Feature

Stranded Assets: Research Gaps and Implications for Climate Policy

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Introduction: Why Do Stranded Assets Matter?

Decarbonization requires ambitious climate policies that put fossil fuel–dependent assets at risk. When risks materialize as unanticipated declines in value and capital is too costly to reallocate, assets are "stranded" (van der Ploeg and Rezai 2020b). We argue that increased attention to asset stranding and related political frictions in climate economics will yield policy-relevant insights that are mindful of political constraints.

We focus on assets threatened by mitigation policy.[1] Fossil reserves face the most obvious risks: meeting the 2°C target requires stranding 80 percent of coal reserves (McGlade and Ekins 2015), and plausible policies could strand over $1 trillion in the upstream oil and gas sector (Semieniuk et al. 2022). Climate change mitigation also threatens carbon-intensive firms, especially energy firms (Guivarch and Hood 2011). Fossil power plants worth $1.4 trillion may be stranded (Edwards et al. 2022). Human capital, residential property, durable goods, urban infrastructure, and many other asset types also face stranding risks. Climate policies could strand 3 percent of banks' and investment funds' total value at risk (Roncoroni et al. 2021). As a result, rapid decarbonization could have severe macroeconomic impacts

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[1]We do not discuss physical risk (i.e., stranding from climate impacts; see Dietz et al. 2016) or transition risk unrelated to policy (e.g., fossil divestment due to changing social norms; Besley and Persson 2019).

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(Diluiso et al. 2021). Abrupt policy tightening could threaten financial stability (Carney 2015; Campiglio and van der Ploeg 2022), and many financial institutions have called for transition-risk-reducing measures (ESRB 2016).

With so much at stake, asset stranding potentially determines the success or failure of climate policies. Economic actors' perceived self-interest shapes climate policy-making. While many benefits of mitigation are diffuse in space and time and contingent on global action, costs are often immediate, salient, and concentrated, incentivizing resistance (Olson 1965; Douenne and Fabre 2020). Many costs ultimately fall on existing strandable assets (such as resource reserves, physical capital, and human capital), and the owners of these assets have played a crucial role in opposing mitigation (Oreskes and Conway 2010; Cheon and Urpelainen 2013; Aklin and Mildenberger 2020; Colgan, Green, and Hale 2020; Stokes 2020). Workers with specific carbon-complementary skills have incentives to back their employers (Mildenberger 2020). As a result, political limitations on carbon pricing have reduced its impact (Green 2021).

Realistic policy recommendations must consider political feasibility (Dixit 1996; Acemoglu and Robinson 2013).[2] Economists typically evaluate mitigation policies from the perspective of economic efficiency (i.e., maximizing *aggregate* well-being). The preferred mechanism is generally carbon pricing, where prices are set to equal the social cost of carbon. Distributional questions are addressed according to the Kaldor-Hicks criterion: admitting policies that leave some agents worse off, provided that transfers *could* make them whole. In practice, compensatory transfers face informational and political hurdles, making it difficult to defuse resistance to mitigation policies. Economists interested in providing practical advice should recognize that a first-best policy will usually be implemented in a second-best form, implying that complementary policies are needed.

In this article, we present findings from our review of the recent literature on climate economics,[3] arguing that political frictions and stranded assets remain relatively underresearched in climate economics. We highlight lessons gleaned from our review, identify areas for further research, and conclude with policy implications. Our review suggests that near-term climate policy could focus on banning fossil-intensive investment and encouraging investment into renewable and energy-efficient capital. These policies may face less resistance than price-based mechanisms and could improve the credibility of future carbon pricing.

The Research Gap

Despite stranded assets' importance for climate policy, economics has paid them relatively little attention. Using bibliometric analysis of relevant keywords on Web of Science, we identified only a small number of papers focused on stranded assets and climate. We searched for article abstracts, titles, or topics mentioning "stranded" or "stranding" as well as "climate change," "climate policy," "greenhouse," or "global warming."[4] Figure 1 suggests that very few articles (41 articles) on climate policies and stranded assets have been published in economics

[2]Our focus is on political feasibility; see Caldecott et al. (2021) for a review of broader social challenges.
[3]For comprehensive literature reviews, see van der Ploeg and Rezai (2020b) and Campiglio and van der Ploeg (2022).
[4]See appendix A (available online).

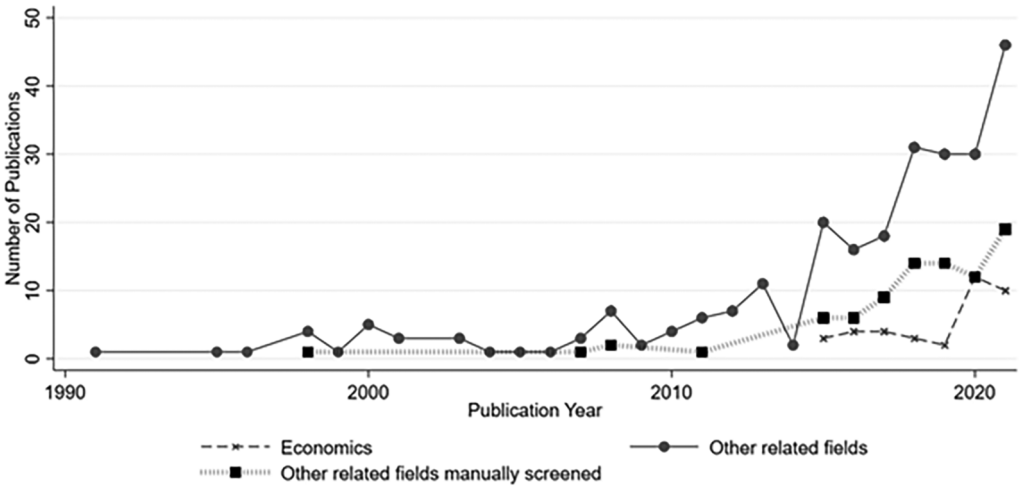

Figure 1 Number of publications on stranded assets and climate in economics journals and related field journals by year, identified by bibliometric search. Years without markers indicate zero observations.

journals, even when including adjacent fields where economists might plausibly publish (285 articles). Manually excluding irrelevant papers narrowed results further (99 articles). The bibliometric approach suggests that economic research on climate and stranded assets has lagged in other fields, only taking off in 2019. While there is no objective benchmark for the appropriate share of publications on a certain topic, we consider the current level of attention to be insufficient given the importance of the topic.

Keyword searches may fail to catch relevant articles (e.g., those referencing "unburnable" reserves, not stranded assets). To overcome this problem and explore the literature in more depth, we conducted an expert review, systematically classifying all articles on climate policy in four leading field journals—*Journal of Environmental Economics and Management*, *Journal of the Association of Environmental and Resource Economics*, *Journal of Public Economics*, and *Environmental and Resource Economics*—in 2017–2020, when scholarship on stranded assets and climate began growing.[5]

We focused on (i) whether papers explicitly consider questions related to asset stranding, (ii) whether analyses focus on aggregate welfare or consider welfare and distribution at a more disaggregated level, and (iii) whether papers analyze compensatory policies, political economy issues, or labor market impacts (figure 2). We also examined various distributional dimensions.

Asset stranding remains largely ignored in recent literature. Only a few papers analyze asset stranding and welfare at the aggregate level. Despite the policy-making relevance of stranding, political economy approaches are similarly rare. Stranding is mostly ignored in articles on compensation and labor markets, topics that themselves appear underresearched.

A larger share of articles study distributional effects of asset stranding, especially across countries. Within-country spatial distribution, sectorally disaggregated impacts, and incidence on energy sectors are the next most common. The interaction of stranding with intra- or

[5]See appendixes B and C (available online).

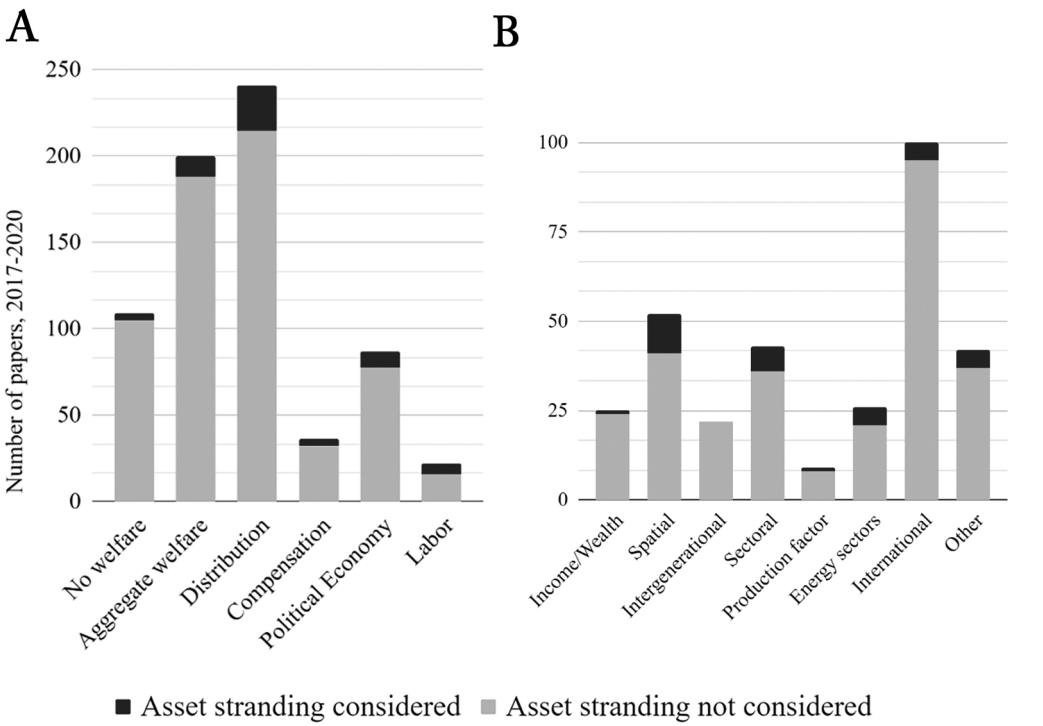

Figure 2 Consideration of asset stranding and related topics in climate economics. One article may span multiple categories (n = 488).

intergenerational distribution of income/wealth has mostly been ignored by climate economists, despite its political relevance.

What Have We Learned?

A variety of different asset types are prone to stranding, with varying distributional and political consequences. Here, we discuss selected results and key political mechanisms.

Stranded Capital

Most fossil fuels must be left unburned to meet climate targets (McGlade and Ekins 2015). Some are associated with extremely high rents. One response is a moratorium on extraction (Collier and Venables 2014), and another response is compensation to owners for unused reserves (Bohm 1993; Harstad 2012; Gard-Murray 2022). Geographic concentration means that compensation could involve politically difficult international transfers.

Energy-generating infrastructure and energy-intense infrastructure are often long-lived; reducing the emissions intensity of this can be expensive or impossible. Investment in polluting assets must stop soon (Rozenberg, Vogt-Schilb, and Hallegatte 2020); however, investment moratoria may increase short-run returns to fossil fuel–related assets (Baldwin, Cai, and Kuralbayeva 2020). Distributional impacts of different instruments, such as grandfathering

versus auctioning emissions permits, have been analyzed extensively (e.g., Fischer, Preonas, and Newell 2017; Rozenberg, Vogt-Schilb, and Hallegatte 2020).

A growing literature studies whether stock returns reflect carbon risk (Bolton and Kacperczyk 2021; Giglio, Kelly, and Stroebel 2021). Institutional investors believe that carbon emissions represent a material risk that is increasingly reflected in prices (Krueger, Sautner, and Starks 2020). Sen and von Schickfus (2020) show that investors expect that stranded coal plants will receive compensation, perhaps because of lobbying power. Meng and Rode (2018) find that financial markets price in vested interests' lobbying power.

Stranded Labor

The existing literature finds that climate policies have mixed effects on employment (e.g., Martin, de Preux, and Wagner 2014). Asset stranding for labor depends on sectoral carbon intensity and skill specificity (Marin and Vona 2019). For example, British Columbia's revenue-neutral carbon tax reduced employment in the most carbon-intensive sectors and increased it in the least carbon-intensive sectors (Carbone et al. 2020), disproportionately affecting less educated workers (Yip 2018).

Focusing on aggregate impacts ignores important limitations on labor mobility, given stranded assets' regional and sectoral concentrations. Aggregate shocks can have spatially heterogeneous effects (Autor et al. 2020). In particular, carbon taxes may be progressive in aggregate (Goulder et al. 2019) but not for exposed workers, who often help employers block mitigation (Bechtel, Genovese, and Scheve 2017; Mildenberger 2020). Carattini and Sen (2019) show that investors' reactions to pricing proposals may depend on their distributional features. Work on trade politics of sunset sectors (Dixit and Londregan 1995) may inform the green transition; see also the large literature on trade lobbying (e.g., Bombardini, Li, and Trebbi 2020).

Multiple Equilibria

Very few papers explore how policies evolve alongside stranding expectations. With endogenous policies, stranded assets can involve multiple mitigation and fossil-investment equilibria (Kalkuhl, Steckel, and Edenhofer 2020). Once weak policy is expected and accompanied by correspondingly high fossil investment, political feedback incentivizes implementing weak policy. Commitment problems are particularly important, as typical policy recommendations use future taxes to redirect investment (e.g., Baldwin, Cai, and Kuralbayeva 2020). One potential solution is tackling fossil investment directly (Kalkuhl, Steckel, and Edenhofer 2020).

Multiple equilibria may imply policy uncertainty. Uncertainty over legal challenges against US regulations delayed investment into sulfur abatement (Dorsey 2019). Continued uncertainty over future policies may reduce energy-related investment and slow switching toward green capital.

Future Research

In our view, stranded assets and their policy effects have received insufficient attention. In particular, work on politico-economic effects remains rare and largely theoretical. Our review highlights a few key issues going forward.

First, Climate Policies, Transition Risk, and Policy Uncertainty Are Endogenous

Existing papers almost invariably treat policy uncertainty as exogenous (van der Ploeg and Rezai 2020a). But optimal policy depends on capital stocks, and investment decisions determining those stocks depend on policy expectations. Policy decisions should be determined endogenously within models that account for multiple expectations-driven equilibria.

Second, Economists and Political Scientists Should Collaborate on the Political Economy of Stranded Assets

Studying past initiatives' distributional impacts (especially compensation schemes) would help explain which designs succeed. Empirical research on politico-economic interactions is an important complement to theoretical models and could help design second-best climate policies with realistic political constraints.

Third, Research Is Needed on Key Dimensions of Inequality and Stranded Assets

We found remarkably few papers considering stranding and income or wealth inequality, given very different asset portfolios and policy exposure across social classes. The intergenerational incidence of stranding and the fine details of incidence on sector-specific human capital are similarly underresearched. Political outcomes can depend on relatively small groups losing from policies that otherwise lead to aggregate gains (Autor et al. 2020; Gard-Murray 2020; Stokes 2020). A better understanding of how asset stranding constrains domestic politics will also help to understand international (non)cooperation (Aklin and Mildenberger 2020; Colgan, Green, and Hale 2020; Tavoni and Winkler 2021).

Policy Implications

Although stranded assets need more economic investigation, we draw some preliminary lessons for policy makers. First, without commitment, carbon pricing may not be the optimal mitigation strategy. First-best mitigation policies redirect investments toward low-carbon assets mainly via high future carbon prices. But without commitment to future policies, market actors may not expect rising prices and may thus continue investing in irreversible carbon-intensive capital. The policy maker may then have to set carbon taxes below the ex ante optimal level—for example, for reasons of political economy (Kalkuhl, Steckel, and Edenhofter 2020) or efficiency, even with rational expectations. Stranded assets imply that mitigation should target expectations; it is not clear whether price-based schemes do this sufficiently.

Second, policy makers should target durable capital stocks in addition to immediate emissions flows, since they determine both long-term emissions and political coalitions. Stated climate targets imply that development of new fossil-related assets must halt (IEA 2021). But reducing fossil investment also limits strandable assets in the future, allowing future policy makers to pass stronger policies, thereby improving present credibility. Subsidizing low-carbon investments could also increase the political scope for ambitious policies (Strunz, Gawel, and Lehmann 2016; Meckling, Sterner, and Wagner 2017). Regulating new carbon-intensive investment will likely provoke political resistance. But it does not reduce, and may

even increase, the value of existing capital (Baldwin, Cai, and Kuralbayeva 2020), creating relatively less resistance than policies that devalue already-developed assets. That said, desirable climate effects must be considered in relation to any deleterious effects, including those on energy security.

Third, policy makers should consider socioeconomic tipping points (Farmer et al. 2019). Unpalatable steps like compensating incumbents may be worthwhile if they enable rapid change (Goulder 2020; Stern and Stiglitz 2021). Decisively subsidizing low-carbon assets through "green deals" could also tip expectations-driven equilibria. Of course, socioeconomic tipping points may also trigger rapid devaluations of stranded assets, causing major financial instability. Economic policy makers should plan ahead to minimize negative impacts of a rapid transition.

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