Implications of basic income policies for climate goals

Iñaki Arto[a], Simone D'Alessandro[b], Kurt Kratena[c], Guilherme Spinato Morlin[b], María Victoria Román[a] and Manuel Tomás[a].

[a] Basque Centre for Climate Change (BC3)

[b] University of Pisa (UNIPI)

[c] Centre of Economic Scenario Analysis and Research (CESAR)

Abstract:

The transition to a sustainable and low-carbon economy presents social and economic challenges that require new policies to ensure minimum standards of living for everyone and to reduce inequalities. In this context, a universal basic income policy can support individuals and communities during the green transition. However, implementing this policy can create a fiscal burden, leading to higher deficits and increased debt if not compensated by greater tax revenues. In this regard, progressive tax reforms aimed at raising revenues from the better-off individuals of the society, such as a wealth tax, might provide the funding required for the implementation of the universal basic income while further decreasing inequality. Nevertheless, a universal basic income can have negative feedback effects on climate goals by promoting consumption and economic growth. To mitigate this trade-off between reducing inequality and greenhouse gas (GHG) emissions, a carbon tax that helps to internalize the external costs of carbon emissions might be introduced as part of the tax reform. To investigate the impact of these policies, we used the Within Limit Integrated Assessment Model WILIAM, a macroeconomic multi-regional input-output model that integrates physical energy, material flows and constraints, as well as climate change damages. Our simulations, run for 21 European countries during the period 2025 – 2050, reveal that these policies substantially reduce inequality but can only partially prevent the negative feedback effects on environmental variables. We discuss the factors behind this potential trade-off between environmental and equity goals and provide recommendations for policy design and future research.

Keywords: Universal basic income, carbon tax, wealth tax, just transition, Integrated Assessment Model, Just Transition

1. Introduction

Inequality has been rising globally over the past few decades, reaching levels comparable to the peak of the early 20th century (Chancel et al., 2022). While this trend is particularly evident in the United States (Stiglitz, 2015), European countries are also experiencing increasing disparities. In 1980, the top 10% earners in Europe received 29% of the regional income in 1980, while the bottom 50% received 24%. By 2017, the disparities increased, with the top 10% income share rising to 34%, while the bottom income share decreased to 20% (Blanchet et al., 2019). During the same period, the income share captured by the top 1% increased from less than 8% to nearly 11%. The average annual growth rate of pre-tax income for the bottom 50% was 0.8%, whereas the 1% experienced a growth rate of 2.2% and the top 0.001%, a rate of 3% (Blanchet et al., 2019). Wealth is distributed in an even more concentrated manner than income. The share of wealth held by the global top 0.01%, an elite group of 520,000 adults, rose from 7% in 1995 to 11% in 2021. The small group of billionaires held 3% of global wealth in 2021 (Chancel et al., 2022). The top of wealth distribution captured the largest share of the wealth growth in the last decades, posing challenging trends to future distribution and to democracy itself (Piketty, 2014).

Stiglitz (2015) explains that inequality is reinforced by policies and politics, including decisions about the education and health systems, taxation, bankruptcy laws, and financial regulation. These choices have helped further enrich the rich at the expense of the rest. Such policies damage the economy, since the elite, instead of driving technological innovation and job creation, captures increasing portions of the income without contributing to overall growth. Inequality not only undermines economic prosperity but also threatens environmental sustainability. Reducing inequalities may be fundamental to curbing emissions, as the highest levels of income distribution are responsible for a disproportionate share of emissions, while there is little room to reduce emissions among the bottom. In fact, individuals within the top 1% are responsible for more CO2 equivalent emissions than the bottom 50% of the global income distribution (Chancel et al., 2022). Poverty and extreme income and wealth concentration are barriers to effective climate action (Green and Healy, 2022; Stiglitz, 2015). On the other hand, more equitable societies tend to exhibit reduced environmental footprints and emissions per capita (Cushing et al., 2015; Wilkinson and Pickett, 2010). Finally, unequal societies foster social and political distrust, which decreases the support for climate policies.

In this context, the transition towards a sustainable and low-carbon economy represents a huge challenge for societies, requiring urgent structural transformations in the ways of production, consumption and distribution of resources. The substitution in energy sources and means of transportation, introduction of new production technologies, and the transition from an economy focused on growth targets to one centered on wellbeing objectives will lead to radical transformations in the labor market that can threaten the standard of living of poorer people. The ecological transition therefore must be accompanied by a set of social policies, which protect citizens from the socioeconomic impacts of these radical transformations. Improvements in income distribution are strategic for reducing the dependency on growth to generate prosperity at a lower environmental cost, besides ensuring that all individuals access a minimum standard of living. Hence, social policies such as a universal basic income as well as changes in taxation come to the forefront of the analysis of policies complementary to the green policies related to the transition.

Public support for universal basic income has increased with the COVID-19, with 71% of Europeans in favor of it (Thompson 2022). But the introduction of a universal basic income immediately raises the question about the relationship between inequality and GHG emissions in a dynamic perspective. The question at stake is whether there exists a trade-off between reducing GHGs emissions and reducing inequality. Hailemariam, Dzhumashev, and Shahbaz (2020) provide a literature review on this topic showing that the evidence is inconclusive, and explain that the mechanisms through which inequality affects emissions are various and work in opposite directions. Income inequality might increase emissions through: 1) the political influence of the economic elite, who own polluting companies and have the most polluting lifestyles; 2) increased consumption/status competition (and longer working hours) across all levels of the income distribution (i.e. the Veblen effect); 3) social distrust and lack of trust in institutions, weakening policies looking for the common good; 4) the persistence of the "job-killing" argument against climate policies (observed more frequently in societies where the State does not protect people from economic shocks); 5) hampering the mass uptake of clean technologies and/or efficient collective provisioning (Vona 2019, Green and Healy 2022). On the other hand, more equality (through redistribution) increases emissions when the marginal propensity to consume and emit decreases with income. This happens when carbon-intensive goods, as energy, are inferior or necessity goods (the share of expenditure in those goods decreases with income), which is the case in developed economies (Pottier 2022)[1].

The interplay between these contrary effects might explain why different studies have arrived at different conclusions (e.g. Jorgenson et al. 2017 or Hailemariam, Dzhumashev and Shahbaz 2020). Grunewald et al. (2017), studying the relationship between the after-tax Gini coefficient and GHG emissions in 158 countries for the period 1980 - 2008 find that the relationship between inequality and emissions is curvilinear, with emissions falling or rising with inequality depending on the initial level development of the country. Their results show that reducing inequality in lower-income countries increases emissions, since the number of people able to afford consuming carbon-intensive goods would increase, something that would not happen in richer countries, where everybody already has access to those goods.

[1] In developed economies where energy is still very carbon intensive, the carbon footprint increases less rapidly than total expenditures, because the first purchased goods (necessities) are more carbon intensive than the latter ones. This explains why rich urban households have larger footprints in absolute terms, but poor rural households emit more proportionally to their income. Contrary, in developed countries that have decarbonized their electricity production, the expenditure elasticity of carbon footprint is close to one, since energy goods are not more carbon intensive than other goods. This means that as decarbonization of electricity, housing and transport advances, the expenditure elasticities will increase in developed countries. In developing countries the expenditure elasticity of carbon footprint is close to or above one, since energy is a luxury good, and the first goods are less carbon intensive than the latter. Income or expenditure elasticities are not constant. In developed countries they might have a U shape and the opposite in developing countries. However, the quality effect is a strong limitation of the footprint calculation methods, and if taken into account elasticities would fall significantly.

Rojas-Vallejos and Lastuka (2020) complete this finding by identifying the income threshold (USD_{2011} 15.000 per capita) from which more equality means less emissions.

As Oswald et al. (2021) show, most studies of the large body of literature on carbon footprints and income inequality, either between income groups or between countries, apply a static perspective (e.g. Moran, et al., 2018 and Wiedenhofer et al., 2017). The empirical fact that higher income sectors of the global society exhibit higher carbon footprints, though, is trivial and does not allow us to draw conclusions about the footprint impact of income redistribution. One important model feature to deal appropriately with that is modeling the different channels that determine the reaction of energy demand and footprints to income changes. Some studies circumvent this effort by making very simple assumptions like a unitary income elasticity of the footprint at all income levels or a linking of income and emission scenarios that are not really coupled (e.g.: Rao and Min, 2018).

Only very few studies deal with a non-linear and heterogenous relationship between income and carbon footprints. Sommer and Kratena (2017) apply a macroeconomic input-output model for Europe to estimate the stepwise income elasticities when a household moves from one quintile to the next. This elasticity is 1.32 for the transition from the lowest 20% of the income distribution to the next 20% quantile, and 0.69 for the transition from quintile 4 to quintile 5 (direct footprint). For the indirect footprint this elasticity value is also decreasing with income. In this context, income redistribution would clearly lead to an emission increase. Oswald et al. (2021) estimate a simple consumption system with different energy and non-energy categories and income elasticities for single goods and combine that with (static) energy footprints by goods. This methodology does not take into account feedback at the macroeconomic level, but describes non-linearity for consumption demand. The model is used by Oswald et al. (2021) for a simulation of income redistribution at the global level between countries for one single year (2011), with the result of an increase of the energy footprint of households by 10% (5% of total energy footprint). They also find that in a more equal world, part of the energy consumption shifts from mobility to at home energy consumption (heat and electricity). A similar study with redistribution within 32 countries of the Global North (Millward-Hopkins and Oswald 2021), assuming a fixed carbon-expenditure elasticity of 0.7, finds that a fairer income distribution would increase emissions by less than 2%. Here, the authors propose to avoid this trade-off by combining a fairer distribution with a decrease in total expenditure or a shift towards publicly provided services (in the form of Universal Basic Services). The rationale behind the first option would be that, as social psychologists have shown, people are willing to accept a decrease in absolute income provided their relative income is higher (J. Solnick and Hemenway 1998).

Our study extends the literature in several important aspects. One is the application of a global macroeconomic input-output model with a high degree of household heterogeneity for European households (60 household types) and integrated bottom-up modules for energy, transport and environment. This methodology combines economic mechanisms with technology detail and incorporates a large variety of model feedbacks, also from primary material and energy markets on the economy (via prices). The other aspect where this study considerably improves the level of policy relevance is that the redistribution policy is not implemented, as in many other studies, by its implicit result, i.e. the change in income distribution that it should induce. Instead, the policy instruments for redistribution (universal basic income and wealth tax) and for mitigating the emission rebound of redistribution (CO_2 tax) are explicitly introduced as policy variables in the public sector-module of the model and their effectiveness is therefore an outcome of the model.

We therefore analyze the impact of a basic income policy under alternative taxation schemes on economic, social, and environmental indicators. Basic income (BI) is conceived as a universal policy that ensures that every individual receives a transfer without any necessary counterpart and regardless of its income or working status. Such a policy provides the access to a minimum standard of living acknowledged as a right to citizens of a political community. Different studies have pointed to the importance of BI as a tool to fight poverty and inequality (Wright, 2016). Cieplinsky et al. (2021) argue that BI can mitigate the social costs of policies related to the ecological transition. Nevertheless, any BI scheme implies a great increase in public expenditure. For this reason, we explore two alternative taxation schemes to offset the negative effect of BI on the public budget: a wealth tax and the combination of a wealth tax with a carbon tax. A wealth tax has been defended by many economists as a measure to fight increasing inequality (Piketty, 2014). It has also been analyzed recently as a measure compatible with ecological goals (Apostel and O'Neill 2022; Kapeller et al., 2023). A carbon tax is part of the set of policies designed to reduce emissions, by creating an economic incentive to cut emissions (World Bank, 2023). However, the regressive nature of carbon taxation has been highlighted as a major obstacle to its acceptance. Hence, recycling tax revenues through redistributive measures might be a potential solution to the perceived unfairness of green reforms. The combined implementation of a basic income and a carbon tax thus also addresses the issue of counterbalancing the regressive effect of carbon taxation by redistributing its revenues (Van Heerden et al., 2006; Distefano and D'Alessandro, 2023).

2. Basic income and taxation policies

Basic Income

The BI is a transformative policy concept that has captured the attention of policymakers and scholars worldwide (see Gentilini et al. 2020 for a literature review). Parrique (2019) explains that a first proposal of a BI was made already at the end of the eighteenth century and cites more recent proposals like Friedman's (1962) or van Parijs and Vanderborght's (2017). BI is usually conceived as a universal policy, ensuring that *every citizen*, irrespective of their income, wealth, or working conditions, receives a regular unconditional payment from the government equal to the minimum amount of money required to live in a certain society (hence, *basic*) (see, for instance, Van Parijs, 2004)[2].

[2] This minimum amount of money is generally above the poverty line. This means that it is enough to live "simply, securely, and with dignity, though… extremely modestly" (Alexander, 2011).

Increasing number of research has analyzed the potential impacts of BI on various aspects of society. Previous works have explored its effects on inequality and poverty, revealing promising findings which suggest BI could be an effective tool in reducing income inequality (Wright, 2016). In fact, the BI could eradicate statistical poverty and economic insecurity (Parrique, 2019). With the support of BI, individuals can escape poverty traps as they would be able to pursue education rather than selling most of their time in low-skilled, low-paid jobs that only provide enough to survive. With this additional education, formerly low-skilled workers would gain access to better paid jobs, reducing their need to work long hours to earn a decent income (Standing 2013). Kangas et al. (2021) explains that one of the purposes of the BI is to give possibilities to people for switching careers, starting new businesses, and learning new skills.

The BI would also contribute to increasing the bargaining power of the labor force, potentially increasing salaries and, hence, redistributing the income generated in the economy. While it is an incentive to decrease the hours of work each person is willing to sell in the labor market, it would not necessarily decrease the number of employed persons. In theory, it would help to distribute the paid work between potentially more people. Also, the BI would be a way to favor the decommodification of the labor force (Standing 2013).

Uncoupling income from paid work, the BI would not only reconfigure power structures in the labor market, but also within households, empowering non-paid workers, traditionally women (Parrique, 2019). The benefit in terms of gender equality is clear, since the BI would put the care activity within the social solidarity space, as part of the activities that deserve public benefits and support. Additionally, it would also enable a transformation of the concept of citizenship, with the recognition of the right to economic security to everybody regardless of their labor situation (Healy et al. 2013).

Another benefit from the BI might be an incentive to the participation in the public and political spheres. Participation in communitarian and political life is a care work and BI facilitates that people can allocate part of their time to contribute to society in this way. Standing (2013) and Alexander (2011) defend that people have the need to contribute to the society, so receiving a BI would not prevent them to work in something they choose (being or not well paid).

Studies have also delved into its potential implications of the BI for environmental sustainability. Cieplinski et al. (2021) suggest that BI may reduce inequality and counteract the negative distributive trends related to climate change and the green transition. Andersson (2010) sees potential environmental benefits in implementing a BI for allowing people to reduce working hours and choose frugal lifestyles, aligned with the voluntary simplicity, something that could decrease economic growth and its associated ecological impact.[3]

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[3] Being critical with this vision, Tcherneva (2007) wonders what would make people, who so far had simple lifestyles just because they were poor, to renounce to dominant consumption patterns once they can afford them. If we assume that consumerism is the way the current economic system has found to compensate people for selling most of their time doing things they do not like, then, the BI would reduce such need of (quick) compensation through consumption (this is what Graeber (2018) calls the "compensatory consumerism").

Therefore, some may argue that the BI could decrease economic growth (e.g. Daruich and Fernández, 2024). In that case, the BI would be compatible with the degrowth narrative and included as part of the degrowth agenda (Parrique, 2019). In Anderson's (2010) words "the society would not be pressured to boost the economy just in order to guarantee an appropriate supply of jobs… In order to break this unholy link between growth and security a citizen's wage or BI is needed." This idea was also supported by Herman E. Daly (pioneer of ecological economics) as part of his steady-state economics (Daly, 1992).

Another benefit, according to Anderson (2010) and Parrique (2019), is that the BI would increase the acceptability of environmental taxes that, in absence of a BI, would be regressive. If green tax revenues would be recycled into a BI, the net distributional effect could be progressive (see a similar exercise in Tomás et al. 2023)[4]. Similarly, Green and Healy (2022) and Vona (2019) defend that eradicating economic insecurity (with policies such as the BI) would lower the opposition to climate policies due to social impact concerns (like job losses or inflationary effects)[5].

Another crucial area of interest has been the impact of BI on health outcomes. In this regard, Painter's (2016) research shows the positive effects of BI on mental and physical health, highlighting its potential to improve overall well-being. Also, a BI can enable meaningful and non alienated lifes for all. The BI is a means of recognizing the social value of non commodified activities, like maintaining traditions, tangible and intangible culture, spreading traditional or new knowledge, practicing faiths, sports, artistic and cultural activities that give purpose to people's lives (Healy et al. 2013).

Nevertheless, there are also studies pointing to the potential disadvantages of the BI. For instance, Daruich and Fernández (2024) find welfare losses in the long run in a simulation exercise with intergenerational linkages via parental investment in child skills. These welfare losses are associated to the fact that: 1) the BI is financed via a labor tax (when it is financed with a consumption tax, similar to a carbon tax, they find welfare gains as shown also by Conesa, Li and Li 2023 and Luduvice 2021); 2) capital and labor supply (hence GDP) decrease due to the effect of the higher distortionary labor tax. On the other hand, authors recognize that in a riskier economy (which might be the case of an economy hit by climate impacts) the desirability of the BI would increase. Other critical voices warn about the insufficiency of the BI to structurally change the current power imbalances and economic democracy deficits. Thompson (2022) argues that the BI might only subsidize new forms of

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Enabling people to more freely choose how much time they sell, and how much time they do things they enjoy, the BI would increase life satisfaction through the use of time, reducing the need to consume (Standing 2013).

[4] Note that carbon taxes might not necessarily be regressive even in absence of revenue recycling, as suggested by Goulder et al. (2019) for the case of the United States.

[5] Vona (2019) argues that in some places, losing your job is the worst thing that can happen to you, even worse than getting sick due to the pollution produced in the factories. This is especially true in regions where the State is absent to promote an industrial policy that diversifies local economies, and to provide social protection for people losing their source of income. Is in contexts, where social inclusion depends on markets, where climate policies generate a difficult situation for those that are already left (behind) to their fate. However, the message that their disgrace is due to environmental regulations is very convenient for those privileged by the status quo. Ensuring the economic security of everybody (with a BI, for instance) would break this vicious circle of climate inaction and workers vulnerable to (any kind of) shocks.

social control (under the new elite of "vectoralists", who have the monopoly of data) if not accompanied with other radical reforms, like the redistribution and democratization of ownership and capital control.

While BI is a policy increasingly discussed in academic debates, it has also been put to the test through localized experiments around the world, e.g. in the Netherlands, Finland, Canada, Spain, the US and Kenya (Thompson 2022). One notable example is the case of Manitoba in the 1970s, where a BI pilot project showed encouraging results (Simpson et al., 2017). More recently, Finland carried out a two-year transfer of BI to two thousand unemployed individuals from 2017 to 2019, shedding light on how the policy operates in real-world scenarios (Kangas et al., 2019).

Kangas et al. (2021) summarize the results from previous BI experiments. He explains that, in developing countries (Namibia and Kenya), the BI had positive effects for poverty alleviation, redistribution of income, "health, nutrition, sanitation, schooling, economic activity, emancipatory effect for women, disabled and minorities". BI experiments in developed countries (the US, Canada, the Netherlands and Finland) created the conditions for learning new skills, attending longer education, trying new jobs and enlarging at-home child care. These programs also decreased stigma, increased health (including mental health), provided higher life satisfaction and well-being, strengthened the cognitive capacities of beneficiaries and increased the confidence in finding employment in the future. However, Kangas et al. (2021) highlight that economic security is not enough to increase the employability of people, who might face other types of barriers.

Empirical evidence on the impact of BI on labor supply remains scarce, as only a small number of experiences exist where basic income policies have been implemented with restricted scope and limited benefits. Therefore, we rely on empirical evidence from other policies involving conditional and unconditional transfers. Results of conditional and unconditional cash transfer policies find a fall in the participation and intensity of child labour (Hoop and Rosati, 2014), and to a lesser extent a decrease of elderly supply of labour (Kassouf et al., 2012). Analyzing transfers in seven controlled trials in developing economies, Banerjee et al. (2017) find no systematic evidence to support the view that cash transfers have a negative impact on employment. Rather, results for Latin American countries show that, for supporting poorer households, cash transfers have positive long term effects on the inclusion of young people and women in the labor market (Abramo et al. 2019).

Regarding the ecological impact, evidence from the Finnish experiment shows limited outcomes in the short term. Kalaniemi et al. (2020) compute the carbon footprint of a BI recipient for the case of Finland, which would be similar to that of a household in the lowest income decile. The authors find that, although the footprint of a BI recipient is roughly half of the average person, it is still above the level consistent with the remaining carbon budget for reaching the 1.5ºC warming target by the end of the century. Therefore, to achieve a doughnut-kind of economy where everybody can have a decent life within planetary boundaries (Raworth, 2017), a mix of policies is needed to shrink consumption across the whole society and, at the same time, decrease the carbon intensity of basic goods (electricity, housing and food) to ensure low carbon options are accessible for all.

Scholars studying BI also evaluate research on lottery winners to gain insights into labor supply choices following an unconditional transfer. These studies show that lottery does not persistently affect labor supply - in spite of short term adjustments as a period of holidays or changes in career paths (Marx and Peeters, 2008). Other studies find that lottery has only a modest negative effect on labor supply (Cesarini et al., 2017) or working hours (Picchio et al., 2018).

BI implies a substantial increase in public spending. For this reason we analyze the implementation of this policy in combination with additional taxes. We explore the effects of a wealth tax and a second scenario in which the wealth tax is combined with a carbon tax. A redistribution of income in favor of lower-income households boosts consumption, since the propensity to consume is decreasing with the level of income. By redistributing income, BI thus increases consumption, having a negative feedback effect on climate goals. Policies like carbon taxation counteract the increase on CO2 emissions following the introduction of a BI. Our simulations will show which is the net effect of these two policies on emissions and how it varies across countries.

Wealth tax

Wealth taxation has resurfaced as a prominent topic in the policy debate, serving as a potential tool to redistribute income and fight inequality. Piketty et al. (2013) argue that implementing a wealth tax can effectively reduce both income and wealth inequality. It is worth noting that wealth is even more unevenly distributed than income, and this wealth inequality has seen a significant surge in the United States and other advanced economies (Zucman, 2019). Furthermore, the wealth to national income ratios in advanced economies have been on the rise in the last decades (Piketty and Zucman, 2014), revealing the cumulative nature of those inequalities.

Apostel and O'Neill (2022) have recently analyzed the potential impact of wealth taxation on Belgium. Their argument revolves around progressive taxation as a means to reduce inequality while easing the pressure for economic growth, thereby improving living standards with a lesser environmental cost for all. However, the authors acknowledge that wealth taxation might not have a substantial negative effect on emissions. Apostel and O'Neill (2022) estimate that a 5% tax above €3 million in Belgium would lead to less than a 1 percentage point reduction in consumption-based CO_2 emissions. On a positive note, Kapeller et al. (2023) showed that a wealth tax can generate significant revenue, playing a vital role in closing the green investment gaps existing in European countries. This points to the potential of wealth taxation not only to address inequality but also contribute significantly to sustainable development efforts in a fair transition (Mastini, Kallis, and Hickel 2021).

Other authors focus on the potential impact of reducing income and wealth at the top of the distribution on emissions and climate policies. According to Green and Healy (2022), emissions would be reduced both directly, through the reduced consumptions of those in the top of the income distribution, and indirectly, through the reduction of the imitation effect in the rest of the population. They also emphasize that concentrated economic power has influenced government policies to obstruct climate action, preserving the existent productive structure. Moreover, the economic elite profit from the regressivity of climate policies like green taxes, by constructing narratives about the losers of the ecological transition and spreading them through mass media whose editorial lines they can influence. Besides, they also benefit from polarization of the public opinion and distrust of politicians and democratic institutions. The promotion of social distrust and "every man for himself" attitudes are especially damaging for the protection of a common good like climate, where cooperation and the sense of belonging to a community broader than the own family is so necessary.

Carbon tax

A carbon tax is a market-based environmental policy designed to curb the CO_2 emissions by placing a price on carbon and thus internalizing the external costs of carbon pollution, in line with the polluter-pay principle proposed by Pigou (1920). In this way, a carbon tax provides an economic incentive processed by markets, which define how and where to cut emissions at the lowest cost (World Bank, 2023).

The introduction of carbon taxation is usually placed among the fundamental policies to support the transition towards a low-carbon economy, by inducing the substitution in consumption and fostering innovation and energy efficiency in production. Different carbon tax policies have been implemented across countries with a steady increase in the share of global emissions covered by carbon taxes and emissions trading systems in the last decade, with the share of global GHG emissions currently covered amounting to 23%. These taxes have proved to be effective, decreasing the carbon intensity of energy use in countries with higher taxes on combustibles (OECD 2019). However, fewer than 5% of worldwide greenhouse gas emissions are covered by a direct carbon price meeting or above the level needed by 2030 to be consistent with long term emissions targets (World Bank, 2023).[6] According to the last report on effective carbon rates (OECD 2023), covering not only explicit carbon pricing instruments, like carbon taxes and emissions trading systems, but also fuel excise taxes, 58% of the GHG emissions of the 72 covered countries (representing approx. 80% of GHG emissions in 2021) were unpriced. In another document, the IMF (2021), by comparing the policy stringency index of different environmental policies, shows how carbon taxes have so far not been a binding constraint in most countries. For instance, the stringency of environmental regulation has increased from 0,5 in 1990 to 4 in 2015, while carbon taxes have increased from 0 to 0,5 in the same period.

[6] EUR 60 per metric ton of CO2 is used as a midpoint estimate for carbon costs in 2020 and a low-end estimate for 2030; OECD, “Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action,” 2022.

While a carbon tax may contribute to curb emissions, it also provides an additional source of tax revenue for governments. How governments employ the increased revenues has fundamental implications for the distributive and environmental impacts of this policy (Freire-González, 2018; Wang et al., 2016). The potentiality to employ tax revenues to stimulate the green transition and other social benefits provides a Double Dividend for governments introducing a carbon tax. This revenue recycling can be crucial to increase the political feasibility of a carbon tax policy (Beiser-McGrath and Bernauer, 2019; Wesseh and Lin, 2019).

The regressive impact of carbon taxation on distribution has often been highlighted as an obstacle to the acceptance of this policy. Wang et al. (2016) argue that directly redistributing carbon tax revenues to households can alleviate the regressive impact of this policy. Note that the reason why carbon taxes are thought to be regressive in developed countries[7] is that only one type of impacts are normally accounted for in distributional analysis, i.e. "use-side impacts" or those associated with the change in prices of consumption goods. As in the case of other consumption tax (like the value-added tax), a carbon tax hits the poor hardest in relation to their lower income. This happens because necessity goods (like food, health or housing) are very carbon intensive, and because the share of income spent in consumption goods decreases as total income increases. This means that richer households would pay larger amounts in carbon taxes in absolute terms, in proportion to their income, they would pay less than poorer households.

Carbon taxes may be progressive when accounting also for the changes in the sources of income, as shown by Goulder et al. (2019) for the case of the US. This happens because richer households rely more on emissions-intensive capital goods as a source of income. As the (progressive) supply-side impact is larger than the (regressive) use-side impact, the net effect of the policy is progressive. Note also that the regressivity of the use-side impact will probably decrease as decarbonization advances in developed countries, as Pottier (2022) explains for the case of Norway. As necessity goods in these societies become less carbon intensive (low carbon housing, electricity and transport), then the use-side impact of carbon taxes would become proportional.

In any case, the perceived unfairness of green-tax reforms is seen as a relevant political barrier and the recycling of tax revenues as a way to overcome it. Nevertheless, tax revenues redistribution may be less economically efficient compared to the design of distortionary tax cuts. A triple dividend of the carbon tax may emerge if the policy and the related revenue recycling strategy reduce emissions, increase employment and reduce inequality (Van

[7] In developing countries, where poor households cannot afford to buy emissions-intensive goods like vehicle fuels, carbon taxes tend to be progressive even if only the use-side impact is observed (Dorband et al. 2019). Pottier (2022) explains this difference between developed and developing countries through their expenditure elasticities of the carbon footprint. In most developed countries, most carbon intensive goods (energy) are necessity (inferior) goods of which expenditures decrease with income (so lower income households spend more proportionally on these polluting goods). Contrary, in developing countries, energy is a luxury good of which expenditures increase with income (then, lower income households spend less proportionally on these polluting goods).

Heerden et al., 2006). Finally, by simulating a carbon tax and a revenue recycling for the Italian case, Distefano and D'Alessandro (2023) find a quadruple dividend with a persistent fall of debt-to-GDP ratio.

Note that the present exercise is similar to the implementation of a carbon tax combined with revenue recycling, consisting in this case of a UBI, which is different in name but similar in practice to a lump-sum transfer or climate dividend equal per capita.

3. Methodology

The Within Limits Integrated Assessment Model (WILIAM) is a dynamic econometric multi-regional Input-Output model extended by endogenous final demand and by mutual feedback between quantities and prices. WILIAM operates in a simulated environment that does not follow from an agent optimisation process. Effective demand drives output growth and composition, under supply constraints such as labour and ecological resources. Unlike other IAM's, in WILIAM, markets are not assumed to be generally cleared by the price mechanism. Therefore, there is no guarantee that all available capital and labor resources will be used and there will usually be spare production capacity available (which is compatible with the presence of involuntary unemployment). Economic growth interacts with exogenous capital and labor productivity, under given liquidity constraints, as well as with endogenous values for energy intensity, labor force and resources availability.

A BI policy was introduced in WILIAM, being modelled as a universal income transfer equivalent to 10% of the annual per capita disposable income of each country starting from 2025, which is handed out to each individual. Simulations run until 2050. The policy was implemented in the 21 European countries that have detailed data for households in WILIAM, meaning that we are able to study distributive impacts of these policies among different household groups. Households are distributed in 60 groups, varying according to urban and rural, family composition (single, single with children, couple, couple with children, other, other with children), and income (dividing households in quintiles). BI is transferred to households in proportion to the amount of people in each household, which reflects the policy conception as a direct transfer to each individual. BI then becomes an extra component of households income, on the one side, and of government expenditure on the other, triggering the endogenous dynamics within WILIAM. An increase in household income boosts consumption, according to each groups' average propensity to consume, therefore affecting economic activity, employment and tax collection. The taxation policies implemented in combination with BI negatively affect households disposable income, and, in the case of the wealth tax, household financial stocks.

The value of the BI varies according to the heterogeneity of income levels across European countries, as can be seen from the annual values for the first period of the implementation (2025) of the BI benefit reported in Figure 1. In general, the benefits are not high enough to guarantee a complete substitution for labour income. The nominal value of BI benefit is updated in time according to the consumer price index of each country. In aggregate, the expenditure with BI represents between 4% and 7% of the GDP of the studied countries (see Figure 2). To put these figures into context, in the EU in 2022, government expenditure in education accounted for 4.7% of GDP, health represented 7.7% of GDP and the total government expenditure reached 49.6% of GDP (Eurostat, 2024).

Figure 1. Universal basic income in USD per household, by country (2025)

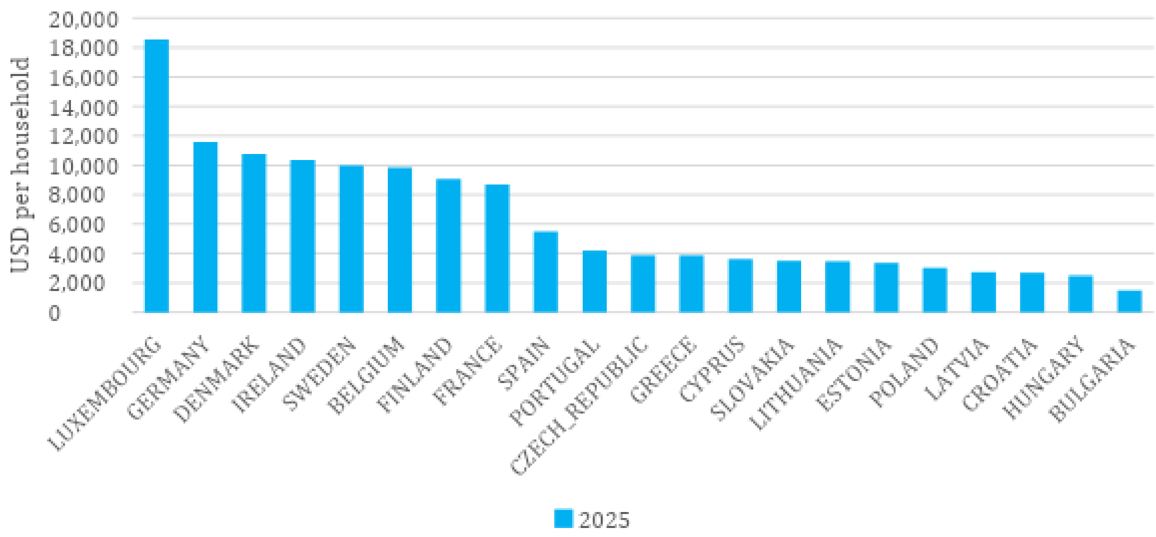
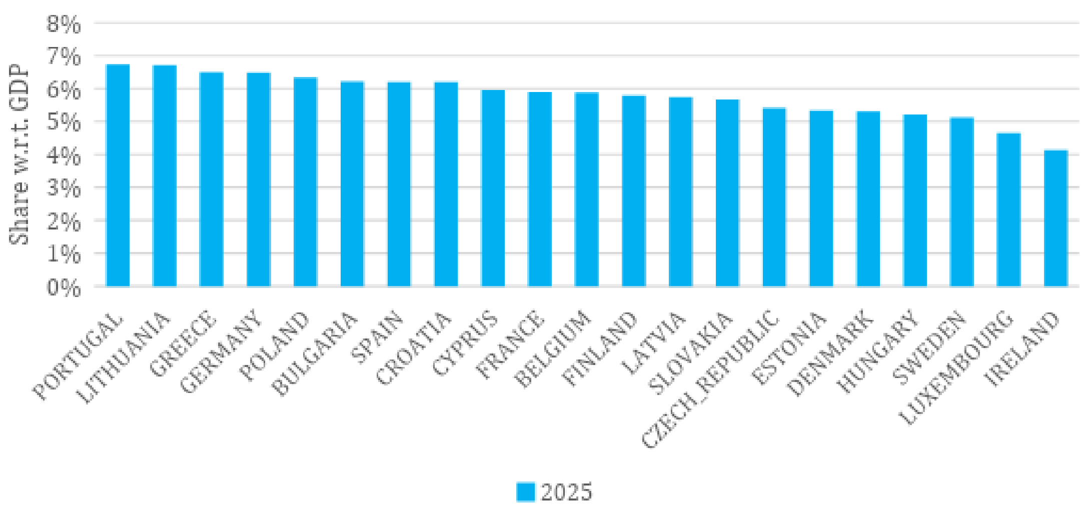


Figure 2. Ratio of Universal Basic Income / GDP (2025)



Since the introduction of a BI implies a great increase in public expenditure, we combine the BI policy with alternative forms of taxation to increase government revenues and offset the negative impact of BI on the public budget. Therefore, we compare two different scenarios, with their results reported as relative or absolute deviations with respect to the baseline scenario, in which no BI policy is active.

In the first scenario (**Tax Wealth**), we consider the case of a wealth tax, collected from the financial assets component of the wealth of households belonging to the two top quintiles of the income distribution. The policy increases the wealth tax rate according to a rate endogenously computed in the model, in a way that the increase in the wealth tax rate delivers a revenue equal to the spending on the BI policy.

In the second scenario (**Tax Wealth + Tax CO_2**), we introduce a carbon taxation combined with the wealth tax. The carbon tax is modeled as a payment proportional to the quantity of CO_2 embedded in household consumption of energy and transport. The value of the carbon tax is asummed to linearly increase in time, departing from 50 USD per tonne in 2025 to 250 USD per tonne in 2050, as shown in Figure 3. The wealth tax still plays a role in this scenario. Since the carbon tax is not sufficient to cover all the BI spending, there is still an increase in the wealth tax proportional to the remaining government spending with BI.

In both scenarios, BI should be, by construction, neutral from the point of view of the public budget. However, the increase in consumption and economic activity caused by the BI increases other sources of tax revenue, generating a net positive effect on public finance. The stimulus on economic activity comes from the increase in household disposable income following the introduction of BI. Households propensity to consume out of income varies by income quintiles, as reported in Figure 4. Therefore, an increase in income for the bottom quintiles significantly boosts aggregate consumption, as the lowest quintile consumes almost all their disposable income, whereas the highest quintile spends less than 60% of theirs.

Figure 3. Evolution of the CO_2 tax introduced in WILIAM

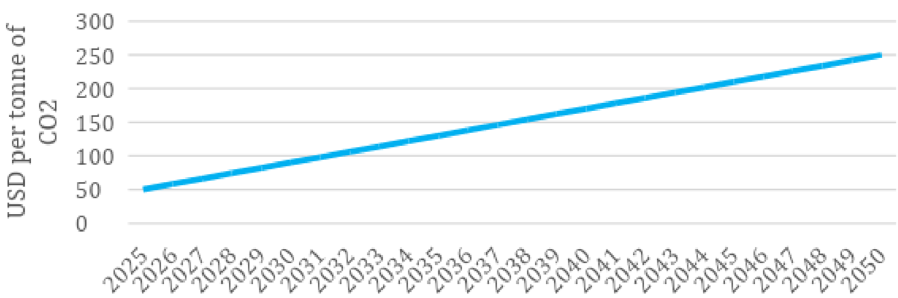
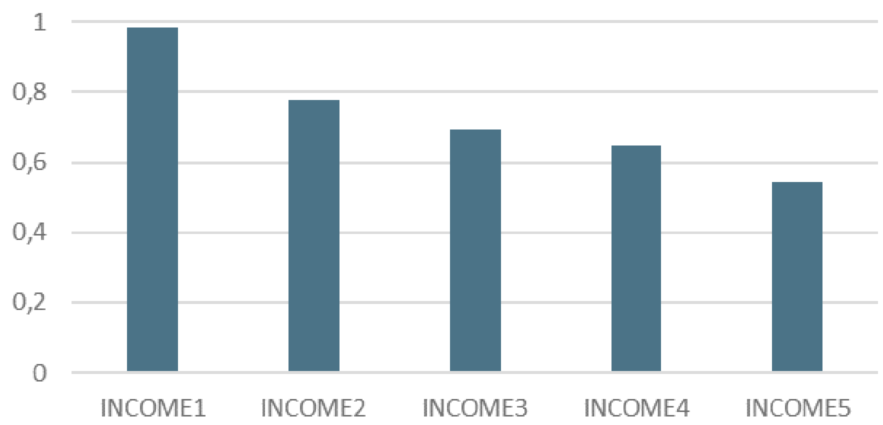


Figure 4 - Average propensity to consume in the EU by income quintile



4. Results

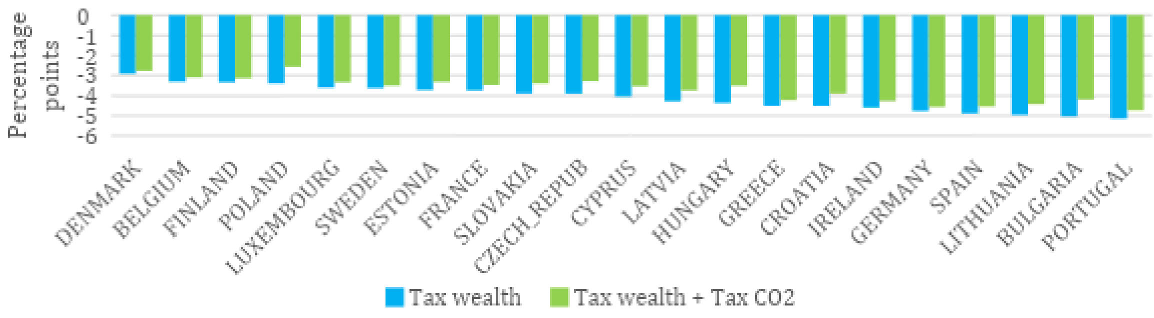
Overall, BI substantially reduces inequality, as measured by the Gini index, moderately improves the economic performance, seen in the GDP level and per capita GDP, and reduces the unemployment rate. The positive social and economic outcomes come at the cost of an increase in CO_2 emissions due to greater consumption in the scenario without a carbon tax. When this tax is introduced, the positive social effect is counterbalanced by changes in energy consumption patterns of households resulting in a decrease of CO_2 emissions in most countries, even with a higher average household disposable income. Therefore, in general, the two scenarios lead to results in the same direction for GDP, Gini, and debt-to-GDP ratio. The main difference between the two scenarios lies in the outcome for cumulative CO_2 emissions.

Figures 5-13 report the results of the two scenarios, in comparison with the baseline scenario, in which the BI policy is not active. Results are presented as an absolute or relative difference with respect to the baseline scenario.

Figure 5 shows that BI effectively reduces income inequality as measured by the Gini index for all 21 European countries in both scenarios, by an amount that varies between 2.5 and 5.1 percentage points (p.p.). To put these numbers in context, such decrease of inequality is in the order of magnitude of that experienced by various European countries in specific years of recent decades[8]. In all countries, the fall in Gini is smaller in the scenario that includes a carbon tax with respect to the scenario only including a wealth tax. This is the expected result since the carbon tax has a regressive impact on distribution, and it also reduces the burden of the wealth tax for the richest. As discussed above, the wealth tax rate is a residual value sufficient to cover the spending with BI. Hence, the scenario **Tax Wealth + Tax CO_2** has a lower wealth tax rate, as part of the BI is financed through the carbon tax.

[8] According to the World Bank database the decrease in the Gini index of Czechia between 1992 and 1993 was of almost 6 p.p. Hungary saw a decrease of almost 5 p.p between 2004 and 2005. France, Cyprus and Luxembourg experienced a decrease of almost 3 p.p. between 2005 and 2006, 2012 and 2013, and 2016 and 2017, respectively ("World Bank Open Data," n.d.).

Figure 5. Change w.r.t. the baseline in the Gini Index (average 2025- 2050)



The economic impact of the BI is reported in Figures 6 and 8. The first shows that the BI increases the per capita GDP growth rate for most countries, delivering a higher level of per capita GDP at the end of the simulations (exceptions are Germany, Lithuania, Sweden, Ireland and Czechia in the scenario with the carbon tax). BI generates an increase in aggregate consumption (see Figure 8) due to the increase in households' disposable income (see Figure 7) and the redistribution of income in favor of lower income households, which, on average, have a greater marginal propensity to consume. Therefore, BI boosts aggregate demand and output, which explains the positive effect of this policy on GDP. This effect is stronger or weaker in the scenario that includes a carbon tax depending on the country.

When comparing both policy scenarios in Figure 7 and 8, it is worth noting that while the average disposable income increases more in the scenario with the carbon tax than the other scenario for all countries. The opposite happens with the average household consumption, which increases more in the scenario **Tax Wealth** (without the carbon tax). this result is expected, since the carbon tax is an indirect tax that disincentivizes consumption of carbon-intensive goods and services. The lower consumption in the scenario **Tax Wealth + Tax CO_2** allows for a decrease in emissions even in the cases in which it delivers a faster GDP growth.

Figure 6. Change w.r.t. baseline of the average real GDP per capita growth rate (2025- 2050)

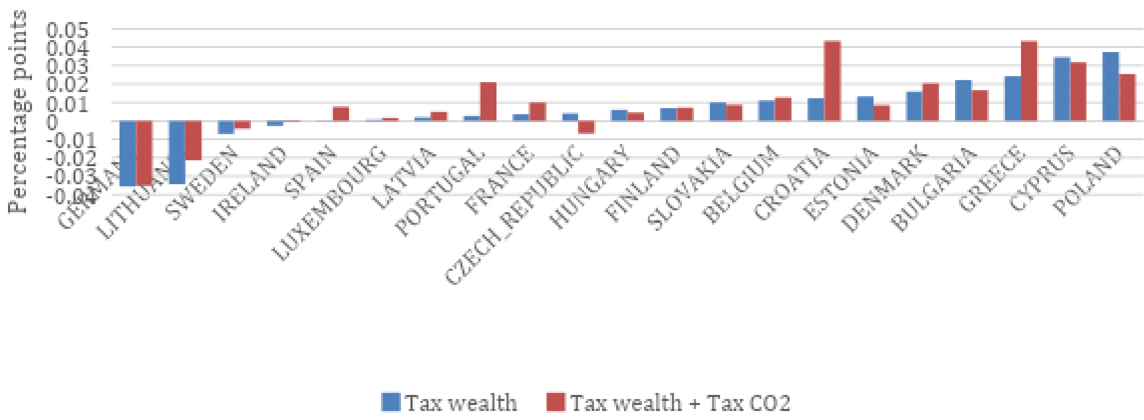
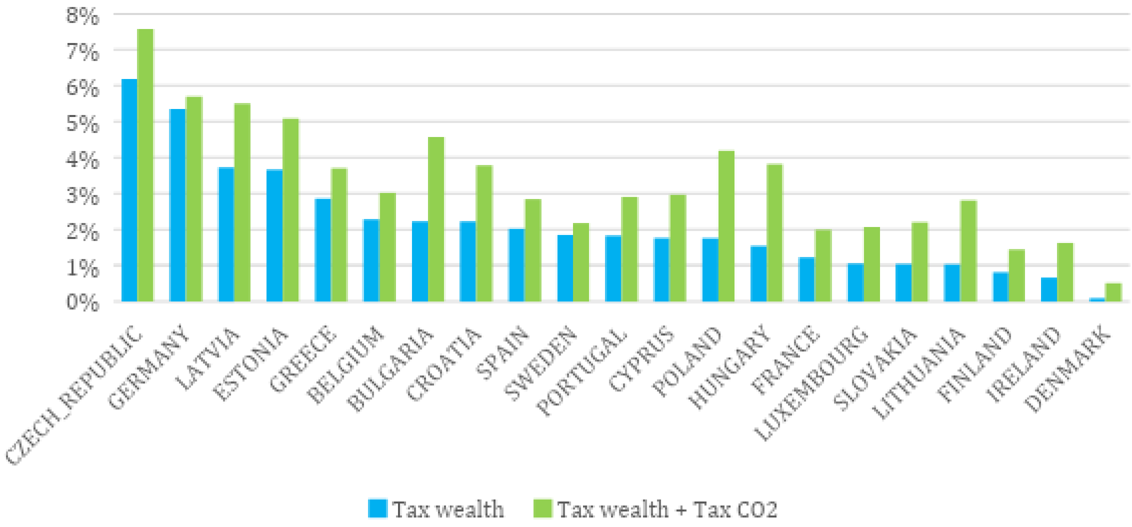


Figure 7. Change w.r.t. baseline of the average disposable income (2025- 2050)

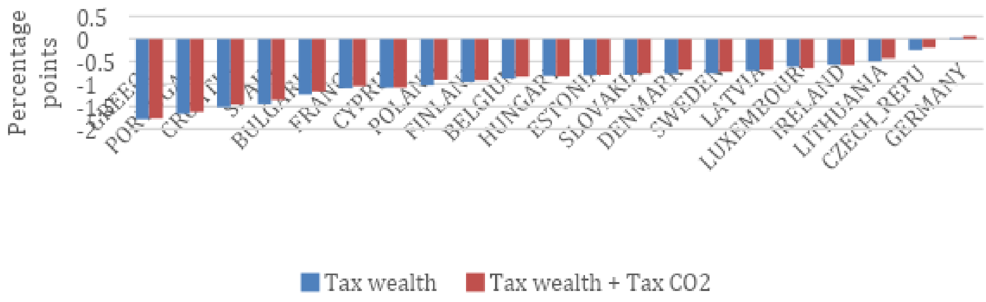


The generalized increase in economic activity is also reflected in the fall in the unemployment rate. The decrease in unemployment, with respect to the baseline scenario is observed for 20 countries and reaches a maximum of 1.7 p.p. Figure 9 shows that the unemployment rate falls in both BI scenarios with respect to the baseline, and this effect is generally stronger in the scenario not including the carbon tax. The only country where the unemployment rate increases in the policy scenarios is Germany. This might be associated with the slower GDP growth and the decrease in households' consumption observed in this country under both scenarios.

Figure 8. Change w.r.t. baseline of the average real households consumption (2025- 2050)

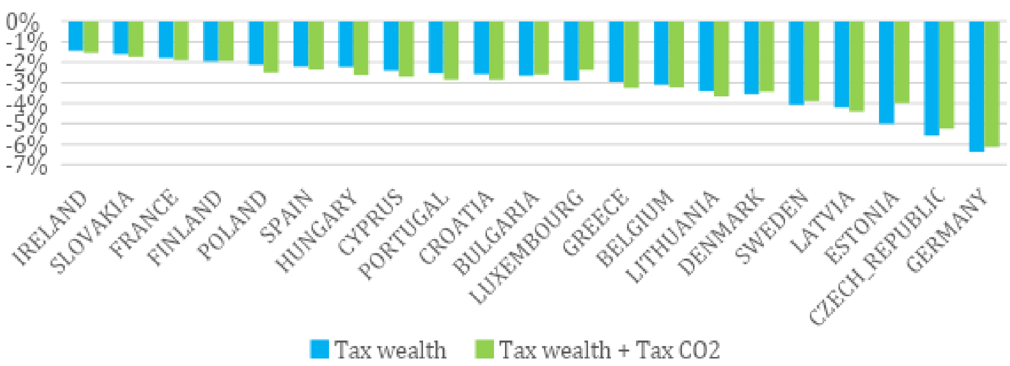
Still concerning the labor market, we should note that the BI does not lead to a voluntary drop in labor supply in our model. In the previous section we discussed how labor supply relates to cash transfers in the empirical literature, and we must stress that the BI benefit proposed in this paper is not sufficient to replace labor income. On the other hand, we observe an increase in the labor force because greater labor demand leads to higher wages and thus to an endogenous increase in the participation rate.

Figure 9. Average unemployment rate (2025- 2050)



In terms of public finance, the combined introduction of the BI and new taxation policies reduces debt-to-GDP ratios for all countries in both scenarios, as seen in Figure 10. For the majority of the countries, the scenario with a faster GDP growth rate is also the one with the largest drop of the debt-to-GDP ratio. A few exceptions show faster growth in the scenario with the carbon tax and that lowest debt-to-GDP ratio is the scenario with only the wealth tax (e.g. Luxembourg), or just the opposite (e.g. Hungary). Nevertheless, the taxation policies offset the increase in public spending and reduce the long run trend of debt-to-GDP in all cases with effects varying from 1 to 6 p.p..

Figure 10. Change w.r.t. baseline in the average Government debt to GDP ratio (2025 - 2050)



The counterpart of the fiscal revenue is the burden for taxpayers. We therefore evaluate the costs of BI to taxpayers in both scenarios. Figure 11 shows the wealth tax rate required to finance the BI policy. One important finding is that the wealth tax rate is stable at a low level, being sufficient to fund the policy. In fact, wealth tax rates exhibit a gradual decline, indicating that the taxation does not erode the wealth stock. The total wealth tax rate, which sums the wealth tax rate of the baseline scenario (for the countries that adopt this policy) and the rate related to the financing of BI, remains between 1% and 4.45%. Several authors advocate for top wealth tax rates around 6-8% as a necessary measure to reduce top-end wealth concentration (Piketty et al., 2013; Piketty, 2014; Saez and Zucman, 2019). Figure 12 shows the composition of the additional tax revenues to finance the BI in the scenario **Tax Wealth + Tax CO_2** . Carbon tax responds for the smaller part of the financing of BI remaining, in general, remaining below 35% of the total increase in the tax revenue.

Figure 11. Average wealth tax rate necessary to finance the BI (2025-2050).

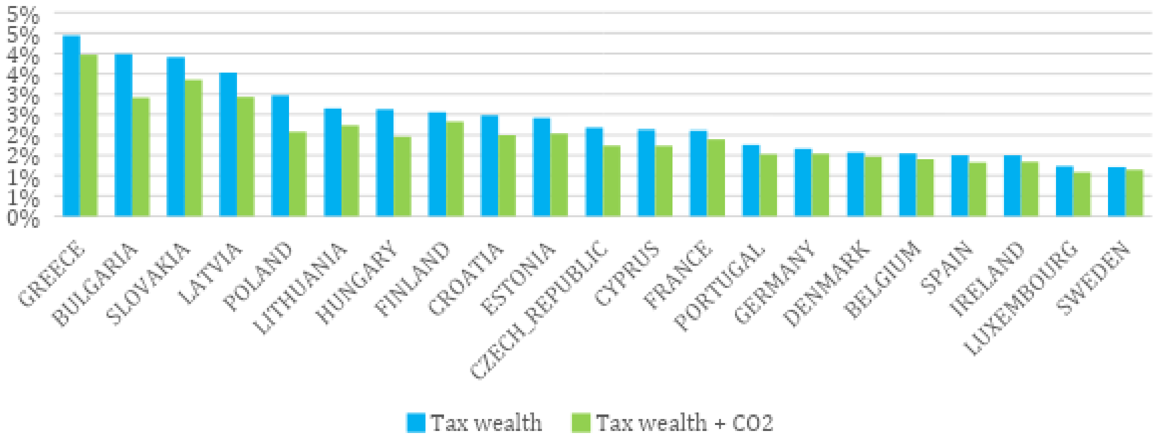
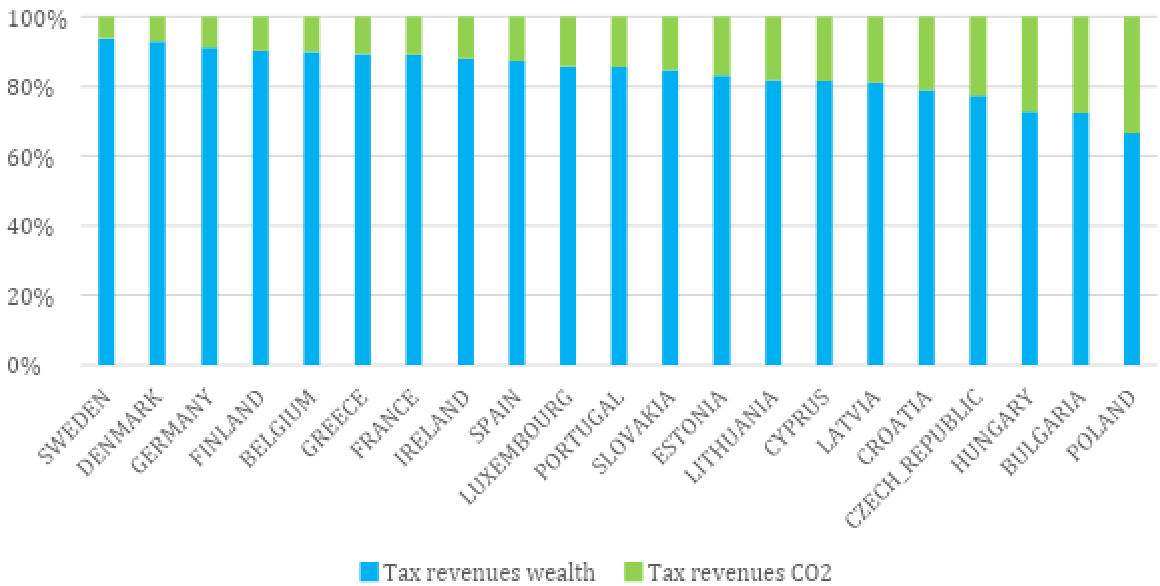


Figure 12. Average composition of tax revenues (2025-2050)



Finally, in the absence of the carbon tax, the BI increases emissions due to its positive effect on consumption. For this reason, the scenario with only the wealth tax generally (except in the cases of Luxembourg) results in an increase in CO_2 emissions of a maximum of 2% on average across the period. Contrary, the scenario with the carbon tax enables to reduce emissions in most cases (with the exceptions of Spain, Greece and Germany). The resulting reduction in emissions are generally not enough, however, for the attainment of climate objectives, indicating the need for a broader and more ambitious policy mix for a fair ecological transition.

Figure 13 – Change w.r.t baseline in cumulative CO_2 emissions (2025-2050)

5. Discussion and conclusion

Inequality is associated with a wide range of negative outcomes (in terms of economic growth, climate policy, life expectancy, educational achievements, crime, unwanted pregnancies or mental health) that affect all members of the society. But tackling inequality is also more difficult in unequal societies since inequality also goes hand in hand with less social cohesion, empathy and solidarity (Pickett and Wilkinson 2010). One possible way out of this vicious circle is the implementation of a BI funded through a wealth tax.

We relied on simulations based on the WILIAM model to verify the results of a BI policy under two alternative funding schemes for 21 European countries in the period 2025 - 2050. We find that the BI is an effective policy to reduce inequality and improve the disposable income of households in the lower income quintiles. For all the countries, the redistributive effect is stronger when BI is entireley funded by a wealth tax. Moreover, BI moderately improves the economic performance, seen in the GDP level and per capita GDP, since it boosts consumption and thus increases final demand. The stronger economic activity is also evident in the labour market's improvement, characterized by a decrease in the unemployment rate subsequent to the implementation of a BI policy. The policies on the side of tax revenue counterbalance the effect of BI on public finance, with a general and unambiguous fall of public debt-to-GDP ratios after the introduction of BI combined with a wealth tax.

Finally, in absence of a carbon tax, the positive social and economic outcomes come at the cost of greater emissions (CO_2), due to increased consumption and GDP level. When the carbon tax is introduced emissions decrease with respect to the baseline scenario, however, in absolute terms, driven by faster growth and consumption, emissions continue to increase from the initial levels. This means that the implemented policy mix is insufficient to reduce emissions, and while a relative decoupling is observed in the results (emissions grow less fast than economic activity), the absolute decoupling is not achieved (emissions decrease as GDP grows). This result points to a direction for future research, where a carbon tax policy would be implemented in a way that achieves reductions compatible with current mitigation objectives, like the net zero target for 2050 in the European Union.

However, bearing in mind the limitations of this exercise, it serves for illustrating what Stiglitz (2015) describes for the recent evolution of the American economy, but in the opposite direction. More equality (thanks to the redistribution of the BI) fuels the economy and promotes growth (making the cake bigger) by strengthening the demand and the public budget, enabling more public expenditure, and reinforcing the virtuous circle of even more equality and faster growth. However, this creates collateral damage in terms of growth in emissions if a carbon tax is not introduced.

Previous theoretical literature has already warned of the potential rebound effect of a BI in cash (Parrique 2019). Some suggestions to avoid this effect are:

- The whole or part of the BI can take the form of direct access to services (healthcare, education, shelter and spaces for activities, food, tools, local public transport and information). This is similar to the idea of the Universal Basic Services (Coote, Kasliwal, and Percy 2019) or to giving the whole or part of the allowance in alternative currency earmarked for specific types of non-harmful consumption.
- Include additional measures that ensure a decrease in total output, through, e.g. decreased productivity or working time reduction. Frey (2019) estimates that in the OECD the ecologically sustainable workweek would be 5 hours compared to the current 40 hours).
- Bundle basic income and maximum income. In Cottey's (2014) proposal the ratio is 1:10, while in Kallis' (2015) is 1:30[9]. This would be interesting for reducing total income (degrowth) and the power of the wealthy to obstruct climate policy. Also, establishing such proportionality would align the interest of the wealthiest with the poorest, and is aligned with Rawls (1971) theory of justice, according to which a fair society would maximize the well-being of the worst-off.
- Decarbonizing the provisions of basic goods, ensuring everybody access to low carbon housing, transport, food and health) by substituting the (more carbon intensive) private provision by efficient public services and/or promoting a new paradigm of consumption, into shared use, communal property, for instance in goods as dwellings (Green and Healy 2022).

[9] Kallis (2015) proposes a basic income of 500€ monthly and a maximum income of 15.000€ monthly for the case of Spain.

Some of these suggestions have been introduced in previous modeling exercises, together with other ideas, to reduce the rebound effect. For instance, Millward-Hopkins and Oswald (2023) contemplate drastic reductions in consumption and income, involving radical changes in consumption habits and much smaller national economies (i.e. degrowth). Emmerling, Andreoni and Tavoni (2023) model a global carbon tax with global redistribution (recycling of the revenues in an equal per capita basis) and account for the regressive impacts of climate change.

These additional measures point to a much more ambitious program than just the implementation of the BI, something that might require, as Cottey (2014) recognizes, a profound change of cultural values and an authority (State or local governments) responsible for ensuring the good use of money and the abolition of the unlimited accumulation and convertibility of money. This would not only entail caps on income and wealth, but also rationing (instead of markets) for those scarce goods that everybody needs in a limited amount (energy, food, shelter or water).

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