

*The University of Virginia &
The Institute for Structural Research*

CARBON TAXATION

*Designing Policy for More
Equitable Outcomes*

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Disclaimer & Honor Code

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgements and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

On my honor as a University of Virginia student, I have neither given nor received unauthorized aid on this assignment.

A handwritten signature in black ink, appearing to read 'GP', with a stylized, cursive flourish extending from the bottom left.

Geoffrey Paul

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Executive Summary

Carbon emissions will be taxed in Germany for the first time this year. This tax will produce significant amounts of revenue and incentivize firms to hasten carbon abatement initiatives. While the overall benefits associated with this carbon tax are substantial, it will carry some negative consequences. This report examines the effects carbon taxes have in other contexts to anticipate outcomes in Germany. Average household purchasing power will decrease as the cost of energy and energy-intensive goods increases, and the demand for labor will decrease among carbon-intensive sectors of Germany's economy. These price increases and job losses will be concentrated among low- and middle-income households, making Germany's carbon tax regressive. As it stands, this new policy will increase energy insecurity and income inequality nationwide.

Several policy options are available to the German Bundestag that can mitigate, or even reverse, this upward trend in income inequality. This report investigates three potential responses the Bundestag can take to dampen the negative effects carbon taxation has on lower-income families. It finds that the most equitable solution that can be implemented across the next decade is an unconditional cash transfer program that would redistribute carbon tax revenues among German taxpayers, and the most efficient solution is likely a combination of cash transfers and increased access to unemployment insurance through reduced qualification barriers.

Background

The European Trading Scheme (EU ETS), inspired by American policies that spread to European Union (EU) states, was a major policy innovation of the 21st century (Voß, 2007; Braun, 2009). Effectively a cap-and-trade system where the EU sets a carbon-emission ceiling and emissions permits are traded in a semi-open market, theoretically allowing firms to compete for the right to create what the EU deems a socially acceptable amount of pollution.

While the EU faced a myriad of constraints in implementing emissions trading policy among its member states, two specific roadblocks presaged the German Bundestag's current carbon tax

Key Terms

Bundestag: The German federal parliament.

Trade sensitive: A good or service particularly vulnerable to competition from imports.

Energy intensive: A good whose production uses a large amount of energy.

Source: dictionary.cambridge.org

policy: developing a consensus among what Christiansen and Wettstad termed the “synergistic and multilevel mix” of stakeholders “at the international, EU, Member State, [and] sub-national” levels would prove difficult (2009; Wettstad, 2005); additionally, suggestions centered around an EU-wide carbon tax proved to be a nonstarter (Braun, 2009). Because an emissions trading scheme had multilateral political support and also enjoyed support from academics who believed it to be a more efficient policy lever than a carbon tax (Montgomery, 1972), the EU ETS was and remains the EU's premiere policy suite aimed at curbing pollution and incentivizing a global market for carbon emissions.

The EU ETS, now also known as the European Green Deal, still affords significant exemptions for sectors that are vulnerable to insolvency or are trade sensitive or carbon intensive. These exemptions are so far reaching that, while the EU ETS currently operates in every EU member state, the policy only covers about 45% of all EU carbon emissions (EU ETS Handbook). What's more, a growing body of evidence has illuminated how inefficient policies that provide relief to carbon intensive sectors that are not especially trade sensitive are (Berman & Bui, 2001; Greenstone, 2002; Engels, 2009; Kuik & Hofkes, 2010; Yamazaki, 2017; Fischer & Fox, 2018). While the most recent update to the European Green Deal in November of 2019 shrank the share of firms exempted from the EU ETS, it is not a stretch to argue that carbon pricing is not being applied in a way that forces polluters to internalize the cost of their carbon emissions optimally since some firms remain exempt and carbon is still priced well below its social cost.

Germany's carbon tax aims to address these shortcomings. Passed in 2019, the tax applies to the entire economy and will bring prices to over €50 per metric tonne in a few years' time (Reuters, 2019). In 2025, when the country's carbon tax increases to €55, Germany will join only five other

countries who meet the World Bank’s estimated minimum price to meet the goals laid out in the Paris Agreement (2019). Alongside France, Germany will be among the first economies of its size to implement a carbon tax of at least €40.

This increase in the cost of energy and carbon-intensive good production will be at least partially borne by the consumer, who will be subject to higher prices. It is likely that the cost of energy will rise about 7% as a result of this new tax (Reuters, 2020b). A rising marginal cost of production will also depress demand for the labor (and capital) among carbon-intensive firms. For reasons I will expand upon in my literature review, these negative effects - increased prices and decreased labor market demand - will fall disproportionately on low- and middle-income German households.

The German Bundestag has a number of opportunities to mitigate the negative impacts its carbon tax will have on German workers and families. This report will outline three potential solutions to the problem of the differential outcomes that result from Germany’s new carbon tax, forecast their costs and benefits, and ultimately recommend a mix of cash transfers and unemployment insurance expansion to efficiently address the inequities exacerbated by Germany’s carbon tax scheme.

Table 1: Germany’s carbon tax scheme

Year	Tax (per mt)
2020	€0
2021	€25
2022	€25
2023	€25
2024	€25
2025	€55
2026	€55-65*
2027	€55-65*
2028	€55-65*
2029	€55-65*
2030	€55-65*

*Priced between €55-€65 at auction

Client Overview: Institute for Structural Research

The Institute for Structural Research (IBS) is an independent research foundation that evaluates the consequences of public policy on labor markets, energy, and climate outcomes, among other areas. Environmental policy and its consequences fit squarely within IBS's range of expertise and aligns well with their interest in applying its modeling and econometric tools. Because carbon taxes are being considered across the entire EU, IBS's affinity for macroeconomic analysis can give it a strong voice within Europe's climate policy landscape.

IBS has been exploring the intersection between climate policy and labor markets for quite some time. Most recently, researchers at IBS have published working papers on how to ensure a just transition for Polish coal miners who face layoffs as Poland decarbonizes its economy (Antosiewicz et al., 2020a) as well as what the distributional effects of carbon pricing are (Antosiewicz et al., 2020b).

How decarbonization affects working class families and the European labor market is currently top of mind for researchers at IBS, and for good reason. The EU is just now embarking on a new phase of its Green Deal, and carbon pricing, along with which industries pay these prices, is set to shift or has already changed in some sectors. Additionally, since the COVID-19 pandemic has potentially altered where parts of the population work, baseline assumptions may need updating. These changes would consequently rework how the socially optimal price of carbon is applied to businesses, along with what downstream effects policymakers can expect as a consequence of their policies.

The ground is shifting underneath IBS and the EU more broadly. Delaying research on how changing carbon pricing impacts both equity and environmental objectives would be a remarkable missed opportunity to improve Europeans' quality of life across future generations.

Literature Review

Forecasting a Carbon Tax

The aggregate effects of carbon taxation have been well established for some time. The idea that a tax can successfully internalize externalities associated with a good that carries a high social but low private cost has been discussed across decades (Pigou, 1952; Dasgupta & Heal, 1979; Polinsky & Shavell, 1981; Pearce, 1991; Poterba, 1991; Bovenberg & Goulder, 2001). A well-crafted carbon tax can effectively internalize the costs associated with human-induced climate change (Pearce, 1991; Metcalf & Weisbach, 2009; Lu, et al., 2010; Marron & Toder, 2014). And carbon tax initiatives in other EU member states has increased prices (Tol, 2007; Cosmo & Highland, 2013; Andersson 2019) and shrunk labor market demand among energy-intensive industries in European and in international contexts (Yip, 2018; Antosiewicz & Witajewski-Baltvilks, 2020).

The negative effects carbon taxation has on labor market outcomes can be mitigated or eliminated by recycling the revenue generated by putting a price on carbon. In 2008, British Columbia made its carbon tax revenue neutral by coupling it with reductions in corporate and personal income taxes and cash transfers to low-income families. While jobs in carbon-intensive industries fell, British Columbia saw a net increase in total jobs and its citizens also enjoyed a rise in personal income. It is unclear, however, whether there was enough slack in the labor market for folks formerly employed by firms who went out of business following the implementation of British Columbia's carbon tax to secure these new jobs. In other words, it is possible that people who were laid off because of decarbonization policies remained unemployed or underemployed, and the new jobs created by British Columbia's tax cuts went to different individuals. That said, the aforementioned positive trends have been linked to the reduction in distortionary taxes like British Columbia's corporate income tax (Murray & Rivers, 2015; Yamazaki, 2017). Mather and Morris corroborate Yamazaki's findings by establishing that a carbon tax is regressive and that these distributional effects can be offset by corporate tax swaps (2014).

British Columbia is not the only model for the potential outcomes of a carbon tax. Public debate in South Africa over a carbon tax much smaller than Germany's has led researchers to forecast outcomes in the 'rainbow nation.' Unsurprisingly, the consensus is that a carbon tax will reduce labor demand and its differential effects would be regressive. Just how regressive they are depends on how revenue is used: reductions in sales or corporate taxes dampen the carbon tax's negative impacts, but not as much as social transfers would (Devarajan, et al., 2011; Alton, et al., 2014). However, spending on social transfers may cause national income to decline further (Alton, et al., 2014). Researchers in China (Chen & Nie, 2016), Portugal (Pereira, et al., 2016), Chile (Garcia Benavente, 2016), and Ireland (Callan, et al., 2009) have produced similar results.

It must be noted that others have found that using carbon taxes to replace distortionary taxes on labor does not necessarily increase overall efficiency in public financing (Bovenberg & Mooij, 1994). Policymakers should bear in mind that pairing a carbon tax increase with a reduction in some other regressive or distortionary tax will not increase overall welfare ipso facto. This caveat does not extinguish the usefulness of carbon taxes, however - it simply calls into question their efficacy in addressing inefficient tax policies. Lawmakers should be careful to implement carbon taxes to reduce net emissions rather than address social inequities.

Cash Transfers

Unconditional cash transfers have received quite a bit of attention in recent years as researchers study potential effects of a universal basic income. While the policy alternative I outline later in this report would operate less like a stable source of income and more like a cooperative organization that charges a fee (the carbon tax) in order to trade within its membership (anyone in Germany), studying how people change their behavior upon receiving some basic level of income is analogous to what we can expect should the Bundestag redistribute carbon tax revenues using an unconditional cash transfer system.

Negative income tax experiments in the US and Canada offered participants significant amounts of money (nearly \$26,000 in some cases). The programs suggest that cash transfers have little to no effect on labor market participation, with the largest effect size being 2-4 weeks of reduced employment. The Eastern Band of Cherokees casino dividend program, which is most similar to the policy option this report illustrates in following sections, had no impact on labor market participation (Marinescu, 2018). Thus, in cases where cash transfers are too small to completely replace earned income, they have negligible to no measured effect on how much a person chooses to work.

The money received from these cash transfers was spent on a myriad of goods and services that improved overall well-being for negative income tax recipients. Between the two trials in the US and Canada, recipients showed improved quality of nutrition, and were hospitalized less than the control group “especially for mental health, accidents, and injuries.” Additionally, their children consumed more education and performed better on tests and in class, and were less likely to develop alcohol or cannabis use or dependence in adulthood (Marinescu, 2018). While effect sizes vary based on demographics and transfer-program design, overall well-being generally increased for folks who received some kind of cash transfer.

Cash transfers are highly effective as a redistribution mechanism because they tend to be flat no matter a household’s income or wealth, and are often even conditioned such that only individuals with the lowest income or wealth receive them. Trends across the 37 member countries of the Organisation for Economic Cooperation and Development (OECD) suggest that income inequality

has risen as cash transfer programs were phased out since the early 1990s (Causa & Hermansen, 2020). Additionally, a case study done in the Netherlands found that cash transfers reduced welfare inequality and transferred substantive amounts of wealth from the rich to the poor (Ter Reelee, 2007). Cash transfer programs typically do not directly target households that face structural changes to the labor market, however. But by allowing transfers to vary geographically, policymakers could increase efficiency by distributing larger transfers to areas most reliant on carbon intensive industry.

Unemployment Insurance

The effects of unemployment insurance (UI) are multilateral. UI programs reduce the liquidity constraints associated with an income shock, allowing an employment-seeker to smooth their consumption more efficiently (Browning & Crossley, 2001; Chetty, 2008). Job seekers reduce consumption following loss of employment *and* in anticipation of an income shock (Stephens, 2001 & 2003). This more efficient outcome contributes to consuming food of a higher nutritional value (Aguiar & Hurst, 2004), lower levels of mental health issues (Tefft, 2011), higher aggregate economic output (Acemoglu & Shimer, 1999), and higher average labor productivity (Acemoglu & Shimer, 2000). UI programs tend to reduce labor market participation not only among those insured but also among their spouses (Cullen & Gruber, 1996). These moral hazard effects are smaller during periods of recession, however (Schmieder et al., 2012), which a labor market contraction in response to a tax hike may mirror.

As a tool for redistribution, UI shifts consumption from employed to unemployed peoples. Whether or not it redistributes money to low-wealth households on average depends on if the replacement rate varies across incomes. A flat replacement rate – the international norm – may exacerbate wealth inequality by compensating formerly high-earning individuals more in gross terms than low earners: covering 60% of €80,000 in lost wages is far higher than 60% coverage for someone earning €30,000 a year. A variable rate would be redistributive, but may be far more actuarially inefficient since the high earner would not only be paying to cover their own risk of job loss but also contributing to a pool that compensates lower earners above and beyond what they pay into UI funds.

All of these factors make perfectly efficient UI programs difficult to legislate. Balancing how UI can depress labor markets against increased consumption smoothing and protecting risk averse job seekers to incentivize them to pursue higher productivity work is politically challenging. That said, the societal gains available to policymakers remain substantial. In most contexts, the optimal replacement rate on lost income is at least 60% (Landais et al., 2018), a threshold only about 30 countries meet worldwide.

Policy Implications

Policymakers are afforded a variety of options that are only mutually exclusive when subject to budgetary constraints and inflationary concerns. Other social programs, such as retirement insurance or in-kind benefits (e.g., housing or education vouchers), may also absorb some of the negative effects of environmental taxation. That said, they have far less precedent as tools to counterbalance tax policies, and are less likely to osmose across the divide between policy writers and legislators.

All in all, policymakers rely on politically expedient but economically wrongheaded narratives to justify the expansion or contraction of social programs too often. While disagreement persists in the magnitude of the effects of cash transfers and unemployment insurance, legislators can now be confident in their directionality. Cash transfers can effectively redistribute wealth, increase education consumption, and improve health outcomes. Unemployment insurance reduces labor market participation but allows workers to save more efficiently and seek jobs that increase market productivity across a population. Armed with a firm background on the current state of literature on social programs, lawmakers can compare the costs and benefits of programs to each other and make informed decisions grounded in this deep reservoir of knowledge.

Evaluative Criteria

Distributive Ratio

In order to most efficiently ameliorate the negative distributional impacts of the EU's ETS in Germany, its benefits must be concentrated among low-wealth households. To measure the marginal benefits of a policy, I will divide German tax paying population into deciles and calculate the percent change in income from the status quo. Because my goal is to mitigate the negative effects workers in carbon-intensive industries or with low wages bear, I will compare the total benefits for taxpayers earning below the carbon-intensive industry average to those earning above that threshold. This will allow me to compare the ratio of benefits captured by low-earning households: the higher

the ratio, the more effectively a policy concentrates its benefits among the families who are most negatively affected by carbon taxes.

$$\text{Distributive Ratio} = \frac{\text{Total benefit for households with income less than €58,000}}{\text{Total benefit for households with income greater than €58,000}}$$

Carbon Reduction Effectiveness

A government's primary goal in imposing a carbon tax is to reduce carbon emissions. Any policy recommendation, then, must account for the possibility that it will work against a carbon tax by incentivizing producers to emit more carbon or consumers to purchase more carbon-intensive goods. Some alternatives may result in no change in carbon emissions from the baseline, and others may even further decarbonize an economy.

I will measure the expected annual change in carbon emissions in tons and monetize any costs or benefits using the EU's standard for the social cost of carbon. For example, if Germany subsidizes energy bills to offset the increase in cost associated with a carbon tax, then energy consumption will not decrease as a result of the new price associated with producing carbon to generate energy. Without subsidizing energy bills, the price of energy will increase by about 7% due to the new carbon tax (Reuters, 2020b). If the price elasticity in Germany is similar to that of its neighbors, then this suggests households will decrease energy consumption by 0.7-2.8% (Linderhof, 2001). Because private households and businesses purchase about 45% of the energy consumed in Germany (Schlomann et al., 2004), and coal represents about 30% of Germany's energy mix (Reuters, 2020a), this alternative would result in a net increase of about 650,000

short tons of coal produced above the current status quo. One short ton of coal is associated with about 5,700 pounds of CO₂ emissions (U.S. Energy Information Administration), which carries a total social cost of about €204 billion from coal alone.

Cost Efficiency

The implementation of a carbon pricing scheme in Germany will create a budget windfall that must be spent efficiently. I will conduct a cost-benefit analysis for each option's projected outcomes until 2030, which covers the current phase of the EU's ETS. My analysis will account for net benefits to taxpaying Germans, and will include the social cost of carbon emissions, real costs associated with programs such as job training or funding childhood education, and benefits from improved labor market outcomes. The alternative with the highest cost efficiency will maximize the net social benefit gained from Germany's carbon-tax revenue.

Political Feasibility

As in all democracies, German politicians must account for special interests when writing policy. Germany's multi-party system is often based on historic trends in distinct geographic regions. I will find legislation that has been considered at either the federal or state level in Germany and is comparable to my alternatives (e.g., energy price subsidies in Bavaria). I will average the percent of representatives that vote 'yes' on each piece of legislation in order to compare political feasibility across alternatives. I will then rate each alternative as having low, medium, or high political feasibility based on how likely each plan is to gain political momentum in the Bundestag.

Scalability

The negative effects associated with a broad application of carbon taxation would be felt around the continent. Because the distributional costs of carbon taxes are still being studied, other countries may look to Germany as an example on how to ease the burden felt by low-income families all around Europe. As such, attention should be paid to how easily another country, or indeed, the EU more broadly, can implement a policy recommendation. I will measure scalability by assessing how easily a policy alternative can be expanded to cover all EU member states. The most scalable option would:

- Utilize a policy lever that all other EU member states already have in their toolkit in some capacity,
- Be administered by a governmental organization that exists at the EU level, and
- Carry effects that are analogous to the German context.

As an exceptionally rudimentary example, consider the suggestion that a carbon tax should be scaled up across the EU. Clearly every state collects revenue from taxes in some capacity,

satisfying the first requirement that each governmental body be familiar with the proposed policy. The carbon tax in question could be written in the same way that the EU's current value added tax is applied: polluters pay their government a carbon tax, which is then collected by the EU. Because the EU and its members have administrative bodies already in place to collect taxes, adding a carbon tax would not require imagining an entirely new bureau to execute, thus meeting the second criterion. Lastly, if the carbon tax were uniformly applied across the EU, it certainly would have significantly different effects on countries based on their current emission levels. Therefore, this proposal would fail to meet the third requirement that the observed outcomes in Germany from this alternative be reasonably translatable across other European countries.

Because this example proposal meets two of the three criteria, its scalability would rate as medium; if an alternative meets all three measures of scalability, it would rate as high; and if a policy meets one or none of the above specifications, its scalability would rate as low.

Potential Alternatives

Alternative A: Distribute carbon tax revenues to taxpayers as unconditional cash transfers

Distributive Ratio

Germany will collect an average of approximately €24.5 billion in carbon tax revenues over the next 10 years. In 2021 dollars, families would receive an average of just over €400 annually were Germany to redistribute their tax revenue among taxpayers. Taxpayers earning less than the median wage for manufacturers would capture about 80% of these benefits, making its Distributional Ratio a very high 4.48.

Criterion	Evaluation
Distributive Ratio	4.48
Carbon Reduction Effectiveness	0
Cost Efficiency	€243.9 billion
Political Feasibility	Medium
Scalability	Medium

Carbon Reduction Effectiveness

The income-effect cash transfers have on purchases of carbon-intensive goods will marginally increase carbon emissions when compared against a baseline scenario where there exists no cash-transfer program. However, because low-income families tend to be more reliant on carbon-intensive goods, a cash transfer would drive demand for these products down compared to the baseline. While the magnitudes of these competing income effects are debatable, most researchers conclude that any positive or negative net impact on carbon emissions will be negligible if tax-revenue redistribution is focused towards lower income groups (Morris & Mathur, 2015; Caron & Fally, 2018). Therefore, while the precise effect cannot be measured, I estimate that Germany would cause no aggregate change in carbon emissions should they distribute revenues as a cash transfer.

Cost Efficiency

As current trends continue, Germany stands to produce about €250 billion in revenues over the next 10 years. The net benefit of a cash payment to German taxpayers is this revenue minus the dead-weight loss associated with a government facilitated transfer. Because the energy prices firms and businesses face are expected to rise by about 7% (Reuters, 2020b), and the elasticity of demand for energy is about 0.4 (Schulte & Heindl, 2016), I expect consumption to be reduced by about 2.8%. The deadweight loss is this consumption reduction multiplied by the cost of the tax. Over ten years, the net present value of this deadweight loss is about €6.1 billion. The net benefit to Germans, then, is about €243.9 billion.

Political Feasibility

While Germany has passed multiple bills that levy taxes on carbon-intensive industries, none of the laws the Bundestag have enacted include specific provisions for cash transfers. Germany does employ conditional cash transfers for other public services (e.g., child benefit payments meant to lower childcare costs for low-income families), they simply have not utilized this policy tool to assuage the negative distributional side effects of a carbon pricing scheme. Since the German Bundestag has also not directly voted against a cash-transfer program for carbon-tax revenues, and because analysts within the EU and abroad continue to propose this mechanism as a means to dampen the regressive nature of flat carbon taxes, this alternative's political feasibility is medium.

Scalability

The EU currently levies a myriad of taxes on its citizens across its member states. Providing a subsidy would simply reverse the flow of accounting, meaning that the EU already has experience with this particular policy lever. Contributing to this alternative's scalability is the fact that the EU would not need to create any new administrative body to handle a new cash flow: it would be as simple as adding a line to its Taxation Customs Union. Thus this alternative meets two of the three evaluative criteria established earlier in this report.

European states favor a carbon tax that is uniform among members of the EU and scaled against a producer's carbon emissions (European Commission, 2011). It stands to reason, then, that a uniform cash transfer across the EU would have some support for its perceived fairness. Because Germany's income distribution and social service apparatus is different from other member states to varying degrees, the potential effects of a uniform, unconditional cash transfer on citizens of other EU member states would certainly be different than those seen in Germany. Therefore, this alternative meets two of the three benchmarks for scalability and ranks as medium.

Alternative B: Reduce barriers to collecting unemployment insurance for workers in carbon-intensive industries

Distributive Ratio

Pricing schemes with outcomes similar to those predicted for the German energy market tend to reduce overall employment by 1.5-2.5% (Walker, 2011; Curtis, 2014). About 20% of unemployed people received no unemployment insurance (UI) benefits in 2019 (Wedia, 2020). If all of these newly unemployed laborers receive UI benefits as a result of lowering the barrier to qualify, Germany will pay about 30,000-50,000 more citizens benefits annually. Because the benefit scheme is so generous that nearly all workers receive some coverage at a flat replacement rate, the top three deciles of earners would receive over half of all UI payouts under this plan leaving its Distributional Ratio at 0.78.

Carbon Reduction Effectiveness

There is evidence in other contexts that increases in working hours has a positive association with carbon emissions – specifically, a 1 percent increase in working hours may increase carbon emissions by up to .67 percent (Fitzgerald, et al. 2018). Conventional wisdom is that increased UI benefits actually discourages work by making the cost of being unemployed relatively smaller. UI coverage’s effect on labor market participation is likely negligible, however (Moffitt, 2016). There is also evidence that strengthening UI benefit schemes makes politicians more likely to vote yes

Criterion	Evaluation
Distributive Ratio	0.78
Carbon Reduction Effectiveness	0
Cost Efficiency	€2.6 to €4.4 trillion
Political Feasibility	Medium
Scalability	Low

on measures that would further reduce carbon emissions (Kono, 2019). Because expanding UI access will result in at most no net change in workforce participation, and since this alternative may even inspire further carbon emission reduction measures, this alternative’s most negative potential outcome is a net zero change in carbon emissions.

Cost Efficiency

Given that the median duration a low-income earner spends on unemployment has hovered around about 200 days and over half of people who collect unemployment insurance benefits exit the program in under a year (OECD), and because manufacturing jobs have been in decline for the past decade (Smit et al., 2020), the past ten years’ trends provide a stable model for how long the German UI system is likely to support over the next decade. If the most expensive assumptions hold true – that is, if every unemployed person signs up for UI benefits, and if the layoff rate for carbon intensive firms is as high as 2.5%, and if folks stay on unemployment longer

than the current median of about 175 days – then this alternative will cost about €8 trillion over the next 10 years. It may cost closer to €4 trillion if layoff rates trend closer to 1.5%, which some groups have projected.

The social benefits of unemployment insurance remain a contested issue. UI coverage may reduce labor participation (Moffitt, 2015). However, because UI benefits are typically spent (rather than saved), the tax multiplier for UI spending is as high as 1.55 (Zandi, 2012). This is likely due to the consumption smoothing effect UI payouts have for families in need. Allowing more German workers to tap into the benefits associated with UI coverage would likely result in an aggregate social benefit of €2.6 to €4.4 trillion over the scope of this analysis.

Political Feasibility

The Bundestag approved a modest increase in its 2021 federal budget line for UI benefits, however this was likely due to the persistent labor market downturn that the COVID pandemic is responsible for. Additionally, the Bundestag has not voted on a bill that would substantively alter Germany's UI system since 2006, when they began using a value added tax to fund UI benefits and lowered the contribution rate for employees.

Only two bills that directly affect manufacturing employees have been sent to the Bundestag floor for a vote since 2010. In 2017, an increase in pension payments passed with overwhelming support, and a bill that would increase benefits for miners in Saxony was defeated by a significant margin. Because only two bills have been introduced, each with vastly different outcomes, the political feasibility for reducing barriers to collecting UI benefits is medium.

Scalability

Unemployment insurance programs in the EU vary widely by country. Replacement rates, eligibility requirements, duration of coverage, and available training programs all depend on which country's program wages are paid into while one is employed (Esser et al., 2013). As such, the costs and benefits associated with increasing the pool of job seekers eligible for UI benefits fluctuate by location. Additionally, creating a governmental apparatus to manage UI claims and benefits across the continent would be a massive undertaking. While all EU member states have some form of unemployment assistance, not every state covers job seekers with insurance funded by compulsory payments from workers. Thus, since this alternative meets none of the criteria to be easily scaled up across the EU, its rating is low.

Alternative C: Use carbon tax revenues to subsidize household energy purchasing

Distributive Ratio

While all German households energy consumption patterns are expenditure inelastic, energy expenditure elasticity decreases as household income decreases. In other words, high-income households tend to change their energy purchasing patterns more than low-income ones when confronted with a price change (Schulte & Heindl, 2016). Using a weighted average to account for differential spending across household types (Schulte & Heindl, 2016), German households spend approximately €150 per month on heating and energy. A flat subsidy for 5% of energy cost – which would come close to covering the anticipated price increase associated with Germany’s new carbon tax (Reuters, 2020b) – would carry the same distributional effects of a cash transfer: a ratio of 4.48.

Criterion	Evaluation
Distributive Ratio	4.48
Carbon Reduction Effectiveness	€4.7 trillion
Cost Efficiency	€26 billion
Political Feasibility	Low
Scalability	Medium

Carbon Reduction Effectiveness

This in-kind transfer will change consumer energy purchasing patterns by lowering the cost of energy. Approximately 35% of every dollar spent on energy goes to coal, oil, or natural gas producers (Reuters, 2020a). Because energy consumption is inelastic across all income groups, the average household will consume about 1.75% more than before the subsidy. Extrapolating from American estimates of the social cost of carbon, each metric ton of carbon carries a social cost of about €48 (Chemnick, 2021). Thus, I expect this policy to create about 120 billion metric tons of carbon emissions that would have otherwise been abated were it not for the proposed in-kind transfer. Over the next ten years, this policy carries a cost of approximately €4.7 trillion.

Cost Efficiency

The main driver of this alternative’s cost is associated with the expected increase in carbon emissions that result from lowering the price of energy. Because Germany’s tax scheme will eventually levy a tax that is greater than the social cost of carbon adopted for this report, however, in 2025, Germans will begin reaping a net benefit from this policy despite increased carbon emissions. Accounting for these costs alongside the benefit of an in-kind transfer with value €90 distributed to German households yearly nets German taxpayers €26 billion in aggregate benefits.

Political Feasibility

Recent legislation that addresses energy pricing has aimed to curb fossil fuel consumption as a byproduct of energy purchasing (bill 19/23482). The Bundestag's most recent revision to its Renewable Energy Sources Act (EEG) reaffirmed Germany's goal to expand renewable energy creation (Appunn, 2020). I have not found significant legislation taken up at the state level that would directly subsidize energy purchases or subsidize energy producers broadly. The Bundestag's understandable focus on renewable energy subsidies belies a significant roadblock to this alternative: German politicians are unlikely to take up legislation that would even indirectly subsidize carbon emitters. Therefore, this policy alternative's political feasibility is low.

Scalability

The EU currently levies a myriad of taxes on its citizens across its member states. Providing a subsidy would simply reverse the flow of accounting, meaning that the EU already has experience with this particular policy lever. Contributing to this alternative's scalability is the fact that the EU would not need to create any new administrative body to handle a new cash flow: it would be as simple as adding a line to its Taxation Customs Union. Thus this alternative meets two of the three evaluative criteria established earlier in this report.

As in alternative A, it is likely that energy subsidies across the EU would be distributed uniformly to be perceived as fair. And much like alternative A, because Germany's demand elasticity for energy may be different than other countries, along with the fact that energy consumption per capita varies across the EU, a single subsidy may be a bad fit for different countries. Some states would reap disproportionately large benefits from such a policy and others would gain far too little. Therefore, this alternative meets two of the three scalability measures and is rated as medium.

Final Recommendation: Unconditional Cash Transfers

An unconditional cash transfer program would be the most efficient way to mitigate the negative differential effects associated with Germany's new carbon tax. Because the transfer would be portioned out uniformly among German taxpayers, low- and middle-income households would capture a higher benefit relative to their consumption patterns and earnings than families earning above the median wage for manufacturing employees. Both its political feasibility and scalability are medium, which is not the case for unemployment insurance (UI) expansion or energy purchase subsidies. An unconditional cash transfer program is likely to induce no net change in carbon emissions,

and taxpayers would reap nearly €250 billion in benefits due to the relative inelasticity of energy demand.

	A: Cash Transfers	B: UI Expansion	C: Subsidized Energy Purchases
<u>Distributive Ratio</u>	4.48	0.78	4.48
<u>Carbon Reduction</u>	0	0	- €4.7 trillion
<u>Cost Efficiency</u>	€243.9 billion	€2.6 to €4.4 trillion	€26 billion
<u>Political Feasibility</u>	Medium	Medium	Low
<u>Scalability</u>	Medium	Low	Medium

These cash transfers would be distributed annually and would vary along with carbon tax revenues. The value of cash transfers would peak in 2026 when carbon prices will begin to float between €55-65 in Germany's carbon marketplace. Germany's current goal is to reach net-zero carbon emissions by 2045 (Reuters, 2021), but the cash transfer program may persist beyond this century's halfway point since the plan is to partially offset current emissions levels using carbon-capture technology, not to eliminate carbon emissions entirely. The transfers would be distributed to German taxpayers' bank accounts via direct deposit, similarly to how COVID aid has been disbursed this past year. Taxpayers without bank accounts would receive checks via the Deutsche Post.

Expanding access to unemployment insurance should also be seriously considered. Although its distributive ratio is far lower than the cash transfer program because higher earners capture more real benefits from UI access, because it is highly cost effective, implementing it alongside a cash transfer program would substantially increase the net social benefit enjoyed across Germany. Because UI expansion actually increases income inequality in my forecast, I do not recommend pursuing this alternative without some kind of cash transfer program accompanying it.

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