Understanding the Inequality and Welfare Impacts of Carbon Tax Policies

Stephie Fried (ASU and SF Fed)

Kevin Novan (UC Davis)

William B. Peterman (Federal Reserve Board of Governors)

From 2019 through 2021, fourteen different carbon tax bills were introduced in Congress. On the surface, these bills are quite similar. Nearly all propose a tax starting in the range of \$25 to \$50 per ton of CO_2. Moreover, most call for the majority of the revenue to be recycled back to households. However, in terms of how to recycle the revenue back to households, there is no clear consensus among policymakers. Several proposals call for the revenue to be directly returned through periodic payments (i.e. carbon dividends) that are either uniform across individuals or means-tested, varying inversely with a household's total income. In contrast, some bills call for a portion of the revenue to be returned to households through tax swaps (e.g., reductions in particular income tax rates). The objective of this paper is to provide guidance surrounding which recycling options to use to maximize welfare.

Drawing on an approach from the macro public finance literature (e.g., Conesa et al. (2009), Heathcote et al. (2017)), we solve for the welfare-maximizing way to recycle carbon-tax revenue in a general equilibrium model of the U.S. economy. We calibrate the model to not only reflect heterogeneity across agents and their lifecycles, but also to match several important features of the US economy, including the current tax system and the importance of energy in the production of the final good and also in utility. Consistent with the wide array of options included in the existing policy proposals, we model an entire continuum of potential recycling approaches. In particular, we consider convex combinations of the following five methods: (i) uniform, lump-sum payments, (ii) means-tested payments that vary with an agent's total income, (iii) a uniform reduction in the capital-income tax, (iv)

a uniform reduction in the labor-income tax, (v) an increase the progressivity of the labor income tax. Measuring social welfare behind the veil of ignorance, we solve for the revenue recycling approach that maximizes the expected lifetime welfare of an agent born into the future steady-state.[1]

We find welfare is maximized by recycling revenue back to households using two distinct methods. Two thirds of the revenue is used to reduce the marginal tax rate on capital income. The importance of this recycling approach is not a new insight but is instead consistent with a large literature – dating back to the orignal 'double-dividend' studies (Parry (1995), Goulder (1995), de Mooij and Bovenberg (1998), Bovenberg (1999)) – highlighting that efficiency gains are achieved by using revenue from Pigouvian taxes to reduce distortionary taxes. The key new insight from our analysis is that welfare is maximized by using the remaining one third of the revenue to increase the progressivity of the overall policy, instead of uniformly lowering an existing tax. In particular, we find that the way to do so is by increasing the progressivity of the labor-income tax. We find that these optimal rebate methods do not depend on the sub-optimal mix of income taxes we begin with and they are robust across a wide range of carbon tax levels and specifications for the utility function.

Returning to the recent surge of carbon tax proposals, there is clearly growing support among policymakers for recycling the revenue back to households through direct payments that are either uniform across individuals or means-tested, varying inversely with a household's total income. One reason that these direct payments are more politically palatable is because they are progressive, with relatively larger benefits accruing to lower income households. Like these policy proposals, we find that it is welfare-maximizing to use a sizable portion of the revenue to increase the progressivity of the policy. However, unlike these policy proposals, we find that direct payments are not an effective way to increase equity. We find that using the revenue to increase the progressivity of the labor income tax achieves far higher equity and welfare than the direct payments.

Intuitively, returning carbon tax revenue through an increase in the progressivity of the labor income tax directs revenue back towards working-age agents with low labor income. In contrast, recycling the revenue through means-tested payments will direct revenue back towards any agents, working or retired, with low total income in that period. From an

[1]Following much of the literature studying revenue-recycling options, we do not model the environmental benefits from carbon tax policies. Rather, we focus on the non-environmental welfare consequences. In addition, we focus exclusively on modeling income heterogeneity, abstracting from heterogeneity across other dimensions (e.g., spatial heterogeneity). Recent work by Cronin et al. (2019) explores the potential redistributional impacts of a carbon tax policy within income groups.

equity perspective, the ideal revenue recycling method would return the revenue to the agents with the highest marginal utility. Ultimately, labor income is more closely correlated with marginal utility than total income because retirees have low total income but, since they are consuming their savings, this does not imply that they have high marginal utility. The key advantage of returning the revenue to using the reduction in the progressivity of the labor tax is that it better targets the revenue to the highest marginal utility agents. These could be agents who just experienced an adverse shock or agents who have low labor income over the entire course of their working lifetime.

The novel insights provided by our analysis stem from the combination of two modeling innovations. First, we don't restrict the recycling options to a small set of blunt approaches – e.g. returning revenue exclusively through lump-sum rebates, exclusively through a reduction in the capital income tax rate, or exclusively through a reduction in the labor income tax rate. Instead, we systematically consider a very rich set of recycling options. Second, the quantitative overlapping generations model we construct incorporates heterogeneity on several dimensions that are crucial for quantifying the distributional and overall welfare consequences of a carbon tax. First, building on recent studies demonstrating that the welfare impacts of a carbon tax can vary across the lifetime and between individuals (Chiroleu-Assouline and Fodha (2014), Williams et al. (2015), Fried et al. (2018)), we model agents' entire lifecycle, generating heterogeneity over age, and include idiosyncratic shocks to labor productivity, generating heterogeneity over income within each age group. Additionally, we use Stone-Geary preferences to capture the fact that low-income agents use a higher fraction of their expenditures for energy (Metcalf (1999), Grainger and Kolstad (2010)).[2]

References

Aubert, Diane and Mireille Chiroleu-Assouline, "Environmental tax reform and income distribution with imperfect heterogeneous labour markets," *European Economic Review*, 2019, *116*, 60–82.

Bovenberg, Lans, "Green tax reforms and the double dividend: An updated reader's guide," *International Tax and Public Finance*, 1999, *6(3)*, 421–443.

Chiroleu-Assouline, Mireille and Mouez Fodha, "From regressive pollution taxes to progressive environmental tax reforms," *European Economic Review*, 2014, *69*, 126–142.

[2]Recent work by Aubert and Chiroleu-Assouline (2019) and Jacobs and van der Ploeg (2019) also examine the welfare consequences of a carbon tax in models with income heterogeneity and homothetic preferences.

Conesa, Juan Carlos, Sagiri Kitao, and Dirk Krueger, "Taxing capital? Not a bad idea after all!," *American Economic Review*, 2009, *99(1)*, 25–38.

Cronin, Julie Anne, Don Fullerton, and Steven Sexton, "Vertical and horizontal redistributions from a carbon tax and rebate," *Journal of the Association of Environmental and Resource Economists*, 2019, *6* (S1), S169–S208.

de Mooij, Rud A. and A. Lans Bovenberg, "Environmental taxes, international capital mobility and inefficient tax systems: Tax burden versus tax shifting," *International Tax and Public Finance*, 1998, *5(1)*, 7–39.

Fried, Stephie, Kevin Novan, and William B. Peterman, "The distributional effects of a carbon tax on current and future generations," *Review of Economic Dynamics*, 2018, *30*, 30–46.

Goulder, Lawrence, "Environmental taxation and the double dividend: A reader's guide," *International Tax and Public Finance*, 1995, *2(2).*

Goulder, Lawrence H, Marc A.C. Hafstead, GyuRim Kim, and Xianling Long, "Impacts of a carbon tax across US household income groups: What are the equity-efficiency trade-offs?," *Journal of Public Economics*, 2019, *175*, 44–64.

Grainger, Corbett A. and Charles D. Kolstad, "Who pays a price on carbon?," *Environmental and Resource Economics*, 2010, *46* (3), 359–376.

Heathcote, Jonathan, Kjetil Storesletten, and Giovanni L. Violante, "Optimal tax progressivity: An analytical framework," *The Quarterly Journal of Economics*, 2017, *132* (4), 1693–1754.

Jacobs, Bas and Frederick van der Ploeg, "Redistribution and pollution taxes with non-linear Engel curves," *Journal of Environmental Economics and Management*, 2019, *95*, 198–226.

Metcalf, Gilbert E., "A Distributional Analysis of Green Tax Reforms," *National Tax Journal*, 1999, pp. 655–681.

Parry, Ian W.H., "Pollution Taxes and Revenue Recycling," *Journal of Environmental Economics and Management*, 1995, *29* (3), S64–S77.

Williams, Roberton III, Hal Gordon, Dallas Burtraw, and Jared Carbone, "The initial incidence of a carbon tax across income groups," *National Tax Journal*, 2015, *68(1)*, 195–214.