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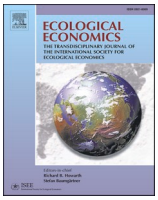

Welfare regimes as enablers of just energy transitions: Revisiting and testing the hypothesis of synergy for Europe

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ABSTRACT

Welfare States are considered key tools to provide just transitions. The hypothesis of synergy states that Social-democratic regimes are in a better position to accomplish them. While synergy has been widely theorised, its empirical verification has remained less studied and provided contradictory results. The weaknesses detected in the state-of-the-art, such as the misalignment of empirical testing and the theoretical drivers of synergy, as well as inconsistencies in the selection of variables and biases imposed by classifications in discrete timings, lead us to define an improved methodological framework. We apply the continuous observation of Ward's hierarchical clustering in squared Euclidean distances under Thorndike's criterium to twenty-three European countries between 2008 and 2016 and reject synergy after detecting that Social-democratic regimes display the best social conditions but the worst environmental performances and that society and the environment are not linked. This outcome motivates us to propose a discussion with a focus on the sustainability of economic growth and the opportunities for sustainable welfare scholarship to settle it.

1. Introduction

Environmental deterioration and widening inequalities are thought to be the two greatest contemporary challenges worldwide (Poschen, 2017). To confront the environmental problem, our societies are initialising energy transitions to low carbon paradigms. While private and public mechanisms are favouring renewable sources, there is a growing consensus on the fact that markets cannot be trusted to perform the transition (Fay et al., 2013), notably in the presence of global public goods (Karlsson-Vinkhuyzen et al., 2012) and asymmetric social effects such as the destruction of jobs in former conventional sectors (without alternatives), the lack of labour mobility in some sociodemographic profiles, skill shortages, gender inequality and regressivity (García-García et al., 2020).

Amid these socio-environmental trade-offs, Welfare States (WS) have been pointed out as a key means to compensate for negative impacts and potentiate positive outcomes, hence contributing to providing just energy transitions.[1] WS are those that at least assume the direct provision of social services, like social security, health, education and housing, regulate private activities to shape the economy and provide cash benefits (Gough, 1979; Corlet Walker et al., 2021). In Western Continental Europe, other features like public-sector entrepreneurship and innovation can also be attached to the WS (Millward, 2011).

In this regard, one issue arises with great relevance: the "hypothesis of synergy". It states that Social-democratic WS in the sense of Esping-Andersen (Esping-Andersen, 1990), i.e., those with high decommodification and low social stratification, are in a better position to perform the transition to Environmental States (ES), therefore establishing an eco-social synergy. Social-democratic WS are identifiable under Esping-Andersen's classification for facilitating a good life to their citizens regardless of their level of market implication and presenting lower differences between the income levels of the most favoured and the least favoured individuals.

The ES, also called Eco States, Green States or Ecological States

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[1] We employ "just energy transitions", in plural, to recognise and include the multiple conceptions of this term in scholar, political and activist dimensions. At least four major approaches can be distinguished based on their perceptions of economic growth and power dynamics: statu quo, managerial, structural reform and transformative (García-García et al., 2020).

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(Bäckstrand and Kronsell, 2015) are those that rely on a significant institutional configuration to manage the environment and its interactions with society so that the social-environmental conjunction is a continuous focus of political activity (Duit et al., 2016) to achieve a sustainable future domestically and globally (Bomberg, 2015). This "significant" institutional configuration involves specific environmental ministries and agencies, environmental legislation and its adjoining regulatory organisms and mechanisms, environmental taxation and dedicated budgets, as well as advisory scientific organisations to orientate actions (Duit et al., 2016; Jakobsson et al., 2018).

Whereas the hypothesis has been remarkably worked theoretically (Dryzek, 2008; Gough, 2016; Gough et al., 2008; Meadowcroft, 2008), its empirical verification remains less studied, even in such fields as Comparative Political Economy (Wood et al., 2020). To our knowledge, only five studies (Fritz and Koch, 2019; Jakobsson et al., 2018; Koch and Fritz, 2014; Otto and Gugushvili, 2020; Zimmermann and Graziano, 2020) have tried to verify it and reached complex contradicting results that deserve more analytical efforts and a deeper reflection.

This paper aims to revisit the hypothesis and widen the scope of its verification, with special attention being given to the energy transition. To accomplish this, we cover the limitations of previous studies. In the next section, we set out the main findings of the literature review that has motivated the present work and their influence on our proposal. We then present the variables selected to test synergy and the solutions that we propose to tackle the weaknesses of indicators in previous works in the third section and our methodology to ensure comparability with previous studies, while avoiding detected procedural weaknesses in the fourth. In the fifth section, we disclose the results and in the sixth, we discuss their implications to derive the main conclusions in the seventh.

2. Literature review and theoretical-empirical alignment

Social and environmental policies can be conflicting (Dryzek, 2008; Koch and Fritz, 2014). First, WS rely on public revenues, which depend either on a politically challenging redistribution or on economic growth. Growth has been widely considered unsustainable, so that welfare policies could be harming the environment despite their social potential (Bailey, 2015; Borgnäs et al., 2015; Büchs and Koch, 2017; Hirvilammi, 2020; Weiss and Cattaneo, 2017). Second, environmental measures tend to be regressive and represent proportionally a heavier burden for less favoured individuals than for the most favoured ones (Arndt et al., 2017; Fischer et al., 2016; Frondel et al., 2015). Third, income distribution propitiated by WS may increase environmentally harmful emissions through the consequent stimulus of a potentially unsustainable consumption derived from increases in disposable income (Gough, 2017). Fourth, considering limited public budgetary capacities, social and environmental measures compete for fiscal funding (Dryzek, 2008; Jakobsson et al., 2018). Fifth, WS and ES differ in their scope: while WS redistribute income and face individually unpredictable but collectively predictable risks, ES redistribute environmental costs and benefits and face collectively unpredictable risks (Dryzek, 2008; Duit et al., 2016).

In contrast, synergy implies that WS serve as a precondition to implementing ES, and sustainability and well-being are interconnected (Ivankina and Latygovskaya, 2015). Special attention has been given to the Nordic countries as accurate representatives of Social-democratic WS (Esping-Andersen, 1990), with apparently positive environmental and energy situations (Kemfert, 2017; World Energy Council, 2020) and supportive public attitudes (Otto and Gugushvili, 2020). According to the hypothesis, the drivers of synergy are:

- *High decommodification*, i.e., the strong likelihood of reaching a satisfactory standard of living and well-being independently of the level of market implication. If people can live a good life regardless of market implication (Gerber and Gerber, 2017), they can be protected from shifts caused by transition policies, such as sectorial phase-offs and reconversions. A WS is an ally to the establishment of an ES, not because of its economic foundation, unlimited growth, which can be unsustainable, but because of this ethical foundation (Eklind Kloo, 2015), which contributes to shifting the justice criterium from subjective preference to human need (Bohnenberger, 2020; Brand-Correa and Steinberger, 2017; Gough, 2017; Koch et al., 2017).
- *A low social stratification.* The reduction of inequalities because of the redistribution of income is a key element also from an environmental viewpoint (Koch, 2013). The resultant low stratification allows the sharing of power, therefore potentiating the procedural dimension of just transitions (Eklind Kloo, 2015), where everyone can consequently participate in social-environmental decision-making in equal conditions.
- *Strong democracy*, which proclaims procedural and restorative justice, so that individuals can participate in equal conditions in the transition and are compensated for any damage to their interests and rights, as recognised by democratic institutions. Strong democracies perform better in environmental terms (Jakobsson et al., 2018; Ramalho et al., 2018; Thombs, 2019).
- *A uniform, standardised and powerful local administration.* The local level in the Nordic countries has been worthy of note since the 19th century. The energy crisis in the 1970s forced the mobilisation of domestic resources to reduce dependency and fuelled a transition to a model of competence with a greater regional power. This model of competence, jointly with the subsequent potentiation of local resources, built the foundations for decentralised and sustainable energy systems based on renewables (Westholm and Beland Lindahl, 2012).
- *A public discourse on ecological modernisation* that pictures a sustainable transition as an opportunity to grow (Büchs and Koch, 2017; Dryzek, 2008; Gough et al., 2008).
- *The parallelism between the implementation of WS and the transition to ES at a political level* (Gough, 2016). Both are rooted in social justice (Jakobsson et al., 2018) and introduced to solve inefficient situations that theoretically markets cannot solve on their own. Likewise, both are responses to long-term social shifts that face notable economic and political limitations (Meadowcroft, 2008). In addition, as WS are functioning structures, environmental measures are provided through them (Koch and Fritz, 2014; Meadowcroft, 2012).
- *The prioritisation of low-intensity services*, notably care (Eklind Kloo, 2015), over other activities with higher resource intensities, contributes to reducing the use of environmentally harmful resources and their overexploitation.
- *Assimilation of environmental measures to social measures*. As climate change and environmental deterioration threaten the livelihood of the planet and the standards of living, environmental policies can be seen as social policies if they face the effects of natural disasters, compensate for the regressivity of transition policies (Bailey, 2015) and protect low-income individuals, who suffer environmental deterioration more harshly (Dryzek, 2008).

According to these drivers, WS can both facilitate and hinder the transition to ES (Table 1).

To our knowledge, just five works have studied the empirical corroboration of synergy, with different methodologies and variables (Table 2). The proper empirical discussion emerges in 2014 (Koch and Fritz, 2014). Koch and Fritz (2014) rely on the canonical classification of WS (Esping-Andersen, 1990) to crosscheck the social and environmental performance of countries in 1995 and 2010. Through a correspondence analysis of centroids, they conclude the independence between welfare and the environment. Those countries with higher social assistance are also the ones with higher Gross Domestic Product (GDP) and ecological footprints. Nevertheless, Sweden and Austria seem to verify the hypothesis. The authors also analyse whether different institutional configurations determine the attitudes of citizens regarding social and environmental policies. By clusters, but focusing on attitudes, Conservative WS show the best environmental results. Accordingly, they reject

Table 1
Fields of synergy and conflict between WS and ES corresponding to theoretical drivers of synergy.

Drivers	Synergy WS-ES	Conflict WS-ES
Decommodification	Ethical foundation for an alternative model. Protection against rearrangements in markets during the transition	Welfare requires continuous economic growth that can be environmentally harmful
Low social stratification	Procedural justice	Regressive environmental policies. Redistribution of income can increase emissions
Strong democracy	Procedural and restorative justice	No detected discordance
Powerful local level	Mobilisation of domestic resources, reduction of dependency and decentralisation	No detected discordance
Public discourse on ecological modernisation	Positive social perception of environmental initiatives	Continuous growth, even if green, can neglect planetary boundaries
Parallelisms WS-ES	Institutional structures and experience	Scopes and risks differ. Competition for public funds
Prioritisation of low-intensity services	Reduction of resource intensity and dematerialisation	The promotion of services is relatively limited, since industry and agriculture are essential to meet needs, demand services directly and generate income to expend indirectly in services. Not all services display a low resource intensity, e.g., transport.
Assimilation of environmental policies to social policies	Adaptation, mitigation, progressivity	Competition for public funds

the hypothesis but cannot completely discard that Social-democratic WS have contributed to the development of ES as the nexus between WS and ES is more complex than expected.

Another work explores public support for environmental and welfare policies as a facilitator of Eco-social States (Jakobsson et al., 2018) and finds no evidence of synergy: Conservative and Liberal WS perform similarly to the Social-democratic ones. As stated by its authors, the weaknesses of focusing on polls are two: attitudes do not reflect real policies nor real welfare, and data come directly from individuals, therefore introducing subjectivity.

More recently, Fritz and Koch have revisited the hypothesis (Fritz and Koch, 2019). Insisting in a correspondence analysis over perceptions, the Social-democratic States combine higher rates of support for climate and welfare policies with poorer environmental performances. Together with Sweden, Conservative WS like Germany and Switzerland arise as supporters of environmental measures.

Another work devoted to mapping Eco-welfare States through hierarchical clustering (Zimmermann and Graziano, 2020) observes that the Nordic States perform above average both in social and environmental terms, therefore considering the hypothesis verified. Nonetheless, since the characterisation of countries is posterior to the clustering, the authors warn that this result is descriptive and limited. Likewise, the mechanisms of synergy remain unknown.

A final work relies on polls and descriptive variables to perform a multinomial regression model (Otto and Gugushvili, 2020). It coincides with previous analyses in pointing to the Nordic States as places of concurrence of elevate support for climate and social policies.

From these works, we extract four conclusions:

First, they try to cluster countries to test the correspondence between social and environmental dimensions.

Second, analyses mostly focus on the study of individual attitudes. Objective indicators, i.e., those that aspire to measure real welfare and environmental performances instead of attitudes or opinions, have only been used in two works (Koch and Fritz, 2014; Zimmermann and Graziano, 2020).

Third, regarding WS, the classification proposed by Esping-Andersen, or a near notion of it, lies beneath most of the studies and overlaps with other classifications about the relationship between contemporary capitalisms and the environment (Cahen-Fourot, 2020; Wood et al., 2020).

Four, works propose diverse variables (Table 2), notably attached to GDP, but avoid a discussion about such a selection and its implications. Previous papers perceive the drivers of synergy as merely contextualising ideas, instead of precise elements that should be aligned with their methodological choices and select their own variables to test it. These works do not explain the reasons behind such differing choices nor interpret their results conditioned to them. Since those drivers were previously determined in this section, we can establish a correspondence with the variables or set of variables[2] proposed to study it (Table 2).

Table 2 reveals that previous studies do not cover all the drivers of synergy, but analyse variables that are not linked with them. Such drivers as the local administration, the parallelisms WS-ES and the assimilation of environmental and social policies have never been used to define variables. Such variables as GDP, attitudes and public opinions, sociodemographic variables, union density, population and poverty do not correspond to a driver.

The drivers can be tested through objective indicators, without relying on opinion polls, which present the abovementioned limitations (Jakobsson et al., 2018). To be coherent, we exclude all subjective variables. Nonetheless, we have detected one exception: the inclination to pay for environmental protection relates to ecological modernisation: if citizens perceive environmental protection and modernisation as mutually reinforcing, they may accept higher environmental taxes.

This disarrangement is probably caused by the clustering rationale proposed in the cited contributions, which approach synergy as a correspondence between social and environmental dimensions, given the listed variables (Table 2). Yet, theoretical developments follow a causal chain based on the traits of WS that facilitate ES. If we follow the latter, the causes of synergy originate in the social dimension under a WS. These would deliver social results that concurrently serve as preconditions, i.e., causes, of the ES. These secondary causes would deliver environmental results. Coherently, we can identify variables related to causes and results, as well as intermediate variables (Fig. 1). The latter represent a nexus between dimensions and constitute an approximation to the mechanisms of the synergy, because causal and result variables merely contextualise the initial and final socio-environmental status. By identifying intermediate variables, we could further the knowledge of such mechanisms, which remain unclear, as concluded by Fritz and Koch (2019) and Zimmermann and Graziano (2020).

This review has determined the drivers of synergy, the variables selected to verify it in empirical works and the disarrangement between the two visions, hence providing an initial screening of variables (Table 2).

3. Solutions to the shortcomings of indicators and previous omissions

Regarding the remaining variables (Fig. 1 A), we can still refine them by identifying additional shortcomings:

[2] To simplify, we call "set of variables" to collections of variables related to opinion polls, given their extension and lesser relevance to this work, as argued in the following paragraphs.

Table 2
Classification of variables employed in previous empirical studies and linked drivers.

Variable	Reference	Dimension		Driver							Unrelated to the drivers	
		Social	Environmental	Decommodification	Stratification	Democracy	Local admin.	Eco. modernisation	Parallelisms	Services	Assimilation	Contextualising	Unlinked
Welfare effort	Koch and Fritz (2014)	X		X									
(Long-term) Unemployment rate	Zimmermann and Graziano (2020)	X		X									
Gini index	Koch and Fritz (2014), Zimmermann and Graziano (2020)	X			X								
Protection of employees	Zimmermann and Graziano (2020)	X			X	X							
Inclination to pay for environmental protection	Jakobsson et al. (2018)		X					X					
Ratio services/ industry	Zimmermann and Graziano (2020)		X							X			
Ecological footprint	Koch and Fritz (2014)		X									X	
CO2 or GHG emissions	Koch and Fritz (2014), Otto and Gugushvili (2020), Jakobsson et al. (2018)		X									X	
Renewability of energy mix	Koch and Fritz (2014), Zimmermann and Graziano (2020)		X									X	
Share of green taxes over GDP	Koch and Fritz (2014)		X									X	
EPI	Zimmermann and Graziano (2020)		X									X	
DMC	Zimmermann and Graziano (2020)		X									X	
Strictness of environmental policy	Zimmermann and Graziano (2020)		X									X	
Seats in the national Parliament obtained by green parties	Zimmermann and Graziano (2020)		X									X	
GDP and GDP PPP	Jakobsson et al. (2018), Zimmermann and Graziano (2020), Koch and Fritz (2014), Otto and Gugushvili (2020)	X											X
Acceptance of statements about state intervention and voluntary frugality	Koch and Fritz (2014)	X											X
		X											X

(*continued on next page*)

Table 2 (*continued*)

Variable	Reference	Dimension		Driver							Unrelated to the drivers	
		Social	Environmental	Decommodification	Stratification	Democracy	Local admin.	Eco. modernisation	Parallelisms	Services	Assimilation	Contextualising	Unlinked
Attitudes regarding income distribution	Jakobsson et al. (2018), Otto and Gugushvili (2020)												X
Sociodemographic variables	Jakobsson et al. (2018), Otto and Gugushvili (2020)	X											X
Public opinions from the European Social Survey (ESS)	Fritz and Koch (2019), Otto and Gugushvili (2020)	X											X
Union density	Zimmermann and Graziano (2020)	X											X
Population	Jakobsson et al. (2018)	X											X
Poverty rate	Otto and Gugushvili (2020)	X											X

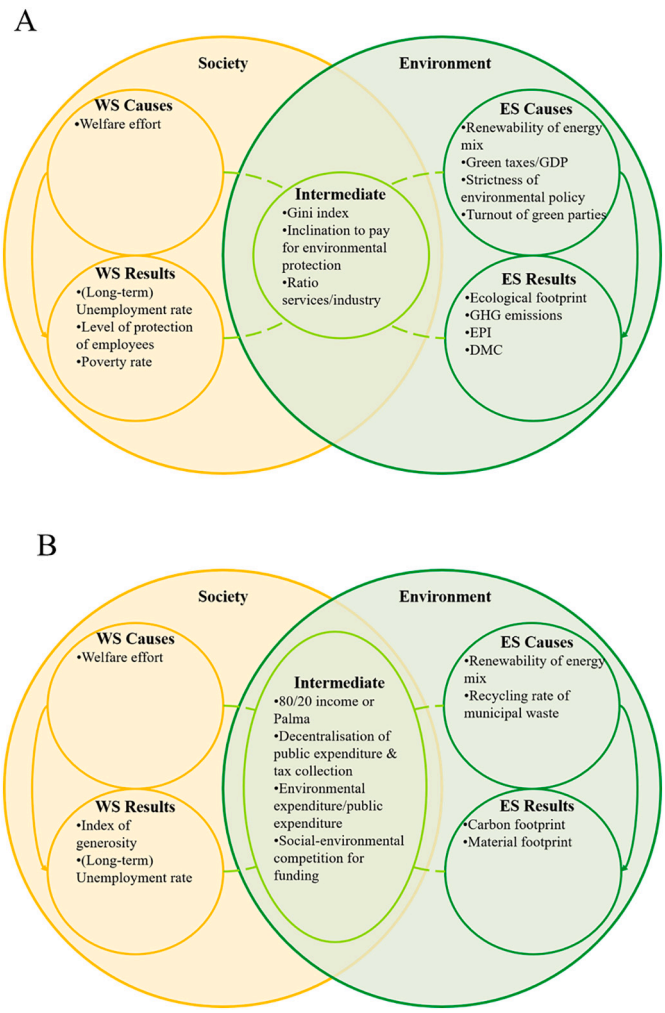

Fig. 1. Classification of the variables proposed in the literature, excluding variables unlinked to drivers (A) compared with this proposal (B) under the theoretical causal rationale. Source: Own elaboration.

First, provided that decommodification is a driver, referencing magnitudes to GDP is contradictory. As the dimension of the market itself, its inclusion is against the possibility of individuals to live a good life regardless of their implication therein. Furthermore, there is a vast discussion about the shortcomings of GDP as a measurement of notions other than economic production (van den Bergh, 2009; Kalimeris et al., 2020) and the barriers to alternative calculations (Hoff et al., 2020). The GDP is strictly the monetary measurement of final goods and services produced within a country. Thus, it does not reflect real welfare. We suggest focusing on the generosity index, which provides a measure of the institutional provisions of national welfare policies that is systematically comparable between countries in long periods (Scruggs, 2014; Scruggs et al., 2017), and maintain the welfare effort, i.e., the social spending as a percentage of the GDP, as a mere indicator of public services. Welfare effort, which can be also problematic given that it is a ratio over the GDP, is used here as a supporting measure due to the restricted availability of the generosity index in recent periods (See Section 4). For its part, the share of green taxes over GDP as a proxy for environmental regulation is avoidable, as the energy renewability already approaches strictness and the prerequisite of regulation. Equally, it serves to avoid the subjectivity introduced by the inclination to pay for environmental protection connected with ecological modernisation. As the deployment of renewables combines environmental concerns and technology, it is also a proxy for such a driver.

Second, the Gini index is applied as an indicator of stratification

(Koch and Fritz, 2014; Zimmermann and Graziano, 2020), but it does not offer greater information regarding income strata, solely about the overall situation of inequality. Conversely, income ratios, like the 80/20 share or the Palma ratio, get closer to this notion as they picture the situation of the tails of the income distribution, i.e., of the most favoured and the least favoured individuals, where the relevant dynamics of inequality take place (Palma, 2014). Besides, we have identified the level of protection of workers as an additional variable that also affects democracy in the same sense that stratification operates: if workers, who are among the most affected stakeholders of the transition (Gambhir et al., 2018), are protected, they can participate and shape decision-making in equal conditions. To simplify, given this coincidence, we consider that income ratios approach cohesion and justice in the sense that the driver of strong democracy suggests (Jakobsson et al., 2018; Ramalho et al., 2018; Thombs, 2019).

Third, the inclusion of the ratio services/industry is misaligned with its corresponding driver, which requires the proliferation of low-intensity services promoted by WS. Conversely, services in general, both high-intensity and low-intensity as inputted in the ratio, include such intensive activities as transportation and housing and their indirect activities, like the deployment of infrastructures (Fix, 2019). Assuming that public provisions are of low environmental intensity is inaccurate. Public services and investments are responsible for notable emissions and employments of resources in current WS because of the high intensity that some of their activities require (Ottelin et al., 2018). We suggest sticking to indicators of emissions and materials, since this driver focuses on the decarbonisation and dematerialisation of the economy, including the direct, indirect and induced impacts of public activities.

Fourth, the strictness of the environmental policy is difficult to quantify accurately and subject to four challenges (Botta and Koźluk, 2014). First, the multidimensionality of environmental regulations, policy instruments and administrative levels. Second, the difficulty of sampling to quantify it through perceptions in surveys, similarly to the issue of subjectivity in the tests of synergy. Third, the identification of the effects of these measures in a sea of policies and institutional configurations. Fourth, the limited availability of comparable data.

Botta and Koźluk (2014) discussed the different methods to tackle these challenges and subsequently created a composed indicator of Environmental Policy Stringency (EPS), which was used afterwards by Zimmermann and Graziano (2020) to test synergy. The EPS evaluates the presence of taxes over greenhouse gases, trading schemes, feed-in tariffs, deposit-refund schemes, standards of emissions and public subsidies for research about renewables. Despite its contribution to this discussion, the EPS is subject to limitations, as recognised by its creators. It is sensitive to the weight of its mentioned integrating factors, simplifies multidimensionality and has a narrow focus on the energy sector and few political instruments. Moreover, it is not available for all countries, not even in the OECD, as the large time-series required for observation. Furthermore, it does not measure the resultant environmental outcomes, solely the effect of the limited policies that it observes. Consequently, we support again the inclusion of indicators of emissions and materials, as direct evidence of such environmental outcomes.

The seats in the national Parliament obtained by green parties, also proposed by Zimmermann and Graziano (2020) in this sense, is scarcely meaningful for two reasons. Firstly, all political parties have an environmental ideology and considering that of the greens to be the most representative in the final political outcome is a limited assumption. Green parties are of recent creation (Carter, 2015). In general, Social Democracies set up the WS under study. Also, other parties share positions with them, as proven by the government alliances in many countries, e.g., Sweden. Secondly, a driver of synergy lies in the local administration (Westholm and Beland Lindahl, 2012), so national Parliaments provide little information.

Fifth, the use of the Environmental Performance Index (EPI) under the time series format required by analyses is not recommended. The goal of the EPI is to provide a national score and a country ranking about the establishment of environmental targets through the combination of environmental performance indicators. The score is dependent on the number, typology and updating of its component indicators, which have ranged from 25 in 2008 to 20 in 2016 to 32 in 2020, for instance. These methodological rearrangements impede the assembly of data to generate time series and panels (Yale Center for Environmental Law and Policy, 2020).

Sixth, the Domestic Material Consumption (DMC) and Greenhouse Gases (GHG) emissions pale in comparison with the material (Wiedmann et al., 2015) and carbon footprints (Hertwich and Peters, 2009), respectively, especially recommended by Ecological Economics and degrowth literature (Weiss and Cattaneo, 2017). The DMC measures the raw materials directly used (under apparent consumption, not final consumption) per year within a country and is subject to the omission of upstream international transactions of raw materials and products. For its part, the GHG focuses on the aggregation of emissions by emitting economic activities in a country. The advantage of footprints is the detection of relevant material requirements (Zhang et al., 2017) and CO2 residues of international trade (Xu et al., 2020). Hence, picturing the environmental situation also from the point of view of consumption and capturing the behaviour of countries beyond their borders. ES reduce their footprints by increasing energy renewability, but also by closing the material cycles through recycling, hitherto omitted despite this relevance. Thus, we suggest the introduction of recycling rates of municipal waste as an approximation, given that long series of recycling rates for key materials are unavailable.

Finally, we must cover the drivers not studied in previous analyses:

To measure the local administration, we propose the decentralisation of public expenditure, i.e., the share of public local expenditure over the total administrative expenditure, and its analogue: the decentralisation of tax collection. These variables reflect relatively the capacity of local administrations to collect their financial resources and spend them in their political programmes, thus indicating their proportional capacities against the other government levels.

To introduce the parallelisms WS-ES, we suggest the share of public environmental spending over total public expenditure, provided that environmental expenditure is the most representative environmental measure that flows through WS. In addition, we have designed a categorical binary variable to measure potential competition for funding. It is equal to 1 when social and environmental expenditure evolves interannually in a contrary sense, or if the increase (decrease) in social spending is higher (lower) than the increase (decrease) in environmental spending.

Regarding the assimilation of environmental and social policies, the two previous variables also match this driver. On the one hand, public environmental spending can be perceived as social spending in ES, as indicated in Section 2. On the other hand, the assimilation of environmental and social policies should prevent fiscal competition, potentially detected by the proposed binary variable.

Consequently, our proposal is shaped in Fig. 1 B.

Comparing former proposals (Fig. 1 A) and ours (Fig. 1 B), we deepen the consideration of intermediate variables, while simplifying the characterisation of the status of social and environmental dimensions through fewer but more complete indicators.

4. Data and methodology

Comparability is mandatory in determining the sample and the methodology to explore how results vary in comparison with former works. Considering the sample, we adhere to Koch and Fritz (2014) and Zimmermann and Graziano (2020), with some exceptions. We introduce Iceland, omitted from both analyses despite its importance for welfare, energy and environmental studies and exclude the Asian countries because of their institutional disparity with the rest of the sample.

In contrast to previous research and to enhance robustness, we

suggest the continuous observation of clusters to avoid the consideration of precise years that could limit understanding, e.g., 1995 and 2010 (Koch and Fritz, 2014), 1993, 2000 and 2010 (Jakobsson et al., 2018), or 2016 (Fritz and Koch, 2019; Otto and Gugushvili, 2020; Zimmermann and Graziano, 2020).

The data sources used are shown in Table 3.

Because of the unavailability of comparable data, some of the variables and countries are problematic:

- The generosity index is unavailable from 2010 and for Eastern European countries, Estonia and Iceland.
- The Palma ratio presents a discontinued calculation.
- In Australia and the US, local public budgets are aggregated under the general government.
- In Canada and New Zealand, there are no comparable data about expenditure, and the US registers "zero" environmental spending, therefore constituting an outlier.
- The material footprint is unavailable for the Czech Republic.

To deal with these limitations, we propose:

- Using the welfare effort as a proxy for public services and subsequently, the generosity index in the available cases, with the additional possibility of observing potential differences between the two indicators.
- Excluding the Palma ratio, as we still have the 80/20 share of income as an indicator of social stratification.
- Sticking to European countries. Therefore, we substitute the data source of the 80/20 income ratio for EUROSTAT to obtain a longer series (EUROSTAT, 2020).
- Excluding the material footprint and using the carbon footprint instead, as both are highly correlated (+0.9) (Supplementary Materials).

Regarding the methodology, we stick to the techniques used in the range of objective indicators. Koch and Fritz (2014) performed a correspondence analysis, while Zimmermann and Graziano (2020) carried out a hierarchical clustering. We prefer the latter, as we are not using as many categorical variables as Koch and Fritz (2014). We follow Ward's Method in squared Euclidean distances because of its wide acceptance. Hierarchical clustering avoids assumptions about the final number of clusters, unlike many previous works that aligned clusters with the Esping-Andersen typology. Conversely, we apply Thorndike's criterium to find the optimal formation of clusters. The whole process is as follows:

First, given that we are dealing with a clustering algorithm, identifying correlated variables is crucial. Clustering aims at determining internally homogenous groups of countries based on the variables that characterise their social-environmental situations and mechanisms. Correlated variables that belong to the same dimension (social or environmental) are therefore duplicated characterisations that unnecessarily enlarge the effort to execute the algorithm and could induce severe errors due to the overlapping of redundant information.

Based on high correlations (Supplementary Materials), we can omit the long-term unemployment rate because of a high correlation with the indicator of stratification (+0.6), the unemployment rate because of a very high correlation with the welfare effort (+0.9), and the renewability of the national energy mix and the recycling rates due to their very high correlations with the carbon footprint (−1.0 and − 0.9, respectively).

Also, the correlation has provided two supplementary results. Local public expenditure and tax collection are inversely correlated with social stratification. Such a correlation could be spurious, as the Nordics are the sole countries that combine both circumstances, because of this factor or another. The welfare effort and social stratification are inversely correlated with the carbon footprint. As the welfare effort is referenced to the GDP, its reduction, with the subsequent increase in the coefficient, diminishes carbon emissions. The negative correlation between stratification and the footprint suggests that the more equal states are also the most emitting countries. Again, the Nordic countries, the most equal and emitting countries, take the calculation to the extreme.

Second, we execute the clustering algorithm with the remaining variables standardised in z-scores, as they present different units. As the sample only overlaps between 2008 and 2016 and the availability of the generosity index is restricted, we propose an analysis in two stages. Initially, we cluster the total sample without the generosity index to obtain an overview from 2008 to 2016. Afterwards, we repeat the clustering for those countries for which the generosity index is calculated from 2008 to 2010. Otherwise, we would only be able to have a small sample of Western European countries between 2008 and 2010, insufficient for our purpose and biased because of the crisis. This focus allows us to test the hypothesis in opposing conditions, through crisis and recovery. As a result, we obtain the annual dendrograms, a representation of different possibilities of aggrupation at different distances between groups.

In a third step, it is necessary to determine the precise clusters among the panoply of combinations in the dendrograms. Usually, the user does this determination subjectively. In this analysis, however, we are looking for the optimal number of clusters, as reflected by data, to reduce subjectivity and potentially obtain greater information about the functioning of social-environmental clusters and synergy. Following the rationale of the algorithm, optimality is determined here through Thorndike's criterium, which considers that the number of clusters that allows the greatest reduction of distances between groups is optimal.

Once the annual number of clusters and compositions are known, we have perceived the need to present them in a compact and consolidated way for all the considered years to infer further insights. To satisfy this need, we have built a concurrence matrix (C), which gathers the information provided by all the corresponding dendrograms. It shows the percentage of runs of the clustering algorithm in which countries, two by two (ij), appear linked along the period (t) for which clustering is successful[3] (n), i.e., the probability of finding that two countries belong to the same optimal cluster in our sample. As the comparison is established between countries, two by two, C is a symmetric matrix: the probability of the concurrence between Austria and Great Britain is the same that

Table 3
Variables and data sources.

Variables	Data sources	References
Welfare effort	OECD	(OECD, 2020a)
Generosity index	CWED 2	(Scruggs, 2014; Scruggs et al., 2017)
Long-term unemployment rate	OECD	(OECD, 2020b)
Unemployment rate	OECD	(OECD, 2020c)
80/20 income share	OECD,	(EUROSTAT, 2020; OECD,
Palma ratio	EUROSTAT	2020d)
Local expenditures	OECD	(OECD, 2020e)
Local revenues		
Environmental expenditure	OECD	(OECD, 2020f)
Potential competition for funding	OECD	(OECD, 2020e, OECD, 2020a, OECD, 2020f)
Renewability of the national energy mix	OECD	(OECD, 2020g)
Recycling rates of municipal waste	EUROSTAT	(EUROSTAT, 2021)
Carbon footprint	Eora MRIO	(Lenzen et al., 2013; Moran et al., 2020)
Material footprint	SDGs Database, OECD	(OECD, 2020h; UN Stats Open SDG Data Hub, 2018)

[3] Because of data availability, all countries provide successful clustering along the considered sample ($n = 9$), except for Iceland, whose data only overlaps between 2013 and 2016 ($n = 4$).

between Great Britain and Austria. In mathematical notation:

$$i = AT, BE, CZ, \ldots, CH, GB$$

$$j = AT, BE, CZ, \ldots, CH, GB$$

$$t = 2008, 2009, 2010, \ldots, 2015, 2016$$

$$c_{ijt} = \begin{cases} 1 \text{ if } i \text{ and } j \text{ belong to the same cluster in } t \\ 0 \text{ if } i \text{ and } j \text{ do not belong to the same cluster in } t \end{cases}$$

$$n_t = \begin{cases} 1 \text{ if successful clustering in } t \\ 0 \text{ if unsuccesful clustering in } t \end{cases}$$

$$C = \begin{bmatrix} \frac{\sum_{t=2008}^{t=2016} c_{AT,AT,t}}{\sum_{t=2008}^{t=2016} n_t} \bullet 100 = 100\% & \cdots & \frac{\sum_{t=2008}^{t=2016} c_{AT,GB,t}}{\sum_{t=2008}^{t=2016} n_t} \bullet 100 \\ \vdots & \ddots & \vdots \\ \frac{\sum_{t=2008}^{t=2016} c_{GB,AT,t}}{\sum_{t=2008}^{t=2016} n_t} \bullet 100 & \cdots & \frac{\sum_{t=2008}^{t=2016} c_{GB,GB,t}}{\sum_{t=2008}^{t=2016} n_t} \bullet 100 = 100\% \end{bmatrix}$$

5. Results

Concurrences prove that clusters are not stable, therefore reinforcing the need for dynamic observation to enhance robustness. The number of optimal clusters increased during the crisis and stabilised afterwards (Fig. 2). After the shock, the cyclical variables (welfare effort, unemployment rates and potential competition for funding) immediately reacted (Supplementary Materials) and generated increasing distances between countries, i.e., fewer clusters and lower concurrence scores corresponding to differential evolutions during the crisis.

To illustrate the instability of concurrences, we present the dendrograms of two selected moments: 2009 and 2013 (Fig. 3). Fig. 3 A shows the sharpest variation of concurrences due to the crisis, which manifests as fewer countries per cluster (12). Fig. 3 B displays a situation of stabilisation after the shock, with larger clusters (6).

After transferring this information provided by the annual dendrograms into the concurrence matrix, it results as follows in stage one (Table 4).

Regarding stable concurrences, the Nordic countries are the most exclusive. Denmark, Finland and Sweden only generate liaisons with each other. In contrast, Norway is the least selective. This extreme exclusivity implies that Sweden, Denmark and Finland are sufficiently far from other countries (including Norway and Iceland) but close to each other, despite shocks.

Conversely, there are very unspecific countries, such as Austria, Estonia and the Netherlands, which establish links with a diversity of countries.

We have elaborated the set of persistent concurrences and their profiles according to the average concurrence values for each variable since the described methodology minimises internal mean differences inside the concurrences. As synergy implies a comparative, we have applied conditional formatting based on the distance to the mean (yellow for average, greener for above average and redder for below average in positive traits, like the welfare effort, and on the contrary sense in negative traits, like the footprints) in order to observe how they compare at a glance (Table 5).

We derive the following insights:

First, contrary to previous research, there is not such a compact group as “the Nordics”, but two well-differentiated groups: Denmark, Finland and Sweden on the one hand and Iceland and Norway on the other. The latter form a concurrence with Switzerland.

Second, concurrences do not follow the Esping-Andersen typology or its adapted versions (Koch and Fritz, 2014), e.g., the mentioned case of Switzerland (Conservative) with Norway and Iceland (Social-democratic), Belgium (Social-democratic) and France (Conservative), Portugal (Mediterranean) and Italy (Conservative), and Germany (Conservative) with Poland and Hungary (Eastern). This lack of alignment implies that the environmental dimension is unrelated to the typologies of WS. The classifications of WS are exclusively related to the social dimension and do not match the obtained eco-social typologies and the underlying performances of the environmental dimension or the behaviour of intermediate variables. Table 5 suggests that there is not an unambiguous approach, but diverse profiles that support the use of these eco-social concurrences instead of the former categorical WS classifications.

Third, the Nordics are socially paradigmatic, but the worst positioned in environmental terms: despite their above-average share of renewable energy (29.23% and 50.08%), they generate the greatest carbon (13.10 and 18.64) and material footprints (33.14) through average recycling rates (42.98% and 39.52%). Denmark, Finland and Sweden display the most remarkable local administration (local spending represents 50% of total spending), the highest level of potential fiscal competition for funding (89% of the years) and the lowest environmental spending (0.72%). Austria and the Netherlands, considered Social-democratic according to an updated version of Esping-Andersen's classification (Koch and Fritz, 2014) although Conservative in the original (Esping-Andersen, 1990), constitute individual cases but present an analogous behaviour, except for an average fiscal competition (78%) and a modest local administration, notably in Austria (14.73%). Nonetheless, the Netherlands does so through a welfare effort (17.62%) and energy renewability (4.47%) notably below the average, but with the greatest environmental expenditure (3.29%) and the second biggest recycling rate (50.13%). Belgium and France are responsible for the greatest welfare effort (29.90%). Yet they reach an average social performance and a better environmental profile. France is the main country responsible for this profile and behaves slightly better, even if Belgium has moderately lower unemployment rates (7.92%) and stratifications (3.89). They also rely on a local administration with below-average importance (16.72%). We conclude that the Social-democratic regimes present the best social situations and the worst environmental results.

Fourth, the concurrence of the Czech Republic, Slovakia and Slovenia introduces an interesting profile. They show poor social performances, except for one of the lowest stratifications (3.54). Likewise, they register average renewability (10.57%) and the lowest recycling rate (22.91%) with one of the lowest carbon footprints (10.97) and one of the highest material footprints (32.36). The country responsible for this behaviour is Slovakia, an outlier regarding the disarray of footprints.

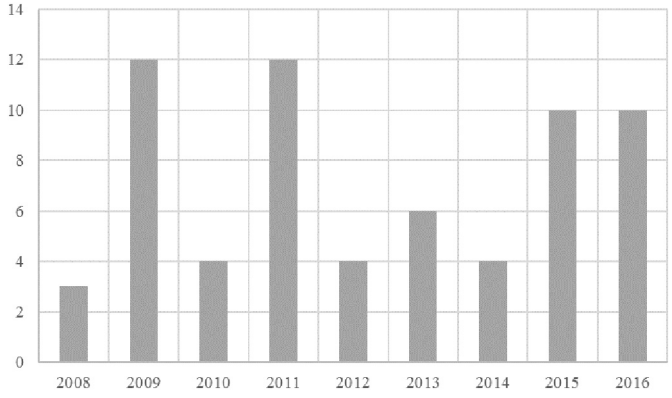

Fig. 2. Optimal number of clusters by year under Thorndike's criterium. Source: Own elaboration.

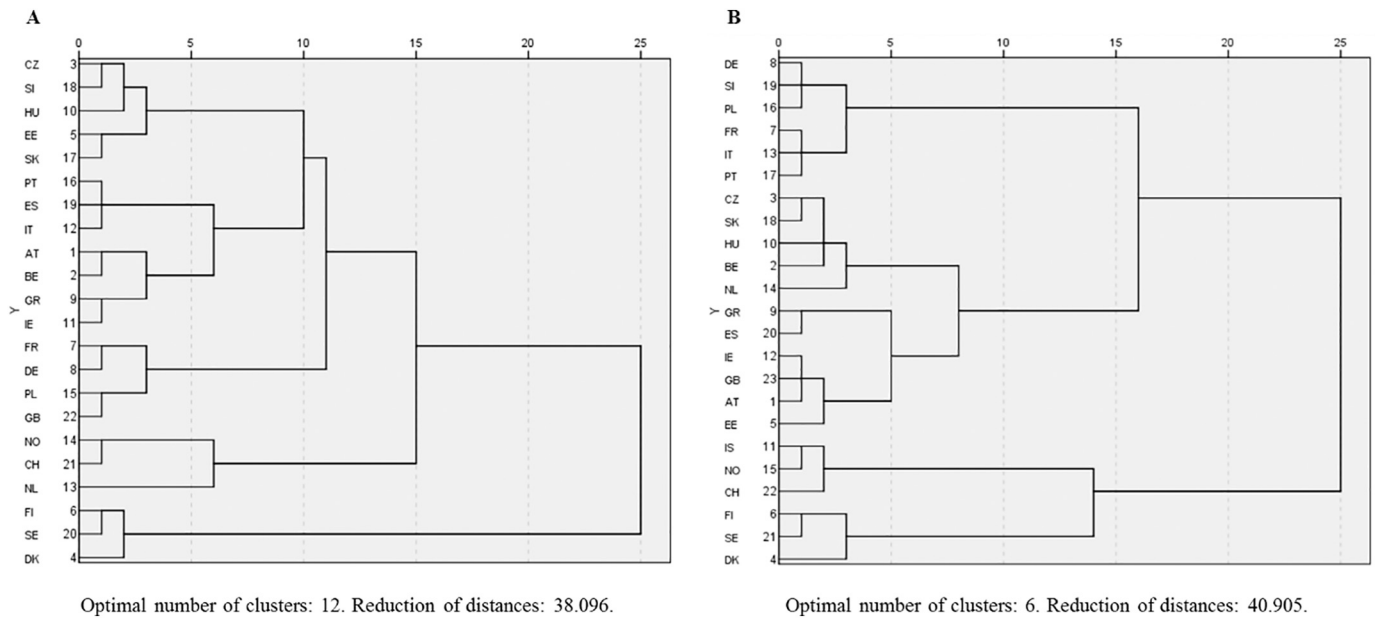

Fig. 3. Annual dendrograms in the first calculation stage in 2009 (Panel A) and 2013 (Panel B). Source: Own elaboration.

Fifth, the South shows the worst social performances despite an above-average welfare effort. As happened with the Nordics, there is not a single South, but two differentiated groups. While Greece and Spain display an average environmental performance, Italy and Portugal exceed, regardless of slightly above-average renewability (18.61%) and a below-average recycling rate (30.46%). In contrast, Greece-Spain registers the lowest local relevance (9.24%), while in Italy-Portugal it is average. As happened with the French-Belgium duo, high welfare efforts (24.84% in Greece-Spain and 25.86% in Italy-Portugal) appear with low social performances.

Regarding the last individual case, Estonia combines one of the poorest social performances, closely following Greece-Spain, and average environmental performance with well below-average renewability and recycling rates.

Sixth, the Liberal regimes from Ireland and the United Kingdom combine average and slightly below-average social performances, significant low renewability (5.69%), average recycling, but better footprints, notably regarding materials (23.66). They also register the second greatest competition for funding (83%).

Finally, the unexpected Conservative-Eastern concurrence of Germany, Poland and Hungary is the average social performer, but displays the second-lowest carbon footprint (9.76) and the lowest material footprint (17.11). The East is not isolated and approaches the Conservative regimes.

The inclusion of the generosity index (not correlated with the welfare effort) has caused few variations for the countries for which it is calculated from 2008 to 2010 ceteris paribus (Table 6): some Social-democratic regimes increase the concurrence with Conservatives and Liberals (Austria with France and Ireland, Belgium with Ireland, the Netherlands and Switzerland), Conservatives with Liberals (Germany with Ireland, Switzerland with Ireland) and Mediterranean with Liberals (Greece and the United Kingdom). Conversely, it increases the gap between Ireland and Greece. In consequence, this secondary exercise does not clarify concurrences.

Thus, we reject the hypothesis of synergy for two major reasons:

First, the Social-democratic regimes present the best social and the worst environmental performances. The socially paradigmatic Nordic countries combine the greatest shares of renewable energy and average recycling rates with the greatest carbon and material footprints. Nordics are unable to translate the mobilisation of domestic resources and renewability into decarbonisation and dematerialisation. Public services represent relevant shares of such footprints, e.g., in Finland 19% and 38% respectively (Ottelin et al., 2018). A similar warning was already pointed out by Koch and Fritz (2014), but they concluded that Sweden (and Austria) verified the hypothesis. Even if Sweden is the best environmental performer in the first Nordic cluster, its footprints do not respond to renewability and recycling: France-Belgium registers similar carbon and material footprints (around 11 T CO2 and 23 T per capita, respectively) with a considerably lower renewable share (6.95% versus 35.67% in Sweden) and a slightly lower recycling rate (45.80% versus 47.77%). Likewise, the verification in Austria is rejected too.

Additionally, Denmark, Finland and Sweden do not potentiate the parallelisms between WS and ES, as they register the most remarkable potential competition for funding and the lowest public environmental expenditure. Contrary to Jakobsson et al. (2018) and Zimmermann and Graziano (2020), Conservatives and Liberals do not perform similarly to the Nordics, but better in average environmental terms, as Koch and Fritz (2014) noted.

Second, as concurrences do not match previous WS classifications, the results reflect a diversity of profiles and, as shown in Table 5, social and environmental dimensions are unrelated. There is not a single, univocal connection between the WS regimes, the intermediate variables and the situation of the environmental dimension. Instead, we find diversified portraits that require further discussion.

6. Discussion

These results point to some methodological and political fronts:

The first clarification is that we have rejected synergy in this sample, with the cited variables applied to the feasible period. Improvements in data availability could enrich the interpretation of results, notably from now on, as data started to be fully available from 2008.

Second, our contribution is the alignment of the empirical-theoretical considerations and subsequent screenings of variables, about which few discussions have been proposed. To obtain comparable results, we have mimicked previous methods, while avoiding the assumptions concerning the classifications of regimes. In this vein, the road unfolds in two different but parallel ways.

Regarding clustering, there is a need to surpass categorical classifications as reality proves more complex. Additionally, synergy is a process of coevolution and, consequently, the discrete analysis provides little information. Besides, synergy as formulated in previous

Table 4
Concurrence matrix, without generosity index, 2008–2016. See Nomenclature (Supplementary Materials).

D	AT	BE	CZ	DK	EE	FI	FR	DE	GR	HU	IS	IE	IT	NL	NO	PL	PT	SK	SI	ES	SE	CH	GB
AT	100%	33%	11%	0%	11%	0%	44%	22%	11%	22%	25%	44%	22%	0%	22%	22%	22%	0%	0%	22%	0%	11%	33%
BE	33%	100%	33%	0%	11%	0%	56%	33%	33%	44%	0%	33%	44%	22%	0%	33%	33%	33%	33%	22%	0%	0%	33%
CZ	11%	33%	100%	0%	11%	0%	22%	22%	11%	44%	0%	11%	11%	33%	22%	22%	11%	67%	56%	0%	0%	11%	11%
DK	0%	0%	0%	100%	0%	89%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	78%	0%	0%
EE	11%	11%	11%	0%	100%	0%	0%	22%	22%	0%	0%	22%	11%	22%	22%	22%	11%	22%	22%	22%	0%	22%	44%
FI	0%	0%	0%	89%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	89%	0%	0%
FR	44%	56%	22%	0%	0%	0%	100%	56%	11%	33%	0%	33%	56%	11%	11%	44%	44%	11%	22%	22%	0%	0%	33%
DE	22%	33%	22%	0%	22%	0%	56%	100%	22%	56%	0%	44%	67%	11%	0%	78%	56%	22%	44%	22%	0%	0%	56%
GR	11%	33%	11%	0%	22%	0%	11%	22%	100%	22%	0%	22%	22%	0%	0%	22%	22%	11%	22%	56%	0%	0%	22%
HU	22%	44%	44%	0%	11%	0%	33%	56%	22%	100%	0%	44%	44%	22%	0%	56%	44%	56%	44%	33%	0%	0%	44%
IS	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	75%	0%	0%	0%	0%	0%	0%	75%	0%
IE	44%	33%	11%	0%	22%	0%	33%	44%	33%	44%	0%	100%	44%	11%	0%	44%	44%	11%	22%	33%	0%	11%	56%
IT	22%	44%	11%	0%	11%	0%	56%	67%	11%	44%	0%	33%	100%	11%	0%	56%	78%	11%	33%	56%	0%	0%	44%
NL	0%	22%	33%	0%	22%	0%	11%	11%	0%	22%	0%	11%	11%	100%	33%	11%	11%	44%	33%	0%	0%	33%	11%
NO	22%	0%	22%	0%	22%	0%	11%	0%	0%	0%	75%	0%	0%	33%	100%	0%	0%	11%	11%	0%	0%	67%	0%
PL	22%	33%	22%	0%	22%	0%	44%	78%	22%	56%	0%	44%	56%	11%	0%	100%	56%	22%	44%	33%	0%	0%	78%
PT	22%	33%	11%	0%	11%	0%	44%	56%	11%	44%	0%	33%	78%	11%	0%	56%	100%	11%	33%	67%	0%	0%	44%
SK	0%	33%	67%	0%	22%	0%	11%	22%	11%	56%	0%	11%	11%	44%	11%	22%	11%	100%	56%	0%	0%	22%	11%
SI	0%	33%	56%	0%	22%	0%	22%	44%	22%	44%	0%	22%	33%	33%	11%	44%	33%	56%	100%	11%	0%	11%	22%
ES	22%	22%	0%	0%	22%	0%	22%	33%	56%	33%	0%	33%	56%	0%	0%	33%	67%	0%	11%	100%	0%	0%	33%
SE	0%	0%	0%	78%	0%	89%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%
CH	11%	0%	11%	0%	22%	0%	0%	0%	0%	0%	75%	11%	0%	33%	67%	0%	0%	22%	11%	0%	0%	100%	0%
GB	33%	33%	11%	0%	44%	0%	33%	56%	22%	44%	0%	56%	33%	11%	0%	78%	44%	11%	22%	33%	0%	0%	100%

Table 5
Persistent concurrences and relative profiling.

Concurrence	Countries	Social			Intermediate					Environmental			
		WEFF	LTUN	UN	SINC	LOCE	LOCR	EPPE	COMF	RENE	RRMW	CARF	MATF
1	DK, FI, SE	27.63	20.54	7.50	3.91	50.04	29.97	0.72	0.89	29.23	42.98	13.10	27.99
2	IS, NO, CH	17.96	24.64	4.58	3.47	27.08	19.85	1.64	0.70	50.08	39.52	18.64	33.14
3	CZ, SK, SI	20.01	50.58	8.82	3.54	20.86	12.26	1.98	0.74	10.57	22.91	10.97	32.36
4	NL	17.62	38.17	5.71	3.79	31.35	9.62	3.29	0.78	4.47	50.13	15.08	26.33
5	GR, ES	24.84	49.61	20.15	6.27	9.24	6.83	2.17	0.78	10.99	24.36	12.86	26.40
6	EE	17.07	41.72	9.69	5.51	24.46	4.88	1.38	0.78	14.91	23.04	14.50	26.35
7	BE, FR	29.90	44.29	8.72	4.15	16.72	11.59	2.06	0.78	6.95	45.80	10.88	22.12
8	AT	27.24	26.21	5.17	4.15	14.73	6.18	0.91	0.78	28.89	58.60	14.61	30.72
9	IT, PT	25.86	52.73	11.37	5.80	21.21	14.65	1.52	0.67	18.61	30.46	9.51	19.34
10	IE, GB	21.36	41.92	9.43	4.89	17.81	7.73	1.79	0.83	5.69	39.03	14.59	23.66
11	DE, PL, HU	22.51	41.99	7.81	4.51	22.24	12.75	1.42	0.78	9.94	36.10	9.76	17.11

Nomenclature: WEFF – Welfare effort; LTUN – Long-term unemployment rate; UN – Unemployment rate; SINC – S80/S20 quintile income ratio; LOCE – Local government expenditure as a percentage of general government expenditure; LOCR – Local government revenues as a percentage of general government revenues; EPPE – General government expenditure on environmental protection as a percentage of public expenditure; COMF – Potential competition for funding (1 if yes); RENE - Renewable energy as a percentage of the national energy mix; RRMW – Recycling rate of municipal waste; CARF – Carbon footprint per capita (T CO2 per capita); MATF – Material footprint per capita (T per capita).

Table 6
Variations in concurrences caused by the inclusion of generosity, 2008–2010. See Nomenclature (Supplementary Materials).

ID	AT	BE	DK	FI	FR	DE	GR	IE	IT	NL	NO	PT	ES	SE	CH	GB
AT	0%	0%	0%	0%	33%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%
BE	0%	0%	0%	0%	0%	-33%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%
DK	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FI	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FR	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DE	0%	-33%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%
GR	0%	0%	0%	0%	0%	0%	0%	-67%	0%	0%	0%	0%	0%	0%	0%	33%
IE	33%	33%	0%	0%	0%	33%	-67%	0%	0%	0%	0%	0%	0%	0%	33%	0%
IT	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	0%
NO	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PT	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ES	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
SE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CH	0%	0%	0%	0%	0%	0%	0%	33%	0%	33%	0%	0%	0%	0%	0%	0%
GB	0%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%

contributions is a matter of comparison. Nevertheless, synergy could also be defined in feasible social-environmental terms based on the profiles of countries or persistent concurrencies, as each of them displays a unique behaviour and a different panoply of possibilities, weaknesses, strengths and threats.

Beyond Social-democratic WS, and with a cautionary approach given the diversity, we can observe some behaviours related to other concurrences. A Conservative WS like Germany joined by some Eastern regimes like Poland and Hungary present the best environmental performance with an average social performance. This a priori unexpected combination is unavailable in other concurrences: Mediterranean WS also have positive environmental situations but combined with the poorest social profiles, and Liberal WS maintain the average social performances close to the Conservative WS with slightly positive to average environmental circumstances. Furthermore, the German-Polish-Hungarian concurrence is unique in comparison with their typologies: not all Conservative and Eastern WS behave in this way. Worthy of mention among the Eastern regimes is the poor performance of the concurrence between the Czech Republic, Slovakia and Slovenia. Future research should clarify this unique behaviour.

On the other hand, there is room for other methodologies. Provided that synergy is unavailable, there is a need to find the conditions under which synergy could appear. Simulation tools and systemic modelling have much to say in this respect. Yet, while looking at the future, research cannot forget the past. Improvements in the availability of metrics beyond GDP, such as the generosity index, beyond Gini, as with income shares and the Palma ratio, and footprints including biophysical-economic dynamics, could illustrate the joint evolution of social and environmental dimensions during past decades.

Third, quantitative contributions cannot relegate the qualitative-institutional discussion about the roles of the state (Vatn, 2020). Diversity suggests complex non-unidirectional ways of approaching synergies and conflicts. From this viewpoint, the potential mechanisms of synergy, i.e., the intermediate variables, must be more varied than those theorised.

The central element in a conflict between WS and ES is the sustainability of economic growth, responsible for environmental deterioration and welfare support. Contrary to the correlation (not causation) between equality and bad environmental performance that we observed (and considered spurious) in Section 4 (as the Nordic countries take the calculation to the extreme in this sample), the reason for the bad environmental performance detected in Social-democratic WS is related to the level of income and consumption. The footprints are calculated from the side of consumption, with the mentioned advantage of imputing to these countries the environmental burden of their international exchanges. Higher consumption, as reflected by the material footprint and supported by higher income levels in the Nordic countries, appears linked to a greater environmental impact, as detected by the carbon footprint.

The absence of synergy fuels the debate about transitions between green growth and post-growth, to simplify despite variety (Drews et al., 2019), and could well provide arguments to both sides. If a decoupled green growth was possible, the conflict would be immediately deactivated. Conversely, in a post-growth scenario, current WS will be placed on the edge of a precipice: as income decreases or stabilises, there is a need to strengthen the coverage of WS through public expenditure supported by revenues calculated over a decreasing or steady income, apart from other specific barriers (Strunz and Schindler, 2018). To face this, some streams suggest redistributing wealth apart from income (Koch, 2020). In parallel, degrowth demands strong democratic support to such challenging measures as the limitation of private property and the redistribution of working time (Cieplinski et al., 2021; Nieto et al., 2020).

When scholarship denies decoupling (Haberl et al., 2020; Hickel and Kallis, 2020) and realises the challenges of degrowth, it arrives at a crossroads that motivates the increasing momentum of sustainable welfare to explore the environmental implications of WS. Sustainable welfare fosters the satisfaction of human needs (not preferences) within ecological limits from an intergenerational and global perspective (Koch et al., 2016) and unveils the internal contradictions of current WS to deal with the transition to ES (Hirvilammi, 2020). Its main tools are universal basic incomes, services and bonds, as well as job guarantee proposals, to increase freedom to determine one's own lifestyle, decommodify society and motivate transformation (Bohnenberger, 2020).

Our conclusions do not limit the possibility of achieving a synergy-facilitating sustainable welfare based on the institutional characteristics of Social-democratic WS. In this regard, Universal Basic Services (UBS), which guarantee a socially agreed decent standard of living as a human right, could serve this goal (Coote and Percy, 2020). UBS are inspired by current universal services like education and healthcare and promote further coverage to childcare, adult care, housing, food, transportation and digitalisation.

Since this paper has argued the misalignment of environmentally intensive public services with the idea of dematerialisation in Section 3, the same problem can be attributed to UBS. For instance, in Coote and Percy (2020), universal housing is beneficial as it guarantees decent living conditions while decreasing emissions because of higher efficiency in new and renewed buildings. However, we cannot disregard the counterpart: the intensive consumption of resources to provide such efficiency and its environmental impact.

Thus, a condition arises to provide synergy-facilitating UBS: the cancellation of their environmental impacts. The potential for this cancellation lies in their nature, in contrast with other tools. While redistributed income is consumed under individual criteria that can be environmentally harmful, as argued in Section 2, UBS operate under supervision based on social criteria. When the public sector, whether directly or indirectly, assumes the provision of UBS, there is an opportunity to cancel their environmental consequences if they are socially oriented towards the least resource-intensive conception of the service so that the eco-social benefits overweight their implicit environmental costs.

Despite this potentiality, much remains to be said in this regard. Synergy and conflict between WS and ES in the frame of just transitions appeal to sustainable welfare scholarship as they can offer facts and strategies to settle the debate.

7. Conclusions

The hypothesis of synergy states that Social-democratic WS are in a better position to evolve towards ES, particularly pointing to the Nordic countries, and has been notably theorised, but few studies have tested it empirically. Theoretically, the drivers of synergy are decommodification, low social stratification, democracy, powerful local administration, ecological modernisation, structural parallelisms between WS and ES, prioritisation of low-intensity services and the assimilation of environmental and social policies. However, drivers are double-edged swords and could promote both synergy and conflict.

Empirical studies have reached contradictory results and suffer from significant weaknesses, many of them unnoticed due to the absence of methodological discussions. Previous studies did not consider the relevance of the local administration, the parallelisms between WS and ES, or the assimilation of policies, but included variables that are unrelated to the drivers. In addition, we have noticed some inconsistencies, such as the primacy of magnitudes related to GDP despite the requirement of decommodification, the misunderstanding of social stratification and the link between services and dematerialisation, the irrelevance of some political variables, the use of non-comparable data and the shortcomings of the environmental variables.

To cover these gaps, we propose a novel set of strictly social, strictly environmental and intermediate variables. To obtain comparable results, we apply Ward's hierarchical clustering and Thorndike's criterium to avoid the previous assumptions about the number and typology of

clusters. Due to shortages in data availability, we must drop non-European countries as well as some variables, such as an updated generosity index and the Palma ratio, and stick to their second-best options, such as welfare effort and income shares.

Our sample overlaps between 2008 and 2016 and aligns with previous research, which covers discrete years, such as 2010 and 2016. To avoid biases derived from discrete analysis, we observe clusters throughout the period and present the results under the form of concurrence scores between countries. Given the interest in generosity, we repeat the clustering by including the generosity index for the countries and the period in which it is calculated (2007–2010), without causing significant variation.

Concurrences prove that clusters are unstable, therefore reinforcing the need for dynamic observation, notably in times of crisis, when countries experience differential evolutions. The Nordic countries, which do not constitute a single group but two, are the most exclusive and stable.

By comparing the relative positions of variables for each concurrence, we have rejected the hypothesis. The Social-democratic regimes present the best social and the worst environmental performances. The Nordic countries are unable to translate the mobilisation of domestic resources and energy renewability into decarbonised and dematerialised economies and present the biggest carbon and material footprints. Results are not aligned with Esping-Andersen's typologies or its variations.

Provided that synergy is empirically unavailable, it should be observed as a possible normative purpose to achieve in the framework of a just transition. Methodologically, there is a need to surpass classifications of regimes and determine the conditions for synergy, thus pointing to dynamic simulation techniques to enrich a debate that could be set out in terms of social-environmental feasibility rather than comparison. Ultimately, synergy involves a discussion about the sustainability of economic growth that could benefit from the emerging field of sustainable welfare to study the loose ends formulated in this work, with a special focus on UBS supported by the institutional configuration of WS.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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