agency (EPA) for "killing jobs." The Clean Air Act, for instance, mandates that the EPA assess "potential loss or shifts of employment" that restrictions may cause. This emphasis extends beyond simple catchphrases. These concerns, however, have received far less attention in academic research, which reflects a fundamental disagreement between academic economists and policy makers regarding the significance of impacts on jobs. To what extent does environmental regulation result in job losses or gains? How much do reallocations (i.e., employment increases in other sectors counter job losses in some sectors) offset aggregate job losses? How should these job consequences be treated in cost-benefit analyses of regulations? How significant are they for policy distributional analysis? These issues are significant just because of their political focus, but they are also important because they might have significant economic ramifications. We try to answer such questions in this paper by referencing the larger economic literature. Sometimes the solutions are rather obvious. In some situations, more study is required, and in those situations, we attempt to list the main problems and pinpoint the important consequences that will dictate the solutions.

Analysis of general equilibrium is necessary. Regulation has an impact on employment that goes well beyond the industries it specifically targets. Potential spillover effects could be either positive (such as increased demand for output from unregulated firms as consumers shift away from the output of regulated firms) or negative (such as effects on the steel industry from regulation-induced increases in electricity prices). They could also be fairly large, so the overall effect of the policy may differ significantly from the effect on regulated firms. This study is important because it demonstrates how environmental regulations support the growth of jobs in sustainable businesses, green technologies and renewable energy while simultaneously safeguarding ecosystems. It tackles the environmental vs. employment question by stressing the difficulties of phasing out polluting businesses while also showing potential in clean areas. Policymakers may use the review to help create just transition plans for impacted communities and workers. In the end, it connects social wellbeing, economic expansion and environmental sustainability.

2. Existing Literature on Jobs and Environmental Policies

Reduced-form empirical research, full-employment general-equilibrium modeling and search-friction models are the three main categories into which the current body of work on employment and environmental regulation may be broadly divided. A strong body of research assesses how current laws affect employment levels in regulated industries using reduced-form empirical methodologies. When comparing refineries in Los Angeles (LA) to those in other US, Berman et al. (2001) found no indication that additional regulation in LA refineries has affected employment. Increased environmental spending is linked to a slight increase in employment, according to Morgenstern et al. (2002), who look at the relationship between environmental spending and employment across four energy-intensive industries: pulp and paper mills, plastic manufacturing, petroleum refining and iron and steel mills. In their evaluation of the Clean Air Act's effects on manufacturing employment, Greenstone and Michael (2002) discovered that, in comparison to counties exempt from the Clean Air Act's requirements, nonattainment counties-which are subject to more stringent rules-lost 590,000 jobs between 1972 and 1987.

According to Curtis and Mark's (2018) evaluation of the NOx Budget Trading Program, manufacturing employment decreased by 1.3% in the program's participating regions. In order to report the "jobs" impact of a particular legislation or policy, some practitioners of Computable General Equilibrium (CGE) have adopted a way of translating changes in labor supply from full-employment CGE models into "full-time equivalent" jobs. This method is widely employed despite having significant drawbacks, chief among them being that it only simulates voluntary shifts in the labor supply, but policymakers are more concerned with job gains or losses due to worries about involuntary unemployment. Instead of having a fully transparent labor market, these search-friction models need jobless individuals to match with hiring companies.

Even in the long-run steady state, involuntary employment is one of the important aspects of real-world labor markets that may be easily incorporated thanks to that matching friction. Using a highly simplified two-sector model, Hafstead et al. (2018a) demonstrate that environmental taxes mostly result in job reallocations from more polluting businesses to less polluting ones, with very little net job loss. This implies that previous difference-in-difference studies have significantly exaggerated employment losses in regulated businesses and have further overestimated net job losses, among other things.

Hafstead et al. (2018b) expand that model in a number of ways, such as by dividing production into 22 commercial and 22 government sectors industries and adding intermediate inputs to the manufacturing process. These additions enable the model to analyze a greater variety of spillovers across industries (including impacts on upstream and downstream enterprises) and make it considerably less stylized and more realistic. In contrast to previous CGE studies that employed full-employment CGE models to estimate impacts on jobs, explicitly modeling employment frictions produces significantly fewer estimates of job losses, according to a comparison of results from that model with those from an otherwise similar full-employment model.

However, a distinct component of reallocation—what kinds of workers lose employment and what kinds of workers acquire jobs-that has significant distributional consequences is not addressed by Hafstead et al. (2018a) or Hafstead et al. (2018b). A search-friction model involving both skilled and unskilled workers is presented by Aubert and Chiroleu-Assouline (2019). However, they limit the search friction to unskilled workers alone and they concentrate nearly exclusively on how environmental tax change affects income distribution. In a model of energy and nonenergy-intensive manufacturing industries, Fernandez Intriago (2019) incorporates sectoral human capital accumulation and erosion. The results show that reallocation among manufacturing industries is likely to favor low-skilled workers at the expense of high-skilled workers.

The distributional effects of reallocation in the economy's nonmanufacturing sectors, however, require more investigation. Using an extension of the Hafstead et al. (2018a) model, Hafstead and Williams (2019) identify workers by their industry at the time of policy implementation in order to address the distributional impacts of environmental policy on jobs. They discover notable variations in the short-term labor market impacts (as determined by shifts in incomes, unemployment durations and unemployment rates) of various policies intended to lower energy-related carbon dioxide emissions among the original industrial worker categories.

3. Employment Channels and Policies

Labor demand is impacted by environmental regulations in five primary ways: (i) Direct effects: Jobs generated by initiatives led by policy (e.g., upgrading buildings, building rail, installing solar PV). (ii) Supply chains and indirect effects: Upstream manufacturing and services that provide inputs (such as steel, glass, electronics, software, design and finance). (iii) Induced effects: Workers' and businesses' incomes fund more jobs and local expenditure. (iv) Effects of reallocation: Gains in cleaner industries and

job losses in high-emission industries (such as coal mining, oil refining and some chemicals). (v) Impacts of innovation and productivity: Automation can eventually reduce job intensity, but policy-induced R&D can increase productivity and open up new markets.

3.1 Carbon Pricing (Trading in Taxes and Emissions)

Raises the relative cost of carbon-intensive industry, promoting substitution and efficiency. Revenues might be used to pay for dividends, tax breaks or green investments. Overall, there will be modest short-term net effects on employment; but, neutral or negative effects can be transformed into positive ones by recycling revenues into investments or labor tax cuts. Fossil fuel sectoral decline is anticipated, necessitating transition assistance on employments.

3.2 Standards of Regulation

Examples include regulations pertaining to EVs and fuel economy, renewable portfolio standards, building energy codes, industrial performance standards and pollution limitations. Investment and employment development, particularly in installation and compliance services can be stimulated by predictable demand for clean goods and services.

3.3 Procurement and Public Investment

Examples include water/waste infrastructure, charging networks, mass transit, grid upgrades, ecological restoration and green public buildings. By lowering risk, high domestic job multipliers especially in the construction and local services sectors-can attract private investments as a employment outcome.

3.4 Industrial Policy, Tax Credits and Subsidies

Examples include concessional financing, local content/skills requirements (where WTO compliant), and production/investment tax credits for renewables, batteries and green hydrogen. This policy able to establish supplier networks and quickly expand new sectors; maintains standards for employment quality and prevents windfalls.

3.5 Policies Based on Nature

Regenerative agriculture, watershed management, mangrove restoration, reforestation and reforestation are examples of nature-based policy. Short-term employment results from nature-based initiatives are labor-intensive; long-term maintenance requires consistent financing; cobenefits include ecosystem services and resilience.

4. Case Studies

4.1. The Energiewende in Germany

Six months before to the Fukushima nuclear tragedy, in September 2010, the German government released the policy paper defining the Energiewende. Wind and solar were scaled up by feed-in tariffs and subsequent auctions, which resulted in a large number of installation and operation and maintenance (O&M) employment. Pressures from offshore (wind energy projects) and worldwide competitiveness caused fluctuations in manufacturing employment. Regional employment was bolstered by robust vocational training and local ownership forms, such as energy cooperatives.

4.2. Clean Energy Industrial Policy of United States

Large tax subsidies (for hydrogen, EVs, batteries and renewables) along with combined requirements sparked job announcements in building and manufacturing in United states. Apprenticeship programs, prevailing pay regulations and domestic content laws linked rewards to the caliber of jobs. Grid expansion and supply chain maturity determine long-term results.

4.3. India: Access to Energy and the Use of Renewable Resources

With significant Ministry of Micro, Small & Medium Enterprises (MSME) involvement in rooftop and minigrid markets, rapid solar and wind auctions increased capacity and decreased costs, creating jobs for installation and O&M. Policies pertaining to charging infrastructure and Electric Vehicles (EVs) subsidies encourage technical and service employment. Public works initiatives and skill development missions have incorporated water conservation and environmental restoration projects, creating jobs locally and enhancing climate resilience.

4.4. China: Production of Clean Technology

Large industrial employment and learning curve cost reductions were brought about by scale-driven production in solar Photovoltaic (PV), batteries and EVs. Job intensity decreases with increasing automation, yet employment is increased globally by upstream mining and refining and downstream installation.

4.5. European Union: Markets Driven by Standards

Stable demand and jobs in the service industry were produced by efficiency directives, circular economy action plans and renewable objectives. The goal of carbon pricing through the Emissions Trading System (ETS) and a carbon border adjustment mechanism is to decarbonize while maintaining industrial jobs.

5. Assessing Employment Impacts: Theories and Approaches

Input-Output (I-O) and Social Accounting Matrices: Use multipliers to capture supply chain and induced impacts. Cons: no price adjustments and static coefficients; advantages: transparency. Price-responsive and economy-wide, Computable General Equilibrium (CGE) models are capable of evaluating carbon pricing and trading. Benefits: behavioral realism; drawbacks: complicated and parameter-sensitive. Econometric assessment includes event studies, difference-in-differences and synthetic control for particular policies (such renewable requirements). Cons: context-specific; advantages: causal identification. From CAPEX/OPEX and labor coefficients (e.g., job/MW) aggregated systemwide, project-level engineering is done from the bottom up. Benefits: detailed; drawbacks: can exaggerate spillovers. Hybrid approaches: Integrate CGE or I-O frameworks with bottom-up technology data.

6. Data Requirements and Research Gaps

There is a dearth of high-quality panel data on incomes, mobility and reemployment in green industries to monitor displaced workers over the long term. There is also a dearth of microevidence about how EPs alter labor demand and firm-level technology adoption. Another crucial factor that is absent in the majority of developing nations is the systematic assessment of initiatives that increase women's leadership and involvement in green industries.

7. Conclusion:

When incorporated into a well-thought-out economic plan, environmental regulations may serve as catalysts for upgrading and employment development. When policymakers combine worker-centric just transition measures, supply-side industrial and skills programs, consistent demand-pull tools, and explicit objectives, the biggest employment increases occur. The weight of evidence suggests that environmental preservation and decarbonization do not have to come at the price of jobs; rather, they may lead to greater prosperity, resilience and equity. However, short-term disruptions are real and need to be handled proactively.

The majority of research indicates that EPs result in net positive employment over the medium to long term, with transitory job losses mostly occurring in carbon-intensive industries and fossil fuel extraction. Jobs are generated in the following areas: public transportation, environmental services, ecosystem restoration, manufacturing of clean technologies, construction and installation (renewables, efficiency retrofits), O&M and circular economy activities (repair, remanufacturing, recycling).

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