Pensions and the Green Transition: policy and political issues at stake

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David Natali (Sant'Anna School of Advanced Studies of Pisa)

Michele Raitano (Sapienza University of Rome)

Giulia Valenti (University of Venice, Cà Foscari)

Abstract

Pension policy has gone through an intense period of reform over the last decades. However, further changes are envisageble in the next future. Major global trends, not only population ageing but also globalization, technological innovation and climate change are going to shape socio-economic and labour organization and thus will have an impact on the adequacy and the long-term sustainability of pension policy. The paper focuses on the green transition as a challenge for pensions in three respects. First, we look at the potential consequences of the future ecological transition on the financing of old age protection. Second, we refer to the future benefits and their adequacy: green jobs and the potential rearticulation of the economic activities will not be neutral phenomena. They will shape future both public and private pension. Third, we focus on the changing role of trade unions in approaching the complex dilemma of supporting the green transition on the one hand, while defending the short-term interest of their rank and file (in terms of tax, labour market and social policies).

1. Introduction

The present paper sheds light on the major potential consequences of the so-called Green Transition (GT) – that is the transition towards a climate-neutral economy – on pension policy. The latter, as well as the broader social policies, are largely shaped by the economic and social context,

mostly because of their impact on the economic structure and the labour market. It is not necessary to embrace a functionalist/structuralist approach to recognize that socio-economic transformation have an impact on social policies. This is also the case of old age protection.

While there are many contributions that investigate the impact of an ageing population (European Commission, 2021) and technological change on pensions (see Natali and Raitano, 2022; Nullmeyer; 2022), to the best of our knowledge no studies have analysed so far the potential impact of climate change and the GT on how pension systems are organised. This paper aims at qualitatively assessing possible consequences for pension systems – and their capacity of being financially sustainable and providing adequate benefits – associated with expected trends in the economic system and the labour market engendered by the Green growth.

In what follows, we first look at the pension systems in Europe and their recent evolution. The summary provided by Section 2 helps understanding the trends in past pension reforms and the paradigm at their base. It is also the first step to assess the capacity of pension systems to address the major challenges of the GT and whether the pension policy inherited from the past (two to three decades of austerity and cost-containment) are well equipped to address the main socio-economic effects of the same transition. Section 3 explicitly evaluates the challenges for the economic system due to the GT through a literature review which focuses on three different potential effects: on economic growth and productivity; labour markets; and the financial sector. All these three policy dimensions have to do with the future of pensions and the related challenges might shape reforms aimed at keeping sustainable and adequate pension financing and benefits, respectively. Section 4 and 5 refer to the main policy and political challenges in the pension field: we investigate the reform options for European policymakers and the political dynamics at stake. As for the latter we first refer to the main political challenges for the trade union movement across Europe. Section 6 concludes.

2. Pension systems in Europe and their recent evolution

In this section we provide a summary of the most popular pension models proposed in contemporary literature and we outline their limits to deal with the challenges related to the green transition.

Contemporary literature has widely proposed various pension clusters in Europe – *Bismarckian vs. Beveridgean* (Myles and Quadagno, 1997); *Social insurance vs. Late-comers* (Hinrichs, 2001); *Social insurance* vs. *Multi-pillar* systems (Bonoli, 2003) – consistent with two different paradigms.

In s*ocial insurance* systems the state provides the greater part of pension benefits through mandatory public schemes that are basically earnings-related (e.g. France and Germany). The financing method is on a PAYG basis. Current contributions paid by both employers and employees (or revenues coming from current taxation, mostly from income taxes, especially when contributions on active workers are not enough to finance pension spending) are not accumulated in individual accounts but rather immediately used for financing current benefits. The main goal of such pension programmes (which represent the so-called "first pillar") – achieved usually applying an earnings-related formula with reference to wages of workers' final/best years – is to grant to pensioners the maintenance of the living standard they had before the retirement. Hence, these schemes mostly aim at guaranteeing pensions adequacy insuring workers against possible negative events during their working life. The high generosity and coverage and the comprehensive character of public pensions are assumed to have crowded out fully funded private schemes.

In *multi-pillar* systems, by contrast, the State has responsibility for basic entitlements with the aim of preventing poverty – especially providing flat-rate or means tested benefits to all retirees/elderly –, while additional benefits are provided by fully funded private supplementary occupational and/or individual schemes (e.g. Denmark, the Netherlands, and the UK). The financing methods are thus mixed: on the one hand, public pension programs (first pillar) are PAYG financed, while, on the other hand, supplementary occupational schemes (second pillar) and pension funds (third pillar) are fully funded (i.e., current revenues are saved and then used to finance future benefits). The matching of a private pillar with a (smaller) public pillar is often proposed to achieve multiple aims (e.g., James, 1999; Feldstein, 1998; Boldrin et al., 1999), e.g.: reduce public spending on pensions; deal with ageing populations attributing a larger role to funded schemes that should be less exposed than PAYG to "demographic risks"; increasing the saving rate and the development of financial markets, that should foster economic growth; increasing mean returns on contributions if the rate of return guaranteed by funded schemes is higher than that obtainable on PAYG schemes; reducing the risk on expected pensions since PAYG and funded schemes differently cover individuals against various sources of risks (e.g., PAYG are

more exposed to demographic and political risks, while contributions accrued in funded schemes are highly exposed to financial risks).

More recent attempts to map pension systems in Europe have started from the assumption that the dominant privatization paradigm (Orenstein, 2011) has led to the progressive convergence of pension systems at least in terms of reform efforts. Ebbinghaus (2012), for instance, identified three groups of countries in Western Europe. The Bismarckian systems (Continental and Southern European countries) are characterized by the persistent key role of earnings-related public pensions. They are described as latecomers in the implementation of the multi-pillar model. Nordic countries (Sweden, Finland and Norway) are part of the emergent multi-pillar systems with public PAYG schemes supplemented by fully funded schemes. Denmark, Switzerland, UK and the Netherlands are part of the mature multi-pillar systems where private funded schemes were introduced decades ago and now play a key role in old age security.

Later on, Natali (2017) has proposed a further classification of pension systems in Europe, with the identification of five clusters. In line with Bonoli (2003), he identifies two main groups of countries: those with social insurance systems (in line with the Bismarckian tradition) and those with multi-pillar systems. However, he further divides each group into different sub-clusters. There are three generations of social insurance countries: those belonging to the first generation introduced public earnings-related schemes between the end of the 19th and the beginning of the 20th century; the second generation consists of the Nordic countries that introduced the same schemes after WWII; the third generation is represented by Eastern European countries that reversed the multi-pillar model in recent years in the aftermath of the Great Recession. In the multi-pillar camp, the first generation is represented by Western European countries that partly privatized their pension system early in (or in second part of the) 20th century, while the second generation includes Eastern European countries that introduced private contribution-based and earnings-related schemes in the last decade of the 20th century and/or at the beginning of the 21st century.

These classifications are relevant but seem of limited interest when we try to assess the potential impact of climate change on pension policy. Firstly, all the countries are now based on the pension policy mix where both public and private schemes coexist, even if the relative roles of the two pillars differ across countries. As stressed by Bonoli (2003: 412) the existence of "[…] a mix of convergent developments and […] a persistence of national differences […]", and "[…] divergent developments will (probably) lead to two different types of multi-pillar systems".

In the last decades, most European countries have shared the reform line consistent with the containment of pension spending through: a stricter link between contributions and benefits; more meagre indexation of pensions; increased number of years of contributions requested for a full pension, higher pensionable age and stricter regulation of early retirement (Ebbinghaus, 2017).

Both public and private schemes have in many countries moved to strengthen the link between contributions paid along the whole working life and expected pensions, with the aims of containing costs and monitoring the trend of public spending for pensions, especially in a context of ageing populations; providing better incentives for a longer working life "making contributions pay" to increase future pensions; and reducing the heterogeneity of actual returns on past contributions associated with pension formulas where only final/best years matter (Holzmann and Palmer, 2006).

To these aims, on the one hand, in PAYG public schemes the reference period for computing earnings related defined benefit pensions has been extended in many countries, and some countries (Sweden, Italy, Poland and Latvia, within the EU) have replaced a defined benefit formula with a NDC formula (Palmer 2006).[1] On the other hand, to reduce risks for sponsors of private funds and monitor the trend of spending, occupational pension funds too have often moved from a DB formula (where, implicitly, guaranteed rate of returns on contributions exist and financial risks are, in a certain measure, shared between workers and fund's sponsors) to a DC formula, where workers expected pensions strictly depend on the success of the financial investments financed by contributions.

As a consequence, reforms have brought about an evident process of progressive 'individualisation' of old-age risks, where the capacity of pension schemes to guarantee the stability of individuals' living standard before and after retirement has been strongly reduced and, thus, individuals are not protected anymore against possible negative events occurred during the working life (e.g., periods spent in unemployment or earning very low wages), since the whole working life history matters for computing future pensions. Redistribution across generations and

[1] Benefits depend on the accrual of contributions paid during the working life and, according to actuarial rules, annuities are computed taking into account expected longevity at retirement, according to the number of years that a pension is expected to be paid. In the pension economics literature, the concept of "actuarial fairness" has then been used recently as a benchmark (Borsch-Supan 2006). Note that the actuarial rules of a NDC allow policymakers to stabilize pension spending even in a context of sustained population ageing, since its technicalities allow the public system to pay a rate of return on contributions able to balance the intertemporal budget of the pension system (Aaron, 1966; Samuelson, 1958).

within pensioners has been restricted in many countries, in the same years when post-industrial labour markets became more flexible (Hinrichs and Jessoula, 2012) and, furthermore, social norms behind the fairness associated with pension benefits have changed if pensions are often considered fair in the current debate only when – apart from the provision of a social assistance minimum benefit for poor elderly – they strictly mirror contributions paid by the individual in the whole working life. Therefore, according to recent reform trends, due to pressures in public balances and to the willingness of fostering individuals' responsibility in contributions accrual – often fostered by EU and international institutions –, the several objectives pursuable through a pension scheme are increasingly reducing to the mere need of smoothing individual resources along the various phases of an individual's life. In the following sections we assess what these trends imply for the capacity of pension system to deal with the new challenges related to the possible scenarios that might be shaped by the green transition.

3. Economic and Social Challenges of Green Transition

According to the Paris Agreement's targets, global GHG emissions should be reduced to keep global mean temperature increase below 1.5°C or well below 2°C compared to 1990. In this framework, European Union plays a leadership role in climate policies and mitigation action, submitting one of the most ambitious NDCs (National Determined Contribution), recently updated in 2020 and the New Green Deal for 2030 targets. The European commitment is set to achieve climate neutrality (net-zero emissions) by 2050, and emissions reduction by at least 55% by 2030 (Germany and European Commission on behalf of EU and its member States, 2020).

Climate policies rise several concerns in terms of economic costs to undertake the transition, as global GDP, employments effect, firm's competitiveness, savings management (see Table 1 below for a summary of main findings emerged from the literature and discussed in detail in next paragraphs).

These impacts occur in and add to a context of technological transformation, new forms and relations of works, population ageing (Speck, 2020), and are thus relevant for understanding future potential dynamics in the sustainability of pensions' contribution and adequacy of transfers.

Table 1: Potential challenges of green transition

GDP growth	Aggregated net costs of mitigation depend on: • technological process • timing of action • policy mix and co-benefits • benefits in terms of avoided damages
Net-employment effect positive but small extent	*Short term* Low carbon technologies more labour intensive
	Medium term risk of losses in competitiveness, carbon leakage, job migration
	Long term Technological change • demand for skilled labour increases • product-driven: increase in the demand for labour • process-driven: decrease in the demand for labour
	Revenue recycling from carbon pricing: • double dividend hypothesis: shift in taxation from labour (high distortionary) to emissions (internalize externalities) • financing other policies (e.g., retrain process) contribute to the net effect on employment
	Multiple targets (emissions reduction, renewables share, energy efficiency improvements) increase net-employment
Job reallocation winner and losers between sectors and regions	*Higher employment losses in carbon-intensive areas and sectors:* • Higher job losses in traditional energy supply and carbon-intensive *Green vs Brown jobs:* differences in tasks and skills • closer in terms of skills compared to other jobs • higher content of non-routine analytical tasks • time-demanding process • on-job-training
Wage dynamics	Income redistribution: • green industries vs brown industries: *green wage premium* • labour vs capital: green jobs are more *labour intensive* • Different jobs: *manual labour* has the lowest benefits in terms of wages
Financing process	• public spending: financing for transition might compete with welfare needs • private involvement in the transition lowers pressure on public spending • stranded assets represent a risk for institutional investors, among them pensions funds

Economic Costs, Growth, and Productivity

Achieving climate goals require a structural transformation of the economy, with shift in the production, energy consumption, transport, buildings, individual behaviour (Edenhofer, 2014). This deep change will determine both winner and losers between different sectors, regions, and workers (Fankhaeser, 2008).

As reported by the IPCC AR5-WGIII, in cost-effective scenarios, the aggregated cost of mitigation to keep the temperature likely below 2°C ranges between 1.5% and 4.2% reduction in global GDP by 2050. It means an annual GDP growth reduction between -0.03% and-0.13% (Edenhofer, 2014).

These estimates get worse in scenarios characterized by delayed actions or limited technological availability. These results are generated by models that often assume perfect implementation of climate policies, with a unique emissions trade system, absence of transaction costs, transparent markets, optimal behaviour, technological diffusion, and no labour and capital market imperfections (Guivarch, 2011).

Besides, as it is complex to compute co-benefits, these are not included in the overall estimates produced by models. Finally, we should consider the aggregated benefits of avoided damages from Climate Change, which are estimated to overcome the total cost of mitigation in the cost-effectiveness scenarios (Edenhofer, 2014).

Low-carbon transition interacts with other structural changes in the society and economy and some results will depend on the joint effect of these forces. A glaring example is the technological innovation that supports and affects climate policies' impact both in terms of GDP and employment. Innovations are expected to rise the labour demand when they are product-driven (Harrison, 2014), while might negatively impact the level of employment if led by process innovation, causing improvements in labour productivity (Cainelli, 2011).

Labour Market and Employment Dynamics

Green Transition is expected to reshape the economy and labour market. Therefore, different scenarios in terms of net employment, job reallocation, wage dynamics, sectoral and regional shifts might rise and play a role in determining welfare challenges, including pension requirements in terms of adequacy and sustainability.

One of the main policymakers' concerns raised by climate policies is the net-employment impact. The topic is widely debated by the literature that leads to controversial results.

According to Fankhaeser, (2008), the net effect on the labour market is multifaceted and might evolve through the short, medium, and long term. Therefore, they distinguish between three classes of impacts on employment. First, they identify the direct employment effect occurring in the *short* term. It is a consequence of adjustments among sectors directly affected by mitigation and the relative job disruption and creation. The shift from carbon-intensive activities to low-carbon ones, more labour-intensive, should determine a rise in employment in the short term. Second, they discuss the economy-wide effects of climate policy in the *medium* term, which are determined by behaviour shifts and value chain changes. These effects might partially offset the increase in employment if climate actions are adopted unilaterally causing a loss in competitiveness, carbon leakage, and job migration. Finally, they point to the dynamic effects of climate policy, in the *long* period. The research and development of low-carbon technologies and their deployment should increase the demand for skilled labour. Besides, the impact of innovation on welfare largely depends on whether the investments across low-carbon and non-energy sectors will be substitutable or complementary. Indeed, a higher degree of substitutability might determine a crowding-out effect in investments.

More recently, Pollitt (2015) use a modelling approach to estimate the impact of a 40% reduction in GHG emissions by 2030 on employment in the EU countries. They analyse two alternative mitigation pathways, the first one based on a unique carbon pricing across EU countries and sectors, and the second one grounded on multiple objectives, including targets on renewables and energy efficiency. The findings show in both options a positive impact on employment but underline a substantial difference in the extent of the results, showing a higher potential in job creations when additional targets are fixed. This is the case of the EU which in the last NDC submitted (2020) claims to improve energy efficiency by more than 32.5% compared to the historical baseline and make the renewable contribution at least 32% of the final energy consumption by 2030 (Germany and European Commission on behalf of EU and its member States, 2020).

The relevant role played by renewable energy is further stressed by Fragkos (2018), who perform a sectoral analysis, estimating the net effect on employment in different sectors. They found on average higher labour intensity and domestic job content in the Renewable Energy Sources

compared to Fossil Fuels Sectors. This result translates into a positive expectation of the low-carbon transition effect on EU net-employment (+1% in the labour force by the half of century). The sectors expected to exploit the higher employment increase by 2050 are electricity, agriculture (biofuels production), and construction (buildings' renovation). Specifically, the sharpest increase will be in the construction and installations of PV and wind turbines and advanced biofuels. Overall, job reallocation between sectors should be around 1.3% by 2050 in the EU and 1.5% globally. On the other hand, the sectors hardest damaged by the transition will be all the traditional energy supply and carbon-intensive industries as coal mining, refineries, and refuelling stations. The authors confirmed a positive change in employment due to climate policies but underlined the sectoral and regional differences in the outcome.

The concentration of employment losses in the carbon-intensive areas and sectors might compromise the social consensus for climate mitigation. Indeed, the distribution of climate policy costs represents one of the main barriers to the actual implementation. Therefore, compensation schemes play a central role in gathering support from fossil fuel-related groups and achieve a *just* transition. Workers belonging to the exposed sectors are likely to take a position against these policies if the employment alternatives, given their skills, are weak (Tvinnereim, 2016). A set of actions, as the low-skilled retrain (Fragkos, 2018), outplacement assistance, labour subsidies (Guivarch, 2011) would be helpful to shrink the unemployment periods and make the reallocation effective.

It is relevant to stress that the net result of climate policies on employment depends on the overall macro-economic dynamic but is largely influenced – as suggested by Fragkos (2018) - on some conditions:

i. The extent of changes in competitiveness, which is affected by the scale of policy implementation (EU or global). Indeed, if energy prices increase only in EU countries, carbon-intensive sectors might suffer from a further decrease in employment due to the loss of market share or the transfer of their activities in jurisdictions without GHG emissions regulation.

ii. The financial scheme adopted: as already mentioned, if investments for low-carbon transition compete with investments in non-energy sectors and the degree of substitutability is high, crowding-out effect might occur.

iii. Policies mix to attenuate or avoid negative side-effects, like retraining programs for workers employed in high carbon-intensive sectors, measures to increase the labour market participation and adequacy ok skills to the green-labour demand.

iv. The revenue recycling scheme implementation.

The usage of carbon tax revenues further contributes to determining the overall impact of climate policies on employment and it is essential for the policy acceptability and consensus. The so-called double dividend hypothesis supports the positive outcome on the labour market from shifting the taxation from labour to polluted sources. Indeed, labour taxation might lead to high distortionary effects, instead, carbon taxation should achieve welfare improvements, reabsorbing the relative externalities. The pertinent literature does not agree on the feasibility of the double dividend hypothesis due to different results on the type of workers to address (all, skilled or unskilled) (Bosello, 2001; Dissou, 2013; Fæhn, 2009) and contradictory results characterizing the short against the long term (Carraro, 1996). Indeed, the most part of the studies relied on CGE models, of which results widely vary with the main assumptions and representation of markets and their imperfections (unvoluntary unemployment, geographical immobility, flexibility in wages, time-demanding job search process, heterogeneity among skills workers).

As seen so far, the overall impact on employment represents one of the main policymaker concerns, but the net-effect, even if positive, makes winners and losers and causes distributional shift among sectors and regions. Besides, also the qualitative analysis of the employment effect needs to be addressed.

The Occupational Information Network (O*NET) Program, under the sponsorship of the *U.S. Department of Labour/Employment and Training Administration*, performs the distinction between green occupations and green tasks, often blurred in the literature (Dierdorff, 2009). The diffusion of green technologies and activities might have effects both on the demand for already existing occupations and for new ones characterized by new skills or tasks. These circumstances and their extent determine the greening of occupations. On this basis, three occupation-based groups are defined:

1. *Green increased demand* group comprehending occupations already existent, but an expansion (e.g., Chemical Technicians, Forest and Conservation Technicians, Hydrologist). The change does not affect the work and workers' requirements, therefore the skills and tasks performed, but their demand.

2. *Green enhanced skills* group represented by pre-existent occupations that are undergoing task changes, and consequently require new skills and knowledge (e.g., Environmental Engineers, Construction and Building Inspector, Plumber). This group of occupations does not experience necessarily an increase in the labour demand.
3. *Green Emerging* group supplies new occupations and tasks for new needs and requires new skills (e.g., Wind Turbine Service Technicians, Biomass Plant Engineers, Solar Power Plant Technicians). The rising demand for this group of occupations is expected to increase employment.

Within these groups, further distinctions can be conducted looking at the routine intensity of the task and the cognitive endowment (analytical, interactive, manual, and cognitive) which characterize green and non-green jobs. The former is marked by a higher content of non-routine analytical tasks and requires more formal education, work experience, and on-the-job training. Additionally, all these last elements drive already existing occupations group (*green demand* and *green enhanced skills*), while for the new jobs only the on-jobs-training results predominant (Consoli, 2016). This result warns on the different characteristics of green versus brown jobs and the related tasks required for different occupations, stressing the importance of accounting for learning by doing (*on-jobs-training*) in the design of labour market policies toward transition, and the involvement of sector consortia and inter-firm association in this process.

As already mentioned, one of the main concerns is the actual feasibility of the job reallocation and its cost. To this aim, it is salient to understand differences in skills needed for green and brown jobs. Empirical research (Vona, 2018), analysing the skill distance between different occupations, identified a narrow gap between green and brown jobs, warning that the wider dissimilarity is with other jobs. The most significant skills gap identified by the literature regards green engineering skills in architecture, construction, and extraction.

Some policy implications follow these results. First, given a close level of complexity between green jobs and brown jobs, targeted technical programs and training result to be more effective than a general increase in post-secondary education. Second, this small gap generates positive but overall restrained expectations on net-employment. This conclusion is in line with other findings on the green stimulus effect on the economy and employment. It is likely to be effective and valuable in reshaping the economy from the green to the brown sectors but less likely to fulfil the economic stimulus necessary to get people back to work quickly to restart and recover the

economy from the Covid-19 pandemic crisis (Chen, 2020). Indeed, the jobs and occupations suffering the highest stress from Covid-19 have low compatibility skills compared to green jobs. Furthermore, the green stimulus is estimated to act slowly in the long period and might be insufficient to respond to short-term recovery needs.

Finally, literature focused on understanding whether the green transition causes any distributional change in income through differences in wages between green and non-green jobs. Some empirical studies (Antoni, 2015; Jackman, 2021) identify the so-called *green-wage-premium* addressed to workers belonging to green industries (+7%), particularly in construction, installation activities, and architectural and engineering services renewable-wage-premium emerges (10%).

On the other hand, this finding seems to be time-variant (reducing overtime) and advantaging only some jobs categories. There is no agreement on which factors explain this gap in wage between industries, whether it might be imputable to differences in skills, a compensation for the higher level of uncertainty on the future green jobs' perspectives or being a consequence of the public green and renewable public promotion.

Other studies (Chateau, 2018) found that carbon pricing leads to a redistribution of income between production inputs, in favour of labour, particularly in countries that are fossil-fuel intensive users. Wage changes result to be variable among regions and sectors, and in particular, the category of blue-collar and farm workers is the one displacing the higher ranges of outcomes, while the services and sales workers, professionals and managers and officials are the ones experiencing the largest benefits. Making some exceptions, low-skilled workers are the ones with the lowest wage benefits in the transition. The impact on manual labour, given the higher exposure to trade and technological changes, is particularly concerning. This issue is deepened by Popp (2020) that studied the impact of the green stimulus originating from the American Recovery Act. They found that the largest part of jobs created was addressed to manual laborers, registering thus an increase in the demand, that however was not followed by a rise in income retribution.

Green Transition and Financial Markets

Green Transition demands a high number of investments, and public expenditure should play a leading role in boosting innovation, changes in infrastructures, human capital, and ecosystem. The following actions and policies require rising public spending toward this direction, which might

compete with the increasing public demand for health and pensions (Speck, 2020). The expanding pressure on public spending might decrease if strengthening the private sector involvement in the transition, which should be encouraged by a well-designed incentive structure. In this direction, among other institutional investors, pension funds can play a growing role.

Battiston (2017) analyse the climate policy impacts on the financial system, comparing a brown scenario with a green one, to evaluate whether keeping global mean temperature below 2°C and the related low-carbon transition might trigger systemic risk (Battiston, 2017). Indeed, several physical and financial assets are at risk to be stranded, that is to "suffer from unanticipated or premature write-downs, devaluations or conversion to liabilities" (Caldecott, 2016), and the extension of this process is estimated to cover the 82% of global coal reserves, 49% of gas and 33% of oil. This risk transfers to the institutional investors in fossil fuels companies that are, in turn, jeopardized by the risk of climate policies. In the EU, pension funds' assets are exposed to climate-policy-relevant-sector both directly (8%) and indirectly (8%)- through shares of investment funds and banks in turn vulnerable to these sectors – for about 16% of their assets (Battiston, 2017). In this picture, the timing of mitigation is crucial. The low-carbon transition might occur orderly, by way of a coordinate and early action toward the climate goals, or disorderly, implying rapid and unanticipated changes and shocks (Battiston, 2019). A disorderly transition increases the number of assets at risk of being stranded and dramatically increase the aggregated mitigation costs, putting a strain on welfare system.

4. Major Policy Implications of the Green Transition on Pensions

To assess how the challenges due to the Green Transition might impact upon the pension systems it is useful framing the evaluation clarifying, on the one hand, the main characteristics which shape these systems and, on the other hand, the main objectives that they should pursue.

Accordingly, basing on findings of the environmental economics literature reviewed in Section 3, in this section we discuss what are the challenges for the financial sustainability of the pension spending and the adequacy of the provided benefits given the current architecture of the EU pension systems and, therefore, how the three main dimensions of these systems – i.e. the financing method, the benefit computation formula and the mix between public and private providers – might be changed to properly react to the Green Transition challenges.

The first objective that is pursued by EU countries pension systems thus refer to the financial sustainability of public schemes, i.e. to a balanced intertemporal budget between revenues (social contributions or general taxes) and pension spending. As clarified by the studies which have investigated the effect of an ageing population on pension system sustainability (Raitano, 2014), the core variables to guarantee sustainability – given a certain architecture of the pension scheme (e.g. as concerns retirement age and the benefit computation formula) – are the GDP growth rate, which influences the potential tax base to finance pension and social protection spending, and, when pensions are mostly financed through social contributions, the wage share (the ration between total wages and GDP), which the amount of social contributions depend on.

According to this perspective, the challenges made by the GT for pension sustainability should not be very serious. On the one hand, no scenarios forecast a drop in GDP – rather they usually expect a rise in GDP growth because of the higher productivity allowed by the GT. On the other hand, differently from the most plausible expected scenarios on technological change (Natali and Raitano, 2022), no dramatic drops in the wage mass and the wage share should occur: indeed, at least in the long-term, both net employment and mean wage – the two factors determining the wage mass – should not reduce because of the GT. Furthermore, if drivers of functional distribution between wages and profits do not change, also the wage share should not be seriously affected by the GT.[2]

Therefore, no structural changes in pension systems characteristics – e.g. reduction in mean benefits, increase in retirement age, opting out towards private schemes, transition from PAYG to fully funded schemes – should be justified per se because of challenges for financial sustainability due to the GT. The only major change should be, at most, an increase in general taxation as the financing source if social contributions would not increase in line with GDP because of an increase in functional inequality.

Prominent challenges might emerge, instead, as concerns the capacity of pension systems of providing adequate benefits to all workers and these challenges relate to how the advantages from the transition from brown to green jobs – i.e. higher employment opportunities and higher, and increasing, mean wages – distribute across the population. In other terms, challenges depend

[2] Functional inequality refers to how the total product is distributed among the various productive sources, mostly wages and profits.

on how the GT will impact upon the personal inequality in employability and wage patterns among the workers.

Actually, even if the prospects of the more skilled individuals are expected to improve both in terms of employability and wage dynamics, the Transition – engendering a major structural change in the economic and productive system – might be characterised by the co-presence of the winners (i.e. the most skilled) and the losers from that transition and the losers should belong the most disadvantaged groups of workers in terms of skills, contractual arrangements, wages and types of jobs and performed tasks. Even in case net employment would rise and, on average, workers would gain from the GT, there might be individuals who lose their job and are unable, at least in the short- medium-term, to find again a stable and rewarded job. Moreover, two cases should be distinguished: 'temporary losers', those who are able to be reskilled and be then employed in green sectors, and 'persistent losers', those who are instead permanently damaged, in terms of employment opportunities and wage dynamics, by the disappearance of their brown jobs.

The effect of the GT on the inequality among workers and its persistence is currently undetermined and will depend on the efficacy of a set of complementary policies (industrial policy, training activities, active labour market policies) aimed at contrasting negative labour market events of the change of the productive system from brown to green tasks. Nevertheless, the temporariness of the persistence of the 'loser status' might ask for different compensatory policies also in the pension field.

Actually, if downgrade risks for workers should be only temporary no relevant changes in the structure of the pension system should be introduced but the link between unemployment benefits and expected pension benefits should become stricter, mostly by extending the guarantee of adequate notional contributions during periods of voluntary unemployment. Accordingly, no changes in the pension computation formula (e.g. earnings related or notional defined contribution - NDC) should be made if adequate notional contributions were paid to protect temporary losers of the Green Transition.

Different is the case for those who should be persistently lose from that Transition, becoming long-term unemployment of remaining entrapped in a labour market path made by low-paid and fragmented employment spells. Indeed, in those cases some changes in pension computation formulas and retirement age might be introduced to compensate the persistent losers. On the one

hand, early retirement options should be made available to elderly losers; on the other hand, pension computation formulas should become 'less individualised'. In other terms, benefit formulas as NDC which consider contributions paid along the whole career as the only factor to compute pensions should be weakened by introducing, e.g., a pension floor, a base pension or a minimum pension which may allow individuals characterised by long but unsuccessful careers to receive an adequate pension benefit at retirement independently of a possible limited amount of total contributions. Likewise, earnings related schemes or 'point systems' which take into account the whole working career to define the benefit amount should be partly relaxed to improve future pensions of the permanently losers. Noteworthy, these guarantees – even if were more generous, on an actuarial base in terms of returns on paid contribution, than what would be guaranteed to the 'not losers' – would not have an impact a serious impact on public spending and on pension system sustainability once, as expected, mean wages and GDP growth would rise as a consequence of the Green Transition. Instead, they would have the advantage to increase the fairness of the pension scheme towards individuals which would lose from structural changes in the economic system because of negative circumstances out of their control.

Finally, also note that the role of private supplementary pension schemes is not expected to rise because of challenges on public pension sustainability and adequacy associated with the Green Transition. Indeed, on the one hand, as mentioned, sustainability challenges do not seem so serious to ask for a reduction in the role of the public sector in the pension field. On the other hand, the winners of the Green Transition would benefit from improved career patterns which may allow them to receive an adequate public pension without the need of opting out to supplementary schemes. Conversely, it is very likely that the losers might not benefit from second pillar schemes which, because of liquidity constraints and administrative limits, are not usually an effective choice for low-paid and precarious workers. As remarked, answers to the implications for future pensions coming from their increasing labour market risks should be found within the public social protection system.

However, as discussed in the next section, private schemes, and especially occupational pension funds, might become a relevant actor if they would ease the reconversion towards a green economy by properly directing the large amount of resources they have at disposal in line with the Green Transition.

5. Major Political Implications of the Green Transition on Pensions

We know from recent contributions that trade unions face a typical dilemma in the Green Transition. On the one hand, if unions advocate mitigation of climate change, workers may turn away because of potential job losses. In parallel, companies will blame unions for lower profits. On the other hand, if unions safeguard employment in carbon-intensive sectors — to the detriment of the environment— this may spark criticism from society at large and environmental movements (Thomas and Dorflinger, 2020). In other words there is a tension between economic concerns with cost of living, wages and employment on the one hand, and the need for costly policy action to counter climate change on the other (Azmanova, 2021; Pochet, 2017).

The political consequences of the GT on pension policy seem quite consistent with the broader dilemma mentioned above. Firstly, there is the possible problem of the inequalities in the distribution of job opportunities across sectors and occupational categories. As stressed above, carbon-intensive sectors might suffer from a further decrease in employment due to the loss of market share and the negative effect of stricter environmental regulation. In parallel, manual workers may suffer from absolute and relative wage losses. Workers in carbon-intensive sector and/or with low skills and manual tasks may thus suffer from low wage jobs, interrupted careers and insufficient pension contributions. By contrast, workers in green sectors may see opportunities for more jobs (thus lower unemployment risks) and higher wages. But the more disadvantaged are well unionised and have a disproportionate representation in the trade union movement.

In the pension field, the consequences of the GT may be addressed through different (complementary) strategies for reforms. The first is a *defensive strategy* where unions may defend carbon-intensive sectors and demand for compensation (financial resources to buffer the main economic consequences of the transition). Trade unions defend brown jobs to protect the future pensions of the same workers. Temporary compensation and/or re-training to allow the same workers to move to the green jobs may be envisaged. Labour organisations may also ask for 'special' old age rules for the losers of the Green Transition: e.g. more options for early retirement. In this case the risk is to internalize the dilemma: with the federation of the carbon-intensive sectors to defend their own interests with potential tensions with the trade unions more involved in the green sectors. On top of that, trade unions run the risk of conflicts with the green movements. The second is a more *encompassing strategy* forged on the base of a cross-

occupation alliance. Trade union confederations may demand for broader reforms to increase redistribution and improve protection in the first pillar (both in social insurance and multi-pillar models) for those categories at risk of insufficient old age protection: e.g. improve minimum pensions; introduce and/or strengthen top ups to contributory pensions. This encompassing strategy may be justified in that brown jobs suffer permanent losses and even the green sectors still suffer from insecurity and the spread of a-typical jobs. The third is a *pro-active strategy* and tends to pre-empt any major loss for the labour movement in the context of the GT. Here the focus is more on the role of pension funds to contribute to reshape the global financial market. Pension funds can use their strength and position to intensify the response of the investment industry to climate change and ensure it is prepared for the future transition. Two possible strategies for trade unions: to exert their role in the design and management of pension funds; or to embrace "shareholder activism": to influence pension funds and their investment—by gaining expertise in monitoring the management of the schemes (Natali, 2018). In this case trade unions may promote green sectors through the pension funds, while asking the public investments to protect workers in the other sectors. In this scenario the alliance between social and ecological movements is probable.

The challenges mentioned in this section could push trade unions to look for new strategies. The trade unions could be forced to focus on improving their social power resources (e.g. capacity to communicate to the public and strike alliances with new green social movements) and defend their administrative and institutional role both in first and second pillars. Some recent pension reform processes provide evidence of the new issues on the agenda (e.g. demands for improved protection for a-typical workers; introduction of top-up benefits to improve the functioning of earnings-relates schemes). The latter signal the trade unions' attempt to address the demand of non-unionised workers and provide an encompassing strategy to old age protection in the Green age. In social insurance countries, the more probable trade unions' strategy will consist of incremental reforms to strengthen the first pillar capacity to effectively cover the workers victims of the GT, while avoiding the drift to basic protection and the parallel spread of supplementary pension funds. In multi-pillar systems, trade unions will probably prioritize the adequacy of basic protection and the financial viability of the public pillar, while improving the coverage of second pillars to new forms of employment and green jobs.

6. Conclusions *(to be added)*

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