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THE IMPERATIVE OF SUSTAINABILITY

Economic, social, environmental

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EXECUTIVE SUMMARY

Integrating the SDGs into the EU agenda

The EU needs a new analytical framework to study economic, social and environmental challenges in an integrated way. The 2030 Agenda for Sustainable Development of the United Nations defines 17 goals, which can be the foundation for such a new framework. As long as the Sustainable Development Goals (SDG) are not on the top of the political agenda, they will be more a window-dressing exercise than a tool to achieve the overall goal, which is the well-being of current and future generations.

A successful implementation of economic, social and environmental goals at the European level requires a significant change in European economic governance and clear priorities. Against the background of the SDGs, this report identifies four crucial points:

- **A European Sustainable Development Strategy 2030 together with a reform of the Stability and Growth Pact**. Targets set by the new strategy must be at least as important as the fiscal and macroeconomic rules of the SGP and focus on the overarching goals enshrined in the Treaties ("well-being of its peoples") or the SDGs.
- **Renewing the European Semester.** The European Semester itself must focus on sustainable development, based on new analytical tools and more coherent short-term priorities, taking synergies and trade-offs into account.
- **An analytical framework to deal with trade-offs, synergies and priorities**. We propose a "magic polygon for well-being-oriented economic policy". This concept is similar to the well-known 'magic square' but entails more concrete economic, environmental and social goals as well as a more in-depth treatment of economic stability.
- **An integrated sustainable development scoreboard**. Eurostat has made available a set of 100 indicators to monitor the progress of the 17 SDGs in the European Union. It should be augmented especially by macroeco-

nomic indicators. To become relevant, it is important to improve our capability to forecast future developments, analyse interdependencies, identify trade-offs, rather than just track the past.

Growth is holding up but clouds appear on the horizon

In the EU growth is holding up but the general outlook is less bright than in recent years. GDP growth is expected to ease back to 2.1% in 2018, 1.9% in 2019 and 1.8% in 2020, after 2.6% in 2017. The anticipated slowdown largely results from the gradual attenuation of the post-Great Recession recovery momentum and the convergence of growth rates towards a lower potential growth path. With the exception of the United Kingdom, the prospect of continued growth would allow the unemployment rate to fall in 2018 and 2019. Yet, the decrease in unemployment will not generate inflationary pressures even in countries where the cycle is advanced. Wage dynamics—which have in aggregate persistently lagged behind appropriate benchmarks—will remain structurally too low to reach a core inflation target close to 2%. **As wages are the main tool to foster the inclusiveness of growth, the European agenda should incorporate structural reforms in favour of employees.**

The slowdown of growth coincides with a revival of political turmoil. The hard bargaining over Brexit, and its still uncertain outcome, the trade war launched by the United States, the standoff over the 2019 Italian budget as well as the turbulence in some emerging countries darken the economic outlook and highlight a set of downside risks. In our central scenario, these clouds do not call into question the growth path, either because their negative effects should be moderate, or because these tensions could vanish without creating additional shocks. **Nevertheless, the current scenario is characterized by several downside risks, so that the growth forecast for 2018-2020 can be considered an upper bound (Table 2). Given the risks especially due to external factors, internal sources for growth—investment and private consumption—should be strengthened.**

During the next years, the aggregate fiscal stance will be slightly supportive in the euro area. The contribution of fiscal policy to GDP growth will be +0.3% point in 2018 and +0.2 in 2019. Then, if Member States stick to their Stability Programmes for 2018-2022, the aggregate fiscal impulse will have a neutral impact on growth in 2020.

Doubts about the commitment of the new Italian government to sound public finances have triggered stress on the Italian bond market and the fear of a new crisis in the euro area. If the rise of spreads vanishes quickly, the Italian public debt could remain stable at around 131% of GDP. However, if the sovereign rates' surge persists and Italian potential growth remains low, at least until 2023, the Italian public debt ratio would increase further. It is fundamental to ensure that the current fiscal impulse is combined with commitments on the sustainability of public finances in the longer run.

So far contagion to the other countries of the euro zone has remained limited. Although the euro area has now some tools to deal with this type of risk, with the ESM and the OMT (Outright Monetary Transactions) of the ECB, a scenario leading ultimately to the explosion of the euro area cannot be excluded. These tools are conditional on an agreement between Italy and the other euro area member countries, which seems unlikely at the moment. On the other hand, markets are pressuring the Italian government to reconsider its fiscal policy and the European partners wish to avoid an open conflict with the third biggest economy of the currency union. Given the size of Italian public debt in absolute terms and the importance of the Italian banking system, Italy may be judged "*too big to fail*".

The euro area is not prepared for the next downturn as imbalances persist and the institutional framework remains incomplete

The increase of public debt is one of the main legacies of the crisis. While it is currently declining, long-run simulations suggest that without further consolidation, public debt will not reach the arbitrary 60% target by 2035 in a number of countries.

The structural adjustment required to bring back public debt to its target would weigh on the reduction of unemployment. Trying to reach a 60% target would lead to a new wave of severe fiscal consolidation in some countries. This would weigh on the average GDP growth by 0.4 point in Italy and Greece, 0.2 point in Spain, and 0.1 point in Belgium. For some countries, the level of the structural budget balance would be very high in 2035, in particular in Italy and Greece. This clearly questions the social sustainability of such a policy. If member states only comply with their respective medium-term objective (MTO), public debt would also decrease substantially in all member states but the adjustment would be lower. **Euro area countries should not engage**

in additional fiscal consolidation unless output gaps are closed, and countries with fiscal room of manoeuvre should use it to sustain growth in the euro area as a whole.

The euro area on aggregate has a large trade surplus. This may not be sustainable, since it creates pressures for euro appreciation that can diminish the growth prospects. Unlike before the crisis, the imbalance is clearly concentrated in surplus countries. If there is no further nominal readjustment, the net international investment position, *i.e.* the foreign assets accumulated, of Germany, Ireland and the Netherlands would increase to close to 200% of their respective GDP, while deficit countries (except Greece) would arrive at a level compatible with the threshold of -35% stipulated in the Macroeconomic Imbalance Procedure.

Even if the situation has improved substantially since 2008, there are still significant current account imbalances within the euro area, especially between France and Germany, where, all other things equal, a relative nominal price adjustment of 20% is needed. The adjustment effort implemented by Southern countries (Portugal, Spain, Italy, Ireland and Greece) since the inception of the crisis is very clear. Conversely Germany, Austria and the Netherlands diminished their nominal undervaluation but at a slower pace. The only country that has not followed the re-convergence pattern is France.

In the euro area recovery has weakened while potential growth has been declining. The upturn will come to an end at some point, and the euro area is not yet prepared for that. The sun has been shining but the opportunity for structural repair work has not been taken. Even on banking and financial matters, where some substantial steps forward have been made, the on-going project of the Banking Union has stalled. A few countries, among which Germany, are reluctant to adopt the European Deposit Insurance Scheme. The incomplete adoption of the Banking Union also highlights the lack of the political will needed to ensure the homogenous regulation and supervision of banks across the EU.

The incomplete adoption of a Banking Union may be insufficient to ensure banking stability. The ECB could have to come to the rescue with extended unconventional policies. Moreover, given low prospects for potential output in the euro area, the policy rate will need to be set at a low level, and tapering measures by the ECB likely postponed. Yet in a low interest environment, risks of financial instability are likely to intensify. Consequently, macro-prudential policies would be needed to limit risk.

A positive development is growing recognition of the need for automatic stabilisation measures working across borders within EMU. This approach should not, though, be seen as being in opposition to a policy of strengthening national automatic stabilisers. This would also increase the stability of the currency area as a whole; as such, each member state has an interest in other members having strong stabilisers, suggesting a need for coordination to bring about an upward convergence in this regard. The Franco-German Meseberg declaration and subsequent agreements suggest that there is now some political momentum behind unemployment reinsurance and the euro area budget proposals, although they are likely to be initially very limited in scope. The latest Eurozone budget proposal (16 November), for instance, is locked into the overall EU budget and appears to be more oriented towards investment support (for which the Juncker Plan is already operational) than to the needed counter-cyclical stabilisation. If these schemes can be successfully established, it will be possible—at the latest in the next crisis—to extend and expand them, once it becomes apparent that it can be in the interest of all member states to do so.

The need for greater automatic stabilization, including of a cross-border nature, in monetary union is undisputed. The proposals under discussion do go to some extent in this direction and deserve support. One should be under no illusions, however, that—with the likely conditionality and order of magnitude—they will be insufficient to provide a substantial stabilisation capacity. There is a risk that such proposals distract attention from the need for more effective stabilisation measures, such as a larger central budget under democratically legitimate control and/or centralised financing of public investment and other measures to tackle boom-bust cycles and competitive divergence.

Social situation improved, but problems persist

Our analysis shows that the social situation has improved in the EU, but differences across countries and sections of the population are huge and economic growth alone cannot improve many of the remaining social difficulties.

On average, the unemployment rates across European countries are back at their pre-crisis levels. The long-term and very-long-term unemployment rates, the NEET's rates, the share of employees working above 50 hours and the job strain index are also improving. However, **there are still 17 million people unemployed and even more underemployed, and** in Greece, Spain and Italy unemployment is still markedly above the pre-crisis levels.

Regarding living standards and inequalities, the median income has increased in almost all European countries except countries hardest hit by the crisis. In Greece, the real median income is just two thirds of its level in 2008. For the EU as a whole, income is now distributed in a slightly more uneven way among the poorest half of the population. The severe material deprivation rate in Europe has decreased since 2005 in general but not in southern Europe. Heterogeneity across countries has decreased, but still remains. Overall, we forecast a declining poverty rate among European countries up to 2020 (Table 2).

In most countries under review, female labour force participation has risen, favoured by increasing women's education. The male breadwinner model increasingly belongs to the past. There are clear synergies between education, employment and gender equality. Achieving the gender equality objective requires a strong commitment of European institutions to put gender at the core of the European Employment Strategy.

Data show that various aspects of the quality of life have improved in the last decade. Although the crisis had an impact and worsened the quality of life, especially in Greece, negative effects could be cushioned in some areas. The proportion of the population reporting unmet needs for medical examination, for instance, actually decreased compared to 2008 in most countries, as did the share of early school leavers. Housing costs have increasingly become a problem; no progress was made in increasing the share of collective transport modes pointing to the need for public investment plans to sustain mobility while reducing CO_2 emissions.

Policy makers need to be aware of possible trade-offs and synergies between economic, social and environmental goals in general and the SDGs in particular. Table 1 illustrates some of these trade-offs and synergies between the different goals.

In facts, there seems to be more synergies than trade-offs between the goals analysed here. However, the synergies are policy-dependent: some policies might help attain several goals (for example promoting employment with active labour market policies or promoting employment opportunities for mothers by providing childcare) while others imply trade-offs (for example promoting low-paid precarious jobs with flexibilisation of labour market).

In line with the SDGs and intended goals of the European Pillar of Social rights with its three main dimensions of equal opportunities and access to the labour market, fair working conditions and social protection and inclu-

sion we aim to promote policies that address these goals. It is indeed necessary to combine active labour market policies with other measures to overcome the direct and indirect negative consequences of unemployment. These policies have to jointly address the demand and supply side on the labour market.

Table 1. **Synergies between social goals and economic growth**

	Ppoverty/ Inequality	Employment / Unemployment	Education	Gender inequality	Growth
Poverty/Inequality					
Employment/Unemployment	**0**				
Education	**+**	**+**			
Gender inequality	**++**	**+**	**+**		
Growth	**0**	**0/+**	**+**	**0**	

Interpretation: + : existence of synergies ; 0 : ambiguous or no relationship.

Expanding social investments to face the increasing demand for care addresses several key principles of the European Pillar of Social Rights and also helps to reduce emissions. This means higher public spending and tax ratios. Those can be attained through higher taxation on top income, corporate profits and wealth.

The environmental boundaries require pro-active industrial policies fostering the transition towards more ecological investments in order to meet the +2°C target. Growing cities need affordable housing and public infrastructure including transport; these will also increase the demand for labour.

Innovative concepts to reduce individual working hours are highly welcome as they ease the environmental sustainability/employment trade-off; they can be implemented in various forms. Whereas part-time working employees often want to increase their working hours, full-time employees working overtime often want to decrease their workload. In addition, stress-related diseases like occupational burnout are becoming a widespread phenomenon.

Increasing collective bargaining coverage would help bring down low-paid work, to ensure decent incomes and can be a tool of organised working time reduction.

Climate debt: EU has exhausted its procrastination capital

Climate change is arguably the most serious challenge that we collectively face. The 2015 Paris Agreement, based on the IPCC review of scientific evidence, has achieved a global consensus about the boundaries that should constrain greenhouse gases emissions to prevent global warming. Almost all countries agreed to cooperate in order to keep the increase in global temperature under 2°C above pre-industrial levels and to substantially accelerate their efforts to limit the global temperature change as close as possible to +1.5°C.

Computing carbon budgets can be useful to warn policy-makers about the effort to be delivered in order to put society on the road to sustainability. A carbon budget can be defined as a statistical indicator of how much carbon dioxide can be released in the atmosphere before we cross given temperature-change thresholds. As global warming is almost linearly related to cumulative emissions of carbon dioxide only the cumulated quantity matters, regardless of the emissions trajectory.

Globally, we should not emit more than 1,320 billion tonnes of carbon dioxide ($GtCO_2$) from now until the end of time, if we want to ensure a probability of 67% that global temperature change will remain below +2°C from preindustrial levels. This figure is substantially lower, at 570 $GtCO_2$, if we consider the 1.5°C threshold instead.

Computing global carbon budgets is subject to methodological debates but remains less controversial than the way of sharing these budgets between regions and countries. There are important normative implications of burden sharing, that cannot be solved by a technical discussion. The literature has underlined a continuum of burden sharing methods, whose two endpoints are the egalitarian approach (granting each human being the same right to emit) on the one hand and full grandfathering (allocating rights to emit CO_2 based on a countries' past emissions—of a given reference year) on

demanded by the mitigation of climate change. It is within our reach, making a failure to address it even more condemnable. Smart policies, implemented early enough, could produce a less costly reduction of emissions. However, current policies are woefully inadequate. Hence, the procrastination scenario is more likely (Table 2) ■

Table 2. **Growth, poverty and CO2 emissions forecasts for the European Union**

	GDP *(volume, In %)*				Poverty rate *(In % of households)*				Change in Co_2 Emission *(in %)*			
	2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
DEU	2.5	1.7	2.0	1.8	16.1	16.1	16.1	16.1	-0.3	0.0	-0.7	0.8
FRA	2.3	1.7	1.8	1.5	13.3	13.2	13.1	13.1	0.4	0.1	1.7	1.1
ITA	1.6	1.0	1.1	1.0	20.3	20.1	20.0	20.1	-1.4	1.1	-0.5	1.5
ESP	3.1	2.6	2.4	2.0	21.6	21.3	21.0	20.8	-1.0	0.8	-1.0	2.0
NLD	3.0	2.8	2.3	2.0	13.2	13.2	13.1	13.0	0.0	-0.6	0.3	1.9
BEL	1.7	1.6	1.8	1.7	15.9	15.8	15.7	15.7	-0.2	0.4	0.6	-1.3
FIN	2.8	2.7	1.8	1.5	n.a	n.a	n.a	n.a	-4.0	0.7	2.7	-1.4
AUT	3.1	3.0	2.0	2.0	14.4	14.3	14.2	14.2	-0.5	-0.2	0.0	-2.4
PRT	2.7	2.1	2.0	1.9	18.3	18.2	18	17.9	-2.5	0.5	2.4	-1.0
GRC	1.3	1.9	1.7	2.1	20.2	19.9	19.6	19.4	-1.9	0.5	1.3	-1.4
IRL	7.2	6.8	3.5	3.5	16.4	16.8	16.8	16.8	-2.1	3.3	2.0	-2.3
Other euro area[1]	3.5	3.4	2.5	2.4	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
EUZ	2.5	2.0	1.9	1.7	17.1	17.0	16.9	16.9	0.6	0.3	0.0	0.8
GBR	1.7	1.3	1.5	1.5	16.3	16.4	16.4	16.4	-0.7	3.9	0.1	2.1
SWE	2.4	2.5	2.1	2.1	15.8	15.8	15.9	15.9	0.8	0.2	2.0	-0.3
DNK	2.3	1.2	1.9	1.7	12.4	12.3	12.2	12.2	0.0	0.5	2.8	-0.8
Other member states[2]	4.8	4.1	3.4	3.3	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
EU-28	**2.6**	**2.0**	**2.0**	**1.8**	**16.5**	**16.4**	**16.3**	**16.3**	**-0.6**	**0.9**	**0.1**	**0.9**

Note: The poverty rate is defined as the proportion of individuals in poor households, which are those whose equivalised disposable income is below 60%.
1. Luxembourg, Slovenia, Slovakia, Malta, Cyprus, Estonia, Lithuania and Latvia.
2. For the poverty rate and the change in Co_2 emissions, aggregates are calculated on a smaller set of countries (those available) and consists in a population-weighted average and a emission-weighted average, respectively.
3. Poland, Czech Republic, Hungary, Bulgaria, Romania and Croatia.
Sources: Eurostat, National Accounting, iASES (formerly iAGS) 2019 forecast November 2018.

SUSTAINABLE DEVELOPMENT GOALS
A NEW FRAMEWORK

On the 25th of September 2015, 193 Member States of the United Nations adopted the 2030 Agenda for Sustainable Development (ASD). United Nations Secretary-General Ban Ki-moon called the agenda a "universal, integrated and transformative vision for a better world" (UN, 2015a). The agenda sets 17 Sustainable Development Goals (SDGs) and 169 targets to achieve economic, social and environmental progress. Or, as it is framed in the preamble of the resolution states, the "agenda is a plan of action for people, planet and prosperity". It underlines the "interlinkages and integrated nature of the Sustainable Development Goals" and the necessary participation "of all countries, all stakeholders and all people" (UN, 2015b). The goals are wide-ranging, from well-being, poverty, health, education, gender equality, decent work and economic growth, reduced inequalities, industry, innovation and infrastructure, to inclusive cities, clean water, clean energy, biodiversity, climate change and peace, justice and strong institutions. Issues, which have been addressed at least to some extent by the iAGS in previous years.

Within our project team, we decided to give more importance to the ASD and its goals. Although we do not try to monitor exactly every goal, we will incorporate them in our analysis. Changing the name of our report to independant Annuel Sustainable Economy Survey—iASES—is one way to make our analytical shift more visible. As we are first of all economists, we still focus on current economic developments and its interactions with social and— to a lesser extent—environmental issues, taking our magic polygon of well-being oriented economic policy as a point of departure. We assume that the ASD should be a matter of various scientific projects from various scientific backgrounds with their respective advantages. There is no one report fits all solution. Nevertheless we go beyond the economic analysis (chapter 1), with a focus on social developments in the EU with a priority to employment, equality and well-being (chapter 2) and its consequences for global warming due to CO_2 emissions (chapter 3). Poverty and CO_2 emissions are nowcasted to fill the lag in the

publication. Important other issues such as global development, resource use or biodiversity, we leave for further research.

With this years title "The Imperative of Sustainability: Economic, Social, Environmental", we address the necessity to address economical, social and environmental sustainability in Europe. As we show in our report, concerns about long-term issues of public debt and intra-EA imbalances are much smaller than seven years before, when we published our first report. While it is true that they are still warranted, our new sustainability analysis of "climate debt", a concept to evaluate the estimated net present value of investment necessities to stay within the carbon budget available to limit global warming to the global goal of 2° Celsius, clearly show that we have to beyond economic sustainability to detect the biggest challenges ahead. Although there is no quantitative tool available to evaluate social sustainability, this topic should get more attention too. The legacy of the social crisis is still pressing at least for some parts of several European societies and might create political instability. We therefore address social sustainability issues—in an expansive, but more qualitative way—too.

Before starting with our concrete economical, social and environmental analyses, we first discuss the strengths and limitations of the ASD and the SDGs themselves. We identify five crucial points for the way forward, namely the lade of a European Sustainable Development Strategy 2030, a reform of the Stability and Growth Pact, the renewing of the European Semester and the absence of an analytical framework to deal with tradeoffs, synergies and priorities as well as of an integrated sustainable development indicator scoreboard.

Strengths and limitations

For its defenders, the SDGs constitute a major shift from the MDGs, in ambition, concept, elaboration and politics (Fukuda-Parr, 2016).

First, the SDGs are comprehensive. The SDGs have very many more targets (169) than the MDGs, which had only 21 targets. This reflects a much larger scope. The MDGs focused on poverty and its alleviation; the SDGs are about sustainable development including social, environmental and economic sustainability. According to Martens (2016), this approach offers the opportunity to respond in an integrated manner to urgent global problems. For Fukuda-Parr (2014), the restricted focus of the MDGs had the unintended consequence of diverting attention from other important issues and objectives. By contrast, the SDGs are supposed to capture the interconnections between issues and encourage integrative and systemic approaches to global problems.

Second, the SDGs are universal. The MDGs were mostly a North-South aid agenda in a "donor-recipient" relationship: the goals were relevant only for developing countries whereas developed countries provided financing and technological transfers. Conversely, many commitments in the SDGs now apply to states regardless of their level of development, although some targets are still mostly relevant for the least developed countries (for example, "end hunger"). Furthermore, the SDGs do not follow a "one-size-fits-all" approach: they take into account different national and local capabilities and circumstances and encourage the formulation of targets at the national level.

Third, the SDGs are inclusive. They were drafted after a process of multi-stakeholder debates. Whereas the MDGs were criticized for being defined by technocrats (UN staff) in a closed room, the SDGs were formulated after a political negotiation amongst states and participation of stakeholders. Nine sectors of society (women, children and youth, Indigenous Peoples, Non-Governmental Organizations, local authorities, Workers and Trade Unions, Business and Industry, Scientific and Technological Community, Farmers) have participated in the process of drafting the SDGs. It partly explains why NGOs received mostly favourably the 2030 Agenda[1]. NGOs welcome not least the fact that alternative indicators to economic growth are recognized. Economic growth with decent work for all is one goal amongst 17 others.

Although the 2030 Agenda has its supporters, it has also been heavily criticized. Just after the adoption of the UN resolution, the noted development economist William Easterly (2015) called the SDGs "Senseless, Dreamy, Garbled". For Easterly, MDGs were appealing because they were precise and measurable. On the contrary, SDGs are "so encyclopedic that everything is top priority, which means nothing is a priority", the promises are "either unmeasurable or unattainable.

In 2016, the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) proposed a set of indicators that is supposed to be annually refined. The list now includes 232 indicators. This is a considerable increase from the 60 indicators attached to the MDGs. For target 1.4[2], it proposed two indicators: 1.4.1 is the "proportion of population living in households with access to basic services" and 1.4.2 is the "proportion of total adult population with secure tenure rights

1. See for example, OXFAM press release 2015: « With policy makers, civil society and citizens around the world, OXFAM welcomes the adoption of Sustainable Development Goals by Heads of State and Government of Un member countries, while warning that progress must be tangible, have a political dimension and upset the status quo »

to land". Despite the high number of indicators, these two indicators in fact only partly address target 1.4. Moreover, the term "basic services" in indicator 1.4.1. remains too vague to be operationalized. Some targets are measurable but unattainable without drastic changes in policy that are not on the agenda. For example, target 1.2. states: "By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions". Indicator 1.2.1 is "the proportion of population living below the national poverty line, by sex and age". In the European Union, the poverty line is defined as 60% of the median equalized disposable income. Between 2005 and 2017, the average poverty rate in the European Union fluctuated between a low of 16,4% (2009) and a high of 17.3% (2016). Cutting the poverty rate by half across the European Union would require drastic changes in wage settings, social protection, tax and benefit systems, etc. that are not on the agenda. In 2017, even the Czech Republic, which has the lowest poverty rate in the EU with 9.1%, was not in line with the target.

Fukuda-Parr (2016) sees selectivity, simplification and national adaptation as potential pitfalls in the implementation of SDGs. With 17 goals, 169 targets and 232 indicators, some will inevitably get more policy attention than others. Governments will neglect targets that are too inconvenient (Saudi Arabia voted for the text which includes "End all forms of discrimination against all women and girls everywhere" as one of its targets). As has been shown above with respect to target 1.4, targets are often complex. Choosing relevant indicators requires simplifying them with the risk that over-simplification strips away the important qualifiers. A third potential pitfall according to Fukuda-Parr is national adaptation, which can reduce the political pressure on national governments. One can add that one of the advantages of international goal-setting is to standardize statistical production. This advantage is being lost if targets are adapted nationally. The creation of the IAEG-SDGs and the production of a global indicator framework only partly address this issue (for example, the definition of "basic services" might differ by country).

In its preamble the resolution states that the SDGs are "integrated and interrelated". However, this point is somewhat lost in the laundry list of goals, targets and indicators. Some of the goals may reinforce others (for example, quality

2. "By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance"

education for all and ending poverty and hunger) but others may counteract other goals (access to energy for all and combating climate change). With an extensive list of goals, priorities, synergies and trade-offs are missing. In short, what is lacking is an integrated framework.

Despite their limitations, the SDGs are gaining traction. The SDGs have created a common language used by international organizations, governments, NGOs and the private sector. They have become a focal point. Some countries (Mexico, Colombia, Finland) use the SDGs to evaluate their budget or their fiscal policy (Hege, 2018). Non-governmental actors are taking ownership of and mobilizing around the SDGs (Hege and Damailly, 2017). The SDGs have created a common base that is both inclusive and participatory. Thanks to the mobilization around the SDGs, attention is given to outcomes that go beyond standard economic outcomes. However, one can fear that the SDGs are used to evaluate the outcomes of political decisions rather than being used as inputs that would influence political decisions. As long as the SDGs are not on the top of the political agenda, they will be more a window-dressing exercise than a tool to achieve the overall goal, which is the well-being of current and future generations.

Ways forward

As we already addressed in our previous reports (see, for example, iAGS 2018, 122f.), a successful implementation of economic, social and environmental goals at the European level requires a significant change in European governance (see, for example, Katseli/Rasmussen 2018: 175) and clear priorities. Against the background of the SDGs, we identify five crucial points:

- a European Sustainable Development Strategy 2030
- a reform of the Stability and Growth Pact
- renewing the European Semester
- an analytical framework to deal with tradeoffs, synergies and priorities
- An integrated sustainable development scoreboard

Implementing an European Development Strategy 2030 and reforming the SGP

In order to close the gap between the annual political coordination process and the overarching goals enshrined in the Treaties (“well-being of its peoples”) or the SDGs respectively, the European Union needs a strategy towards 2030. Indeed, the European Council already stated in October 2018 that it is “fully committed to the 2030 Agenda for Sustainable Development and its implementation” and “a comprehensive implementation strategy” (European Council,

2018). In developing such a strategy, European institutions should reflect on the flaws and weaknesses of the Europe 2020 strategy, which constituted a similar attempt but became hardly more than a window-dressing exercise. This is, first, because the European Semester process primarily targets fiscal rules and competitiveness, not well-being or sustainable development. Second, no additional resources—like the EU budget—were used to implement the Europe 2020 strategy. Moreover, at the national level, austerity measures enforced by the Stability and Growth Pact (SGP) have reduced the means to achieve the targets. Therefore, the targets set by the new strategy must be at least as important as the fiscal and macroeconomic rules of the SGP. This is necessary in order to have sufficient room for manoeuvre to deal with trade-offs and set priorities according to the current situation and political preferences—but without getting completely rid of necessary macroeconomic coordination rules. Binding objectives could, for example, be related to (Katseli/Rasmussen 2018):[3]

- public investment and structural deficits
- public assets and debt
- current accounts
- median real disposable household income
- gender pay gap
- unemployment
- at-risk-of-poverty rate (AROP)
- income inequality (GINI)
- greenhouse gas emissions
- resource use

Renewing the European Semester

The European Semester itself must focus on sustainable development, based on new analysis tools and more coherent short-term priorities, taking synergies and trade-offs into account. Country reports and recommendations must address the whole range of economic, social and environmental challenges, not predominantly the compliance with fiscal rules. Although the threat of selectivity, simplification and national adaptation identified by Fukuda-Parr cannot be resolved ex ante, it should be considered throughout the process, helped by expert councils. The process should also include various stakeholders, especially social partners as the most representative organizations of civil society.[4]

3. A more or less extensive analysis of these indicators can be found throughout our iAGS.

Although there is no objective way to measure well-being and some goals might be wrongly perceived as more important/relevant than others and some might be more costly to achieve than others, democratic decisions are the only way forward to balance different subjective preferences in societies.

An analytical framework

As an analytical framework for economic policy making, we propose once again (see also iAGS 2017 and 2018) a "magic polygon for well-being oriented economic policy". This concept is similar to the well-known 'magic square' but entails more concrete economic, environmental and social goals as well as a more in-depth treatment of economic stability. To some extent, the goals of this concept are already incorporated in Article 3 (3) of the Treaty of the European Union. Following the critique of GDP growth as a goal in itself instead of a means to achieve well-being brought forward by Stiglitz et al. (2010), we replace growth by "fairly distributed material well-being", "quality of life" and "ecological sustainability" and—as a consequence of the recent crisis—add "financial stability" and "stable public sector activity" as further goals for economic sustainability. Since some of these goals are at odds with each other (particularly low inflation and full employment), in practice the 'magic' involves achieving these goals simultaneously as far as possible, taking the current economic situation into account. So for example, when the inflation target is met, full employment should be a higher priority. Although our concept is narrower than the SDGs, it can serve as a link between the broader vision and evidence-based economic policy-making, if backed by a detailed set of indicators for the more specific targets (e.g. see Feigl/Wukovitsch 2018).

Another possibility would be to measure stocks of capital, as it would offer a synthetic measure of sustainable development. If sustainable development is defined as ensuring the needs of the present generation without compromising the ability of future generations to meet their own needs, then measuring stocks of natural, human, social and physical capital makes sense. In this framework, sustainability implies that a decrease in one kind of capital (for example natural capital) can and needs to be offset by an increase in other forms of capital (for example human or physical capital). The main advantage of this approach is to be truly integrated. Trade-offs are measured with a price system and are therefore quantified. However, the capital approach also has its limita-

4. As an example of civil society incorporation, see the italian Alliance for Sustainable Development (ASviS 2018).

tions: one need to value many assets for which there are no markets (for example biodiversity), which usually generates no robust and highly contestable results; even when there are market values, they do not necessarily reflect how the different assets matter for future well-being; one also need to assess the substitutability between the different forms of capital, and this may be constrained. Furthermore, not all relevant aspects can be transformed into a form of capital, especially not the ones attributed to the quality of life. This is why we suggest not to take this approach as a starting point, but to examine ways in which it can be developed further, and use it only as a complementary analytical framework.

An integrated sustainable development scoreboard

Eurostat has made available a set of 100 indicators to monitor the progress of the 17 SDGs in the EU (Eurostat 2017). They contain for example the Europe 2020 target indicators or most of the indicators mentioned in I.2.1. Although the set is better suited to monitor the progress of the SDGs than the full UN list of indicators, it should be further consolidated for the political and public debate – and augmented especially by macroeconomic indicators necessary to monitor the polygon's economic stability goals or the list of binding targets in a renewed Stability and Growth Pact. Neither a too extensive set of targets and indicators (which is implicitly a non-decision) nor a single, newly constructed synthetic indicator (which implicitly delegates decisions to academics) is an alternative to measure progress: In order to mobilize scarce resources and political momentum, we need something in between capable to steer the selection process of priorities. Furthermore, to become relevant, the ability to forecast, rather than track past performance, is important. For most indicators, there is no methodology to calculate serious forecasts so far. In chapter 1 and 2, we try to approach this aim with nowcasting exercices of CO_2 emission and poverty, but further research has to be done. In the meantime, we should give a qualified intuition about progress, for example by displaying the gap between current and target values (e.g. Eurostat 2018) or trends in the short (e.g. Feigl/Wukovitsch 2018) and medium (e.g. Lindner 2018) run. A promising example is the APPS Index developed by the Fondazione Eni Enrico Mattei, published first in the 2017 ASviS report (ASviS 2017). On the webpage, the index—which is based on 27 indicators selected by relevance, availability and possibility of projecting their trends up to 2030—is now available for many countries (Fondazione Eni Enrico Mattei 2018). In case of the EU, the overall Index is expected to be marginally lower in 2030 compared to 2007 under the business-as-usual-assumption.

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MENACES TO RECOVERY
THE ECONOMIC OUTLOOK OF THE EUROPEAN UNION

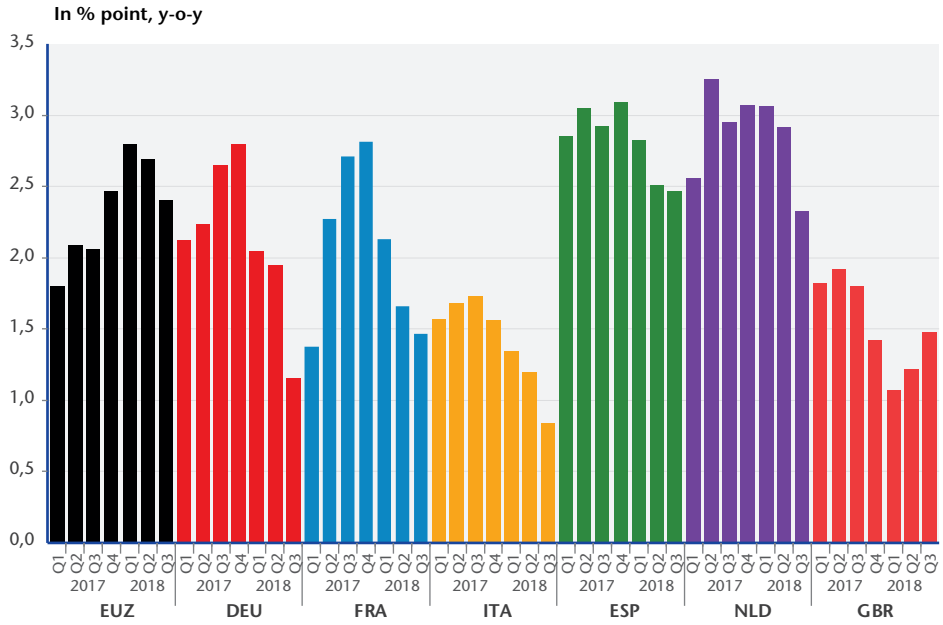
After the double dip of 2008-2009 and 2011-2013, the economic outlook in the euro area experienced an upturn which resulted in healthy 2.5% GDP growth rate in 2017, against 1.9% the previous year. This recovery has helped to reduce the imbalances resulting from the crisis. The unemployment rate fell by almost 4 points between 2013 and 2017. Budget deficits decreased from 6.2% in 2010 to 1 % in 2017, which led to the stabilization of public debt. The current account imbalances have also apparently stepped back. However, there are still challenges ahead. There are signs of economic slowdown since the start of 2018 and new tensions have emerged that might threaten the recovery (Section 1). Although public debt is stabilizing, the current fiscal rules are still stringent and may constrain some countries to implement consolidation (Section 2). The current account imbalances have receded but not vanished and nominal adjustment is still needed (Section 3) still raising the issue of wage adjustments and wage policy in the euro area (Section 4). Those further adjustments mainly rest on the same countries, those most weakened by the crisis, pointing out the need to improve European governance (Section 5).

I.1. Growth under tensions?

Statistical information available for 2018, indicates some signs of slowdown of growth (Figure 1) coinciding with a revival of political and financial turmoil. The hard bargaining over Brexit, and its still uncertain outcome, the trade war launched by the United States, the standoff over the 2019 Italian budget as well as the turbulence in some emerging countries darken the economic outlook and highlight a set of downside risks. These clouds do not call fundamentally into question the growth path, either because their negative effects should be moderate, or because these tensions could vanish without creating additional

shocks. We do, however, forecast a slowdown in the GDP growth of the European Union between 2018 and 2020, largely resulting from the gradual drying up of the post-Great Recession recovery momentum and the convergence of growth rates towards a lower potential pathway. Given the downward risks especially due to external factors, internal sources for growth—investment and private consumption—should be strengthened by an appropriate *policy mix*.

Figure 1. **Growth in the European Union**



Source: Eurostat.

1.1. The end of a cycle more than the beginning of a crisis

In the third quarter of 2018, annualised (y-o-y) GDP growth in the euro area eased back to 2.1%, with growth in that quarter stalling in most euro zone countries. The growth rate has declined since the 2nd quarter of 2017 where the annualised rate reached a peak at 2.8%. In the United Kingdom, the pronounced growth slowdown is confirmed. On a yearly basis, GDP grew by 1.2% in the second quarter of 2018, a 0.5 point decline since the British vote for Brexit. It should be noticed, however, that the slowdown was already on track at the time of the vote and that the peak of growth was observed at the end of 2014; GDP grew by 3.1% year-on-year.

The growth observed in the major European economies in recent years has helped to reduce the output gaps that had been negative since 2008. However, as these gaps are closing, recovery will progressively come to an end, and growth is expected to converge to a pace equal to its longer-term potential. Estimates of labour productivity and labour force trends suggest, moreover, a decline in underlying potential growth.

Over the forecast horizon, the growth path will be affected by shocks affecting economies. In the short term. The negative shock related to the oil price increase between 2017 and 2018 will knock 0.3 percentage point of 2018 growth in Germany, France and in the United Kingdom and 0.4 point in Spain. This increase in energy prices reduces the purchasing power of households in European countries and increase the production costs of firms.

1.2. **Fiscal policy: back to neutrality**

In the euro area, the widespread consolidation phase has ended and the aggregate fiscal impulse will be slightly positive in 2018 (0.3 point) and 2019 (0.2 point). Then, if the Member States stick to their Stability Programmes (SP) for 2018-2022, the aggregate fiscal impulse will be slightly negative in 2020 (-0.1 point). It is important to notice that governments tend to announce a respect of the strict rules of the European governance in their SP but they finally vote budgets that stick to a minimalistic view of the rules. Thus, fiscal impulse may be more accommodative in 2020.

In 2018 the fiscal boost is particularly strong in the Netherlands, Spain, Portugal and in Germany (Table 3). In 2019 fiscal policy will remain expansionary in Germany and in Austria. The Italian government has also announced a significant fiscal impulse (1.0 point) that deviates significantly from the rules of the preventive arm of the Stability and Growth Pact (SGP). On the other hand, France will implement a restrictive policy, enough to keep the nominal deficit under 3% of GDP, in spite of the important one-off cost linked with the transformation of the tax-credit on the firm wage bill (CICE) into a permanent cut of social contributions. In 2020, Germany, Austria and Italy are forecast to maintain an expansionary fiscal impulse, while France, Portugal and Spain implement a structural adjustment close to the benchmark target recommended by the European governance.

To judge the impact of the policy on growth, it is necessary to take into account the detail of the budgetary instruments used by governments and the timing of their implementation. In 2018, the aggregate fiscal policy will support growth by 0.3 point in the euro area. The positive fiscal impulse in Spain, a country

Table 3. **Discretionary fiscal impulse (point of GDP)**

	2018	2019	2020
AUT	+0.3	+0.2	+0.2
BEL	+0.2	+0.4	+0.1
CYP	-0.3	+0.7	+0.7
EST	-0.8	-0.1	+0.2
FIN	+0.3	-0.2	-0.1
FRA	0.0	-0.2	-0.3
DEU	+0.3	+0.6	+0.2
GRC	+0.1	+1.1	+0.4
IRL	0.0	-0.1	-0.6
ITA	0.0	+1.0	+0.1
LVA	+0.7	0.0	-0.5
LTU	+0.1	+0.0	+0.1
LUX	+0.3	+0.2	+0.3
MLT	+2.5	+0.1	+0.2
NLD	+0.5	-0.3	-0.2
PRT	+0.4	+0.5	-0.3
SVK	+0.1	+0.1	-0.1
SVN	+0.9	+0.5	+0.1
ESP	+0.9	0.0	-0.4
EUZ	**+0.3**	**+0.2**	**-0.1**

Source: Ameco (November) and iASES (formerly iAGS) 2019 computation.

with an open output gap, has a significant positive impact on aggregate output. This will remain so in 2019 (+0.2 point). Italian fiscal policy, in a context of open output gap, plans significant measures in favour of households. However, the expansionary impact of the fiscal impulse would be lower than expected if interest rates strongly move up. Italian sovereign rates have surged, linked with doubts on the intention of the new Italian government to preserve sound public finances. If the increase of the sovereign spread is transferred to the interest rate of new credits to the private sector the crowding out effect will be more important and diminish—or in the worst case scenario erase—the support to growth. Therefore, the introduced expansive measures—especially the income support for poor households—should best be financially balanced by measures with low multipliers such as wealth-related taxes to calm markets and thus avoid harmful effects on growth.

If Member States implement the policies announced in their SPs, fiscal policy won't support growth in 2020. However, its impact would be roughly zero in spite of a negative fiscal impulse. The closure of the output gap observed in the monetary union will reduce the size of the multipliers associated with the negative fiscal impulse, while the impact of past fiscal policy would support growth (Table 4).

Table 4. **Euro area Aggregate Fiscal Stance**

In potential GDP points

	2017	2018	2019	2020
Discretionary Fiscal Effort (bottom-up approach)				
iASES (formerly iAGS) 2019	-0.1	-0.3	-0.2	+0.1
Change in structural balance (top-down approach)				
iASES (formerly iAGS) 2019	0.0	-0.2	-0.3	-0.1
Impact on GDP				
iASES (formerly iAGS) 2019	+0.3	+0.3	+0.2	0.0

Source: Ameco and iASES (formerly iAGS) 2019 computation.

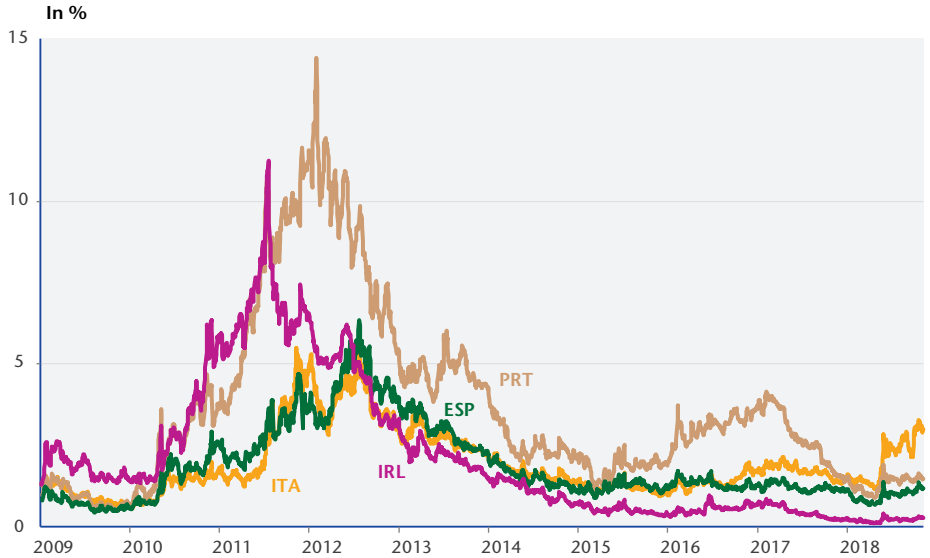
Taking into account the forecast downward risks and that the unemployment figures, while improved, are still quite far away from full employment, the broadly neutral fiscal stance seems appropriate for the Euro area, enabling debt ratios to continue to come down. There is however still an open debate related to national fiscal policies as countries with the higher unemployment rates are also those with higher debt. The trade-off between short term (full employment) and long term (debt sustainability) goals remains a critical issue as emphasized in iAGS 2012 and iAGS 2013 reports.[1] Although the projected net public investment rate is expected to turn slightly positive after years of shrinking public capital (EA +0.1% of GDP in 2019), member states should use the balanced budget multiplier to increase investment—and therefore employment and growth—in a fiscally neutral way. Considering the challenges ahead (digitalisation, climate change, growing cities, wealth inequalities…), the euro area needs an accelerated growth of public capital.

1. See Part II for an update on the debt sustainability analysis.

1.3. The fear of a new crisis in the euro zone?

The draft budget proposed at the end of September by the Italian government exposes the government to a fierce battle with the Commission. Beyond the compliance of the draft budget, the prospect of a higher budget deficit for 2019 (2.9% according to the Commission and 2.4% according to the Italian government vs. an initial commitment of 0.8%) also trigger stress on the Italian sovereign yield and the fear of a new crisis in the euro area. The market interest rate on Italian 10-year bonds jumped 0.7 percentage point after the announcement of the budget. It had already increased by 1.3 points in May. Thus, at the end of October 2018, the spread with the German rate was 2.8 points, against 1.5 on average in January 2018. The Italian government is thus under pressure, although limited in the short run by the above average-maturity of seven years. However, current tensions on Italy's sovereign yield do not reach the peaks seen at the worst of the sovereign debt crisis in 2012 (Figure 2). The risk of contagion from the rise in Italian rates to the other countries of the euro zone, especially Spain, has remained very limited so far.

Figure 2. **Sovereign yields in the euro area**



Source: Thomson Reuters.

Since his election, Donald Trump has embarked on an aggressive trade policy with his economic partners leading to an increase in certain tariffs. While the main threats and sanctions have been directed against China, accused of unfair

trade practices, Europe is also under threat. However, we base the forecast on a status quo scenario between the United States and the European Union. Under these conditions, trade tensions would mainly affect the US and Chinese economies and the impact on European countries would be negligible as long as a trade war does not trigger turmoil in the financial markets.

1.4. Growth is holding up

Growth will be somewhat lower in the EU in 2018; 2% after 2.6% in 2017 (Table 5). In the euro area, the sum of the various shocks has only had a marginal effect on growth, the slowdown resulting mainly from the gradual end of the recovery. This is notably the case in Spain, with growth decreasing from 3% to 2.6% between 2017 and 2018. In Italy, the growth rate is forecast to be lower in 2018 than in 2017 (1% after 1.6%) and then rise slightly in 2019 (+ 1.1%) in to the wake of the expansionary fiscal policy. The growth perspectives of the French economy will also be shaped by the fiscal calendar, which would result in a slowdown in 2018 before a slight rebound in 2019. Finally, supply constraints combined with negative shocks to exports (and temporarily in the automobile industry) will lead to a growth slowdown in Germany. GDP be reduced from a peak at 2.5% in 2017 to 1.8% in 2020. In the United Kingdom, the decline in growth is the result of both an adjustment of investment and the loss of purchasing power of households in relation to higher inflation. Spill-over effects on other European economies will be limited—provided a hard Brexit is avoided (see 1.5 below). In most countries poverty rate would decline while CO2 emissions would grow in 2018 for Spain, Italy and the United Kingdom but would remain stable in Germany and France.[2]

With the exception of the United Kingdom, the prospect of continued if more subdued growth would allow the unemployment rate to continue to fall in 2018 and 2019 (Figure 3), especially as productivity cycles are closing in several countries. Unemployment in Germany is expected to remain below 4%. Conversely, the decline would continue but France, Italy and Spain would be remain far from full employment. Despite a convergence overall towards the unemployment rate observed in 2007, the gap would still be significant in France, Italy and Spain.

2. Methodologies used to compute forecasts for the poverty rate and CO2 emissions are detailed and discussed in chapter 2 and 3 respectively.

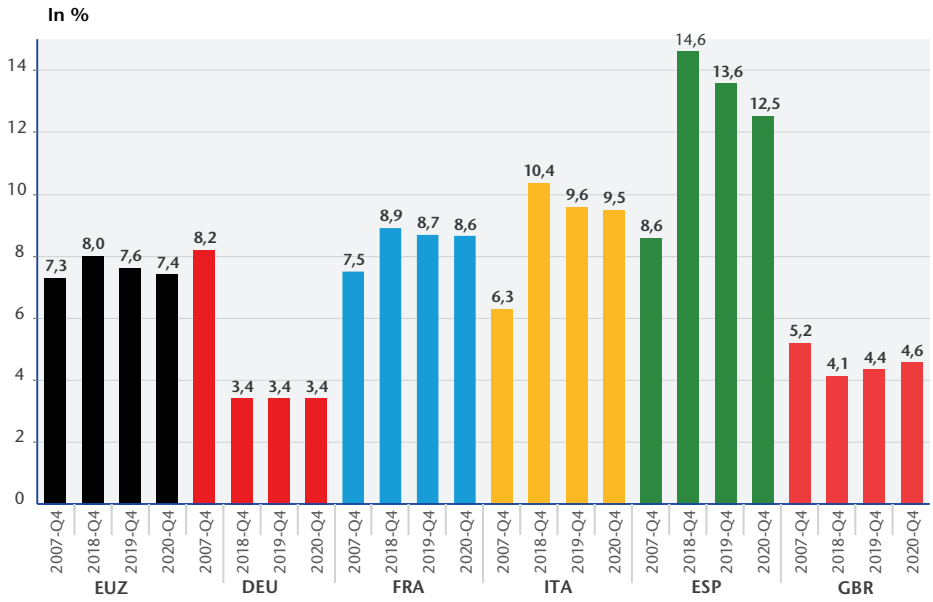
Table 5. **Growth, poverty and CO2 emissions forecasts for the European Union**

	GDP *(volume, In %)*				Poverty rate *(In % of households)*				Change in Co_2 Emission *(in %)*			
	2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
DEU	2.5	1.7	1.7	1.8	16.1	16.1	16.1	16.1	-0.3	0.0	-0.7	0.8
FRA	2.3	1.7	1.8	1.5	13.3	13.2	13.1	13.1	0.4	0.1	1.7	1.1
ITA	1.6	1.0	1.1	1.0	20.3	20.1	20.0	20.1	-1.4	1.1	-0.5	1.5
ESP	3.1	2.6	2.4	2.0	21.6	21.3	21.0	20.8	-1.0	0.8	-1.0	2.0
NLD	3.0	2.8	2.3	2.0	13.2	13.2	13.1	13	0.0	-0.6	0.3	1.9
BEL	1.7	1.6	1.8	1.7	15.9	15.8	15.7	15.7	-0.2	0.4	0.6	-1.3
FIN	2.8	2.7	1.8	1.5	n.a	n.a	n.a	n.a	-4.0	0.7	2.7	-1.4
AUT	3.1	3.0	2.0	2.0	14.4	14.3	14.2	14.2	-0.5	-0.2	0.0	-2.4
PRT	2.7	2.1	2.0	1.9	18.3	18.2	18	17.9	-2.5	0.5	2.4	-1.0
GRC	1.3	1.9	1.7	2.1	20.2	19.9	19.6	19.4	-1.9	0.5	1.3	-1.4
IRL	7.2	6.8	3.5	3.5	16.4	16.8	16.8	16.8	-2.1	3.3	2.0	-2.3
Other euro area[1]	3.5	3.4	2.5	2.4	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
EUZ	2.5	2.0	1.8	1.7	17.1	17.0	16.9	16.9	0.6	0.3	0.0	0.8
GBR	1.7	1.3	1.5	1.5	16.3	16.4	16.4	16.4	-0.7	3.9	0.1	2.1
SWE	2.4	2.5	2.1	2.1	15.8	15.8	15.9	15.9	0.8	0.2	2.0	-0.3
DNK	2.3	1.2	1.9	1.7	12.4	12.3	12.2	12.2	0.0	0.5	2.8	-0.8
Other member states[2]	4.8	4.1	3.4	3.3	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
EU-28	**2.6**	**2.0**	**1.9**	**1.8**	**16.5**	**16.4**	**16.3**	**16.3**	**-0.6**	**0.9**	**0.1**	**0.9**

Note: The poverty rate is defined as the proportion of individuals in poor households, which are those whose equivalised disposable income is below 60%.
1. Luxembourg, Slovenia, Slovakia, Malta, Cyprus, Estonia, Lithuania and Latvia.
2. For the poverty rate and the change in Co2 emissions, aggregates are calculated on a smaller set of countries (those available) and consists in a population-weighted average and a emission-weighted average, respectively.
3. Poland, Czech Republic, Hungary, Bulgaria, Romania and Croatia.
Sources: Eurostat, National Accounting, iASES (formerly iAGS) 2019 forecast November 2018.

The decrease in unemployment rates is not expected to generate inflationary pressures even in countries with positive output gaps. In Germany, nominal wage growth will reflect the lower level of the unemployment rate without triggering a significant acceleration in the price index. Indeed, the impact of the rise in wages will be offset by a fall in the import deflator in the euro zone. Beyond these factors limiting short-term pressures, the persistence of long-term inflation expectations below pre-crisis levels may explain why inflation is not back to the level seen in previous advanced-cycle phases. Finally, several labour market reforms implemented in Europe, including the decentralization of wage

Figure 3. **Unemployment rate in the main European countries**



Source: Eurostat, iASES (formerly iAGS) 2019 forecasts.

bargaining, have reduced the power of wage earners. In addition, the lower sensitivity of wages to activity would result from a composition effect—changes in the level of education and experience—of the labour force. Using individual level data for the Eurozone before and during the Great Recession, Verdugo (2016) shows that the relationship between real wages and change in unemployment rates is still significant. The lower reactivity of wages observed at the macroeconomic level would result from a change in the composition of the labour force with a higher share of people less sensitive to unemployment. Taking together, wage dynamics will remain structurally too low to reach a core inflation target of close to 2%. As wages are the main tool to foster the inclusiveness of growth, the European agenda should incorporate structural reforms in favour of employees (see Section 4).

1.5. Asymmetric risks

The current scenario is characterized by several negative risks, so that the growth forecast for 2018-2020 could appear as a maximum level under the assumption that the various risks do not materialize.

Thus, in the event that no agreement is reached between the United Kingdom and the European Union, the WTO rules would apply to the United Kingdom's trade relations which would no longer benefit from the agreements signed by the Union. This would result in higher tariffs and a return of restrictions on the mobility of people and capital. The negative effect on UK exports could be partially offset by a depreciation of the pound sterling, which would amplify the rise in the cost of imports. Such a shock would be unfavourable for British households who would experience a reduction of purchasing power. EU27 exports to the UK would be hit. The negative effect on trade and activity could be deepened by possible relocations of certain activities. Multinational firms would like to avoid losing access to the European market. The absence of an agreement would also open a new period of uncertainty over trade relations that would add to the tensions triggered by US trade policy.

In Italy, the risk is a rate spike that increases the interest burden in the medium-term and does not allow the government to stabilize its debt in the long-term. An increase in rates would reduce the positive effect of the Italian fiscal expansion by tightening the funding conditions for agents. Given yields for Italian bonds up to 5 years duration are still below the average interest rate over total debt (3.0% in 2017), the short-term risk is not very high. However, beyond a certain threshold, markets could panic causing a snowball effect. Rising rates drive up the deficit and debt, fuelling the risk of unsustainability pushing rates higher. There is a strong self-fulfilling component in this dynamic. In the absence of panic, rates remain low and the Italian debt is sustainable. As during the sovereign debt crisis, the deterioration in growth prospects would also fuel the risk of unsustainability. The euro area now has some tools to deal with this type of risk with the EMF (European Monetary Fund) and the OMT (Outright Monetary Transactions) of the ECB. They may partly explain why, so far, contagion to other countries has been limited. These tools are, however, conditional on an agreement between euro area member countries and Italy, which would undoubtedly force the government to reconsider the direction of its fiscal policy. The worst case would be where the threat of a euro area explosion resurfaces.

I.2. Debt sustainability analysis

The fiscal consolidation implemented between 2010 and 2015 has contributed to the stabilization of public debt in most euro area countries. However, public debt ratios are still high in some countries raising the questions of their ability to bring back debt-to-GDP ratio to 60% as required by existing fiscal rules.

Besides, the announcement of a higher deficit in 2019 in Italy has triggered a new wave of tensions on sovereign debt markets. In this second part, we analyze the debt sustainability of euro countries and focus on the risk of a new episode of panic and contagion on sovereign yields.

2.1. Should euro area engage in a new episode of fiscal consolidation?

Euro area countries should in principle comply with all the relevant fiscal rules. First, the country-specific structural deficit targets, the so-called medium-term objectives (MTOs). Second, public debt is expected to converge to 60% of GDP. The reduction of debt should reach 1/20th of the spread between the current level of debt and the 60% target on average within three years. Third, an expenditure rule, which limits public expenditure growth (depending on potential growth). At present, Commission and Council focus in their evaluation of fiscal policies as well as their policy recommendations on the first rule, as it is the most restrictive one and it is at the centre of the TSCG, the so-called Fiscal Compact. However, the political attention can change quickly, notably when all EA countries will comply with the 3% rule for public deficit, as it should be the case in 2018. One has to keep all the rules in mind.

Discussions on the need for additional fiscal consolidation will not stop as long as the debt-to-GDP is above 60% and has not converged to that threshold. Therefore, we simulate the path of public debt-to-GDP ratios until 2035, which is the horizon of the 1/20th debt rule incorporated in the revised SGP and in the Fiscal Compact. The simulated path of public debt depends on our forecasts of the fiscal impulses for the euro area from 2018 to 2020. We then assume zero fiscal impulses beyond 2020. Simulations are done with a model representing the main countries of the euro area: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain.[3]

In the baseline scenario,[4] we suppose that interest rates in all euro area countries converge to the same level and that inflation expectations are anchored to the same inflation target (2%). Consequently, we consider a scenario of interest

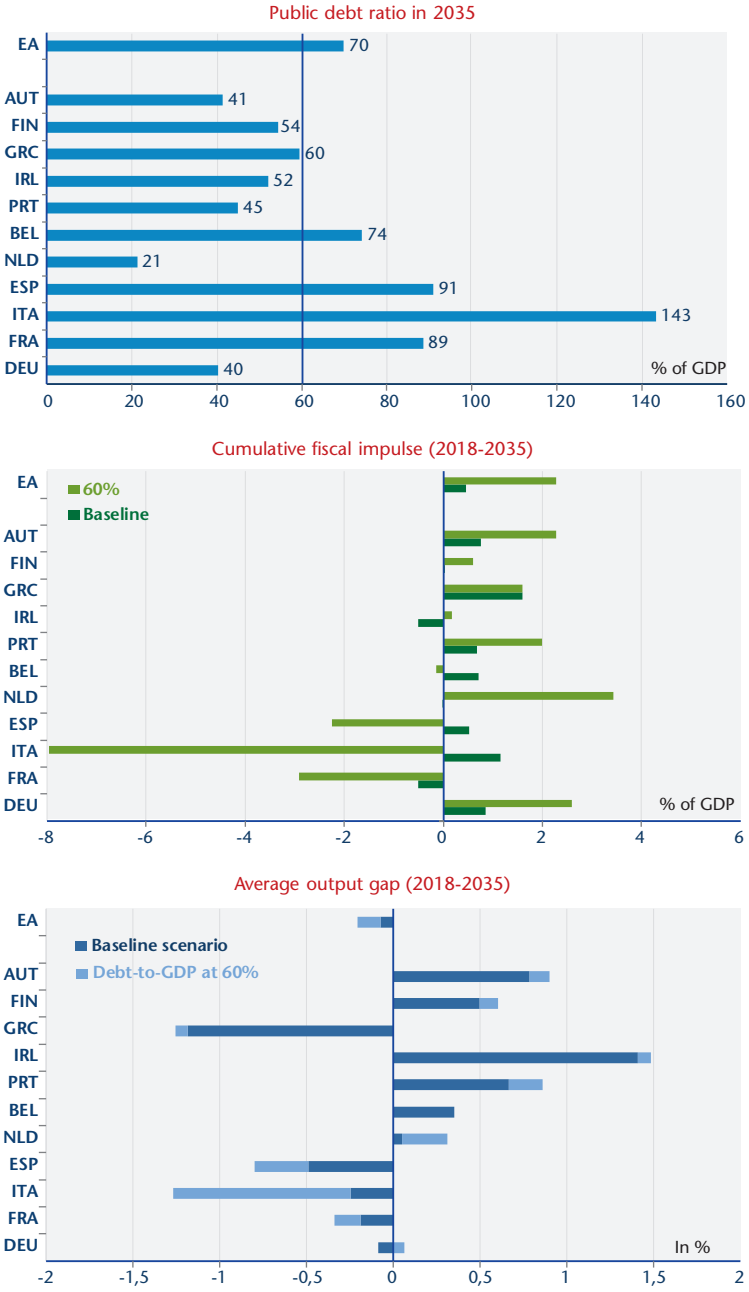
3. The impact of fiscal policy on economic activity depends on the fiscal multiplier effect, which is supposed to be time-varying. It is high when the output gap is negative (-1.5 for an output gap below -3%), equal to 0.5 when the output gap is zero and it becomes small (0.2) when the output gap exceeds 3%. Details of the model are available here https://www.iags-project.org/documents/iags_appendix2013.pdf.
4. The projected value of debt includes future stock-flow adjustments –forecasted in the AMECO database– that reduce or increase the debt ratio.

rate normalization. Risk premia decline and nominal interest rates are consistent with long-term real growth and expected inflation. Under these assumptions, we compute the debt dynamics, structural balance, inflation rate and GDP growth rate (or output gaps) from 2018 until 2035. Results are reported in Table 6 and Figure 4. The simulations suggest that France, Italy, Spain, and Belgium would not reach a 60% debt-to-GDP ratio by 2035. Consequently, these countries would have to implement additional fiscal efforts to be able to comply with the debt rule. With public debt reaching 143% of GDP in Italy, consolidation would have to be substantial. The gap would also be significant for Spain (91%), France (89%), and Belgium (74%), although while the debt ratio in Belgium would be far from 60%, it would decrease significantly between 2020 and 2035 indicating that the convergence is ongoing. Conversely, the convergence would be very slow for France and Spain, and Italy's debt would increase by 12 percentage points of GDP.

Considering a "no change in fiscal policy" beyond 2020, debt levels would decrease below 60% in other countries, providing some fiscal space. Germany and the Netherlands would be in this situation, with public debt reaching 40% and 21% respectively in 2035, but also Ireland, Finland, Austria and Portugal. Structural balances may also illustrate the situation of public finances. Italy would record a structural deficit amounting to -2.9% in 2020 and the situation would deteriorate from 2020 to 2035 because of the higher debt burden. Similar projections apply for Spain and France, but the deterioration would be less pronounced, due to a slightly decreasing public debt for these countries. Netherlands and Portugal, would benefit from a surplus, increasing the room for manoeuvre to implement more expansionary fiscal policy in the future. We also compute the decomposition of changes in debt between the fiscal surplus, "snow-ball" effect and stock-flow adjustments (see results in Appendix).

Moreover, the average output gap between 2018 and 2035 would be almost zero for the euro area with Spain and Greece being in the worst situation. Actually, France, Italy, Spain and Greece would suffer a negative average output gap over the period. The inflation rate would remain below the 2% target until 2020. This is a reason why countries should not engage in more fiscal consolidation: growth has accelerated, but some economies have not recovered from the crisis yet, and almost all countries (except Germany, The Netherlands, Austria and Ireland) still have a negative output gap in 2018.

Figure 4. **Public debt in 2035, fiscal impulse and output gap**



Source: iASES (formerly iAGS) 2019 model.

Table 6. **Public finance and output performances under the baseline scenario**

(no risk premium, no fiscal impulse beyond 2020, time-varying fiscal multiplier, hysteresis effects)

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Average output gap	Inflation rate (%)	
	(1) 2020	(2) 2035	(3) 2020	(4) 2035	(5) 2018-2035*	(6) 2018-2020	(7) 2021-2035	(8) 2018-2035	(9) 2018-2020	(10) 2021-2035
DEU	56	40	-0.2	-0.6	0.9	1.8	1.7	-0.1	1.8	2.1
FRA	94	89	-1.8	-2.7	-0.5	1.7	1.3	-0.2	1.9	2.1
ITA	131	143	-2.9	-4.1	1.1	1.0	0.2	-0.2	1.1	2.0
ESP	96	91	-1.9	-2.7	0.5	2.4	1.3	-0.5	1.5	2.0
NLD	48	21	0.3	0.6	0.0	2.4	2.0	0.0	1.8	2.2
BEL	99	74	-1.6	-1.2	0.7	1.7	1.2	0.3	1.6	2.2
PRT	120	45	0.1	2.9	0.7	2.0	1.4	0.7	1.0	2.0
IRL	59	52	-3.1	-2.5	-0.5	4.7	3.1	1.4	1.5	2.1
GRC	171	60	3.0	4.7	1.6	1.9	0.9	-1.2	1.0	2.2
FIN	60	54	-1.6	-1.6	0.0	2.0	1.1	0.5	1.4	2.1
AUT	66	41	-1.1	-0.2	0.8	2.3	1.3	0.8	2.8	2.1
EA	**84**	**70**	**-1.2**	**-1.5**	**0.4**	**1.9**	**1.4**	**-0.1**	**1.7**	**2.1**

* In the baseline scenario, fiscal impulses are equal to 0 from 2021 to 2035.
Source: iASES (formerly iAGS) 2019 model.

The next step is to assess whether countries are able to meet the ceiling by 2035. As for previous reports, the aim is to reach 60% for all countries. Then countries, which have a debt below 60% in Table 6, implement positive fiscal impulses. Considering current fiscal rules, we apply fiscal impulses capped at +/-0.5. Successive positive (if country-debt is below 60% in Table 6) or negative (if country-debt is above 60% in Table 6) impulses are implemented from 2019 until the debt-to-GDP reaches 60%. We find that almost all countries would be able to comply with the fiscal rule on public debt despite a significant consolidation effort (Italy would reach the target two years later). Yet, it may involve a significant additional effort. The cumulated effort between 2018 and 2035 would amount to 8.0 points in Italy (Table 7). In France, it would amount to 2.9 points, which is 2.4 points above the effort announced for 2018-2020. Spain would have to implement a consolidation effort of 2.2 points.

Germany would benefit from fiscal space according to the debt criterion and could implement a fiscal stimulus of 2.6 points, which is 1.7 points higher than what is currently expected and shown in Table 7. The Netherlands, Portugal

Ireland, Finland and Austria could also implement expansionary fiscal policy in this scenario. This would result in higher GDP growth. From 2018 until 2020, the average GDP growth would be 0.1 to 0.2 point higher in these countries. Conversely, growth performance in countries implementing a new wave of fiscal consolidation would deteriorate: by 0.5 point in Italy, 0.2 point in Spain, and 0.1 point in Belgium. Besides, structural balance would become in surplus in 2035 for Italy, France, Spain, Belgium, Portugal and Greece. In Italy, the surplus would reach 6.0% of GDP and 4.6% in Greece. This clearly questions the social sustainability of such a policy. As illustrated in previous reports, a trade-off obviously arises between the debt objective and the growth objective. Though almost all countries would meet the 60% debt-to-GDP ratios in 2035, it would imply a reduction in growth for countries implementing additional fiscal consolidation. Growth would then be lower in the euro area as a whole and heterogeneity in growth performance would widen. Growth would also deteriorate in countries that have already suffered from the double dip recession. The countries with fiscal space are already those in which the unemployment rate has recovered to or close to pre-crises levels.

Table 7. **Is it possible to reach a 60% debt-to-GDP ratio?**

(baseline scenario except +/- 0.5 fiscal impulses depending on public debt gap vis-à-vis 60% target)

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Average output gap	Inflation rate (%)	
	(1) 2020	(2) 2035	(3) 2020	(4) 2035	(5) 2018-2035	(6) 2018-2020	(7) 2021-2035	(8) 2018-2035	(9) 2018-2020	(10) 2021-2035
DEU	56	60	-0.6	-2.7	2.6	1.9	1.7	0.1	1.8	2.1
FRA	94	60	-1.4	0.3	-2.9	1.6	1.3	-0.3	1.9	2.1
ITA	131	70	-0.9	6.0	-8.0	0.6	0.1	-1.3	1.0	2.0
ESP	96	60	-1.4	0.6	-2.2	2.1	1.3	-0.8	1.4	2.0
NDL	49	60	-1.1	-3.5	3.4	2.6	1.9	0.3	1.9	2.2
BEL	98	60	-0.7	0.2	-0.2	1.6	1.2	0.3	1.6	2.2
PRT	119	60	-0.6	1.4	2.0	2.2	1.4	0.9	1.1	2.0
IRL	60	60	-3.8	-3.3	0.2	4.7	3.1	1.5	1.5	2.1
GRC	174	60	3.4	4.6	1.6	1.5	0.9	-1.3	0.9	2.3
FIN	60	60	-2.0	-2.2	0.6	2.1	1.1	0.6	1.4	2.1
AUT	66	60	-1.6	-2.1	2.3	2.5	1.3	0.9	2.8	2.1
EA	**84**	**61**	**-1.0**	**-0.4**	**-0.7**	**1.8**	**1.3**	**-0.2**	**1.7**	**2.1**

Source: iASES (formerly iAGS) 2019 model.

These simulations suggest that there is still a risk of a new wave of fiscal consolidation in the future, unless fiscal rules are changed or at least not applied strictly. This may still entail output costs, and add deflationary pressures for the euro area and notably in countries where the output gap is negative and the unemployment rate high (Greece, Portugal, Spain, Italy and France).

Finally, we simulate the EA economies' trajectory assuming that countries stick to the -0.5% structural surplus to GDP ratio starting from 2020. We apply a simplified MTO rule. The fiscal consolidation depends on the output gap:

- no adjustment if the output gap is lower than -4%;
- a negative fiscal impulse of 0.25 point of GDP if the output gap lies between -4% and -3%;
- a negative fiscal impulse of 0.5 point of GDP if the output gap lies between -3% and 1.5%;
- a negative fiscal impulse of 0.75 point of GDP if the output gap is higher than 1.5%.

Applying this rule, countries that need to do some fiscal consolidation to reach the 60% debt-to-GDP ratio would have to do less adjustment (higher cumulative fiscal impulse in Table 8 compared to Table 7). In that way, applying the preventive arm of the SGP starting from 2021 would be a way to spread the adjustment and to avoid dampening the current recovery. France would reach 65% debt-to-GDP ratio in 2035, Spain 68% and Italy 108%. For Greece, we assume that starting from 2020, the country does fiscal expansion until its primary surplus is 3.5%, as defined in the Memorandum.

But such an approach has also some well-known drawbacks. First, this kind of rule is asymmetric since countries that comply with the rule are not committed to doing fiscal expansion. Moreover, in the long run it implies always increasing structural balances as debt and interest burden decrease. And when debt goes below 60%, the MTO is not compatible with a stabilized debt-to-GDP ratio.

As a conclusion, firstly EA countries should not engage in additional fiscal consolidation unless output gaps are closed. Secondly, countries with fiscal room for manoeuver should use it to sustain growth in the EA. It would sustain economic activity in those countries, but with positive spillovers to the others, and maintain the fall in unemployment rate without putting at risk debt sustainability (60% debt-to-GDP ratio could still be achieved in 2035).

These scenarios are based on the hypothesis that euro area countries are not hit by adverse shocks. Sovereign yields spreads are expected to vanish rapidly. Such a scenario has recently been called into question as tensions have resurfaced after the Italian government announced a higher fiscal deficit for 2019.

Table 8. **Is it possible to reach a 60% debt-to-GDP ratio if we follow the preventive arm of the SGP?**
(Baseline scenario except fiscal impulses depending structural surplus-to-GDP ratio target starting from 2021)

	Public debt (% of GDP)			Structural balance (% of GDP)		Cumula-tive fiscal impulse	GDP growth rate (%)		Average output gap
	(1) 2020	(2) 2035	(3) 2045	(3) 2020	(4) 2035	(5) 2018-2035	(6) 2018-2020	(7) 2021-2035	(8) 2018-2035
DEU	56	39	31	-0.2	-0.5	0.8	1.8	1.7	-0.1
FRA	94	67	49	-1.8	-0.3	-2.5	1.7	1.2	-0.3
ITA	131	110	88	-2.9	-0.3	-2.0	1.1	0.2	-0.5
ESP	96	69	51	-1.9	-0.3	-1.4	2.4	1.3	-0.6
NDL	48	20	7	0.3	0.7	0.0	2.4	1.9	0.1
BEL	98	60	39	-1.6	0.2	-0.3	1.7	1.2	0.3
PRT	119	44	-1	0.1	3.0	0.7	2.0	1.4	0.7
IRL	59	25	10	-3.1	0.5	-2.8	4.7	3.1	1.4
GRC	170	94	61	3.1	1.1	4.7	1.9	0.9	-0.8
FIN	60	39	28	-1.5	-0.1	-1.1	2.0	1.1	0.5
AUT	65	30	13	-1.1	0.8	0.0	2.4	1.3	0.8
EA	**84**	**56**	**40**	**-1.2**	**-0.1**	**-0.7**	**1.9**	**1.3**	**-0.1**

Source: iASES (formerly iAGS) 2019 model.

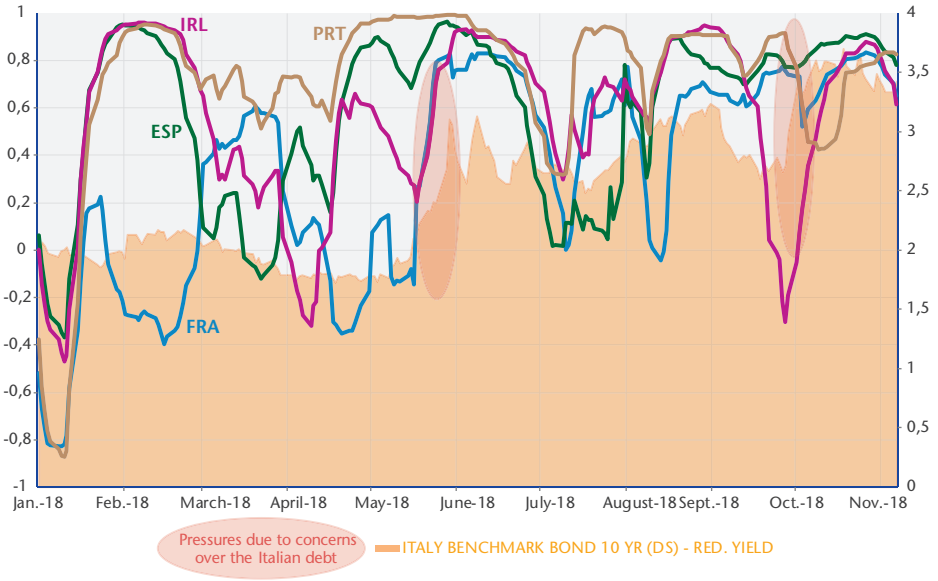
2.2. Market discipline and contagion

After a robust growth in 2017 (1.5% in real terms), we expect Italy's GDP growth to moderate to 1% in 2018 and stabilize around 1% over the 2020 horizon. GDP deflator's increase from 2017 to 2018 will not recur and it will remain rather stable over the upcoming projection period (1.2% and 1.1% respectively in 2019 and 2020). Domestic demand will continue to support growth along with a muted contribution from the external sector,[5] fuelled by higher exports and higher public spending. While the general government deficit is set to decline to 1.8% of GDP in 2018, this should be only temporary before it reaches 2.7% of GDP in both 2019 and 2020 on the back of a more-than-expected expansionary fiscal stance. Consequently, there is no downward forecast of the public debt-to-GPD ratio by 2020: it is to revolve around 131%.

5. The foreign trade contribution is set to be negative in 2018 and will remain close to zero the next two years.

While the general government deficit should stay below the 3% ceiling, its upward projection in the upcoming years has generated financial stress on financial markets. Interest rates on Italian sovereign bonds started to rise after the Italian government coalition took office in May 2018 (Figure 5).

Figure 5. **Contagion from Italy to Eurozone members**



Notes: The four coloured lines depict the correlation between the Italian CDS premium and four countries' premia, namely France, Spain, Ireland and Portugal (left axis). We calculate correlations on a 30 days rolling window with data retrieved on a daily basis. We chose these four countries because they share the highest correlations during tensions period, highlighted in the red ellipses. The latter correspond to spikes in the Italian 10Y government bond yield.
Source: Thomson Reuters.

In the next exercise, we simulate the path of public-debt-to-GDP ratio in two alternative scenarios, which departure point consists in a permanent increase in the 10 year BTP-Bund spread, from 2019 to the next general elections scheduled for May 2023 at the latest. Whilst all countries in the euro area experienced a tightening of their financing conditions at the time (compared to that of Germany), this was particularly the case of Portugal and Spain. As Portugal and Spain suffered the most from higher spreads, one can easily argue that higher risk perception towards the Italian debt path may spread to those countries in addition to Ireland and Greece (which is still under supervision of the ESM). Hence, in a second alternative scenario, we allow for contagion between Italy and the countries mentioned above. Simply put, long-term public rates in the

iAGS model[6] are defined as the risk free long-term (the German sovereign rate) augmented with a risk premium. Therefore, our first assumption is an increase of 190 bp of the Italian government bond interest rate from 2019 to 2023.[7] The three countries' risk premia—as measured by the credit default swaps premia—are highly correlated to the Italian one (0.8) and tend to increase in times of increased risk perception (Figure 6, red areas). We thus evaluate, as a second step, contagion effects on public debt path by allowing 80 % of the Italian spread shock to spread to Ireland, Portugal, Greece and Spain. We compute the debt dynamics, structural balance, inflation rate, GDP growth rate and output gaps from 2018 to 2035. Results are displayed in Table 9.

Table 9. **Increased risk perception towards Italian government bonds: Deviation from the baseline scenario**

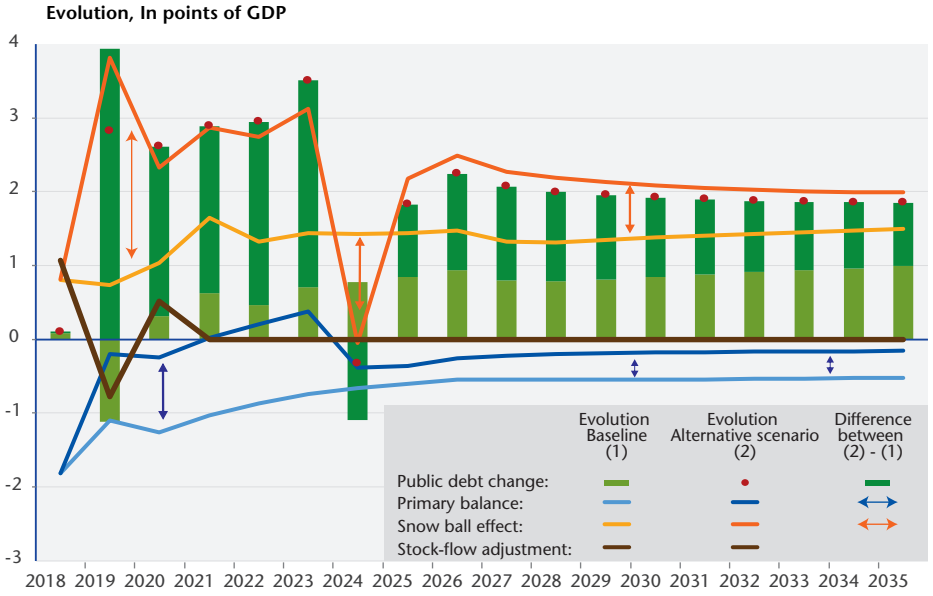
	Public debt (pp)		Structural balance (pp)		Average annual growth (pp)	Average output gap	Average annual inflation (pp)	Increase of sovereign spread to Germany (bp)
	2020	2035	2020	2035	2018-2020	2018-2035	2018-2020	2019-2023
Scenario I : 190 bp increase in the Italian government spread from 2019 to 2023								
ITA	6	24	-0.9	-1.3	-0.6	-0.4	-0.2	190
Scenario II : Scenario I with contagion to other EA members (80 % of the shock is transmitted)								
DEU	-0.3	-0.8	0.0	0.0	0.04	0.02	0.01	0
FRA	-0.5	-1.2	0.1	0.1	0.05	0.03	0.01	0
ESP	3.9	13.9	-0.5	-0.9	-0.52	-0.31	-0.17	150
NLD	-0.5	-1.0	0.1	0.1	0.06	0.03	0.02	0
BEL	-0.6	-1.2	0.1	0.1	0.05	0.03	0.01	0
PRT	6.9	18.1	-0.8	-1.1	-0.82	-0.44	-0.27	150
IRL	3.8	11.4	-0.4	-0.9	-0.67	-0.42	-0.22	150
GRC	8.5	18.4	-0.6	-1.1	-0.84	-0.52	-0.26	150
FIN	-0.5	-1.1	0.1	0.1	0.06	0.03	0.02	0
AUT	-0.4	-1.0	0.1	0.1	0.05	0.03	0.02	0

Source: iASES (formerly iAGS) 2019 model.

6. Details may be found here: http://www.iags-project.org/documents/iags_appendix2013.pdf.
7. The rationale behind this assumption stems from the fact that + 190 bp is the highest spread value reached by the Italian interest rate with respect to the German one after the end of May 2018. It is a rather conservative assumption with respect to historical values, especially during the European debt crisis in November 2011 (the maximum spread reached with respect to Germany was 400 bp at the time).

Regardless of the chosen scenario, simulations reveal that the Italian public debt ratio would increase by 6 points of GDP at the 2020 horizon compared to the baseline, and reach 137% of GDP. In the long-run, public debt is set to increase 24 points above the baseline amounting to 167% of GDP. Its deterioration is attributable to interest expense which weighs heavily on the structural balance: it adds another -1.3 points of GDP on the baseline expected deficit in 2035 (-4.1 points of GDP). The negative impact on GDP growth is quite important as the latter stumbles from 1 to 0.4 on average between 2018 and 2020. The increase in interest rates harms the private sector through the credit channel. Finally, there is a significant snow-ball effect (Figure 6) compared to the baseline scenario. Its contribution to Italy's public debt is 1.7 points of GDP on average the 2018-2023 period.

Figure 6. **Contributions to public debt in Italy**



Note: The snow-ball effect captures the impact of interest expenditure on accumulated debt, as well as the impact of real GDP growth and inflation on the debt ratio (through the denominator). The stock-flow adjustment includes differences in cash and accrual accounting, accumulation of financial assets and valuation and other residual effects.
Source: iASES (formerly iAGS) 2019 model.

Once we allow for contagion under an adverse scenario, deviations from the baseline in terms of debt-to-GDP-ratio lie between 4 and 8 points of GDP: the most affected country being Greece, whose debt settles at 179% of GDP in 2020. The situation further deteriorates after 2020, with deviations ranging from 11 (Ireland) to 18 (Portugal and Greece) points of GDP. None of them

would have a debt below 60%, fiscal space would shrink. Concerning the other EA members, public debt shrinks on a small basis at the 2035 horizon compared to the baseline (especially in France and Belgium). It stems in part from increased interest rates paid by the fragile states that forces the ECB to cut rates, which in turn reduces interest expenses and stimulates growth (it is the case for the countries mentioned above but also for the Netherlands and Finland).

As the spectre of the European debt crisis and the difficulties to reach to a solution then looms over the most fragile EA members. The European Commission called for the opening of an excessive procedure against Italy on November 21st, which had the second highest debt ratio in the euro area after Greece in 2017. Moreover, Italy represents 18% of the euro area GDP; its failure to preserve sound finances does not come without systemic risk (too big to fail).

I.3. Did current account imbalances decrease in the euro area?

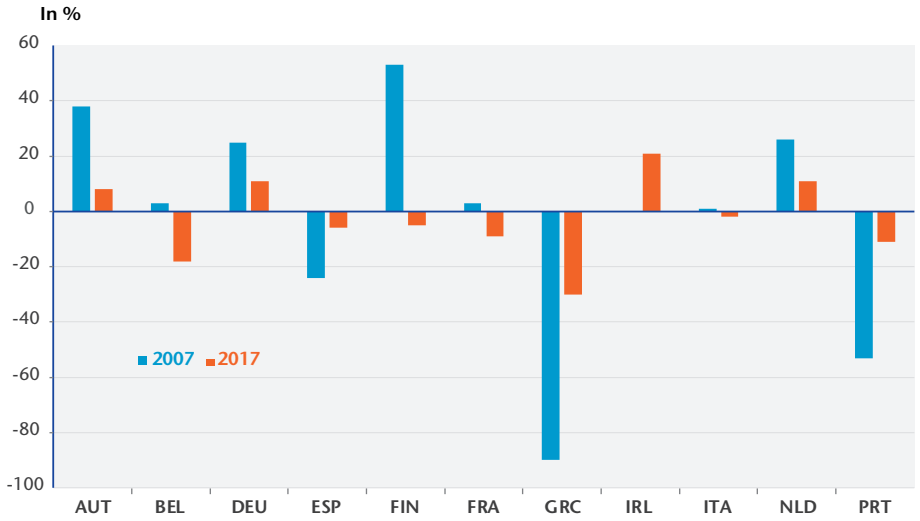
The evolution of current account imbalances within the euro area, can be performed using a "fundamental equilibrium exchange rate" methodology. The idea is to compute the adjustment of the general price level in every euro area economy that would be compatible with both an internal equilibrium (the full utilization of production factors, both labour and capital) and an external equilibrium (a current account deficit small enough to limit foreign debt accumulation—or conversely a surplus that does not lead to an excessive accumulation of foreign assets). The computation also depends on the sensitivity of imports and exports to price movements of domestic and foreign exporters.[8] Figure 7 shows the nominal adjustments that we estimate were necessary in both 2007 and 2017, computed relatively to the EA average.

Concerning the economic policy conclusions drawn from this exercise, there are three limits to this approach to keep in mind. First, there are relevant factors not primarily determined by nominal prices like the dependence on energy imports or non-price competitiveness. For example, adjustment could be achieved by fostering the national production of renewable energy, which improves the external balance and the room of manoeuvre within the carbon budget (see Section 4) at the same time. Second, one has to take into account the external imbalance of the EA as a whole relative to the rest of the world. Today, the euro

8. See Annex for a complete description of the methodology.

is undervalued, given the large trade surplus of the area. If the demand for imports is not raised by targeted policies like income increases at the bottom of the income distribution with a high marginal propensity to consume, a real appreciation is needed to go back to equilibrium, and that can be obtained either through a nominal appreciation or through price increases within the euro area. The latter solution would be preferable in order to avoid a deflationary spiral, and in that case, price increases should be higher in Germany than in Southern countries. Third, it is not straightforward how prices can be adjusted. One usually thinks of nominal wages or taxes, but this is at least partly absorbed by changes in the mark-ups. Bearing these caveats in mind, the following analysis gives an impression of the magnitude of EA imbalances.

Figure 7. **Nominal adjustments needed with respect to EA average**

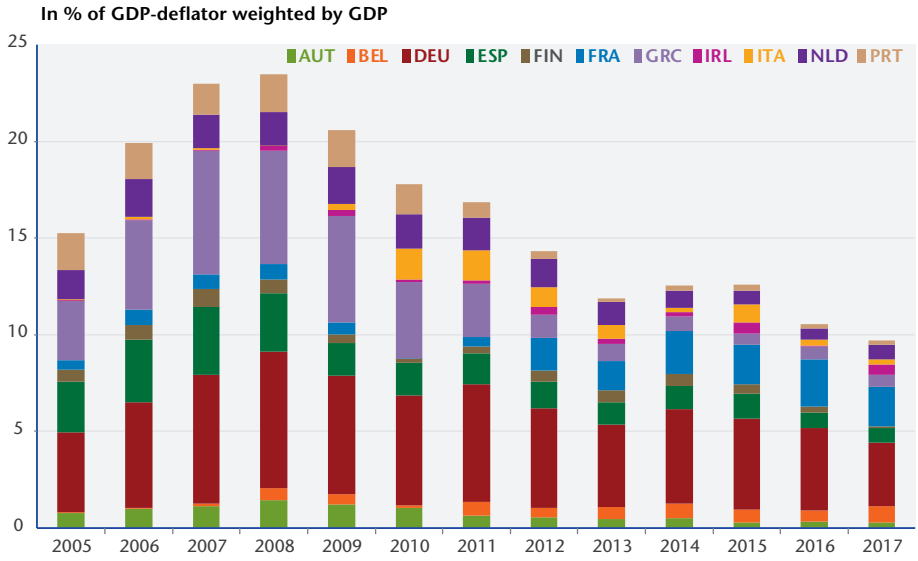


Source: iASES (formerly iAGS) 2019 calculations.

Despite a few short-term oscillations due to instability in the underlying current account data, the indicator is broadly consistent over time, and delivers a story that is consistent with well-known developments in the euro area.

We also computed in Figure 8 an aggregate indicator of nominal adjustment needs within the EA, which is the average (weighted by GDP) of the absolute value of the misalignments reported in Figure 7. We also report the contribution of each country to this indicator. This gives a measure of the heterogeneity among EA countries, while at the same time pointing to the countries that contribute the most to this heterogeneity.

Figure 8. **Indicator of intra-EA nominal misalignments, with per-country contributions***



* Compared to last year's report, the calculation of Indicator of intra-EA nominal misalignments has changed. Now it is the average (weighted by GDP) of the absolute value of the misalignments. In iAGS (2018), it was the GDP-weighted cross-country standard deviation of the per-country adjustment needs. This does not change the qualitative results on EA nominal misalignments.
Source: iASES (formerly iAGS) 2019 calculations.

The picture that emerges from these calculations is that nominal misalignments within the EA reached a peak in 2008, at the time the crisis broke out, then substantially diminished until 2013, and slightly decreased since 2015. The adjustment effort of the Southern countries (Portugal, Spain, Italy, Ireland and Greece) is then very clear, since they contributed only 25% to the indicator in 2017 against more than 50% between 2001 and 2007. This adjustment is not due simply to the contraction in demand, since the indicator calculated here corrects for relative output gaps. It is mainly induced by the contraction of wages. The indicator is however sensitive to the output gaps used.

Conversely Germany, Austria and the Netherlands diminished their nominal undervaluation, but at the same time Germany is now the main contributor to the heterogeneity, reflecting the asymmetric nature of the adjustment that took place. Italy remains at a rather well-balanced position. There is however one country which does not follow the reconvergence pattern and for which the euro is becoming increasingly overvalued, namely France. The contribution of France to the heterogeneity index has substantially increased over the last years;

a possible interpretation is that the import restraints made by southern countries by cutting wages (besides the effect of their especially heavy credit-constraining banking crisis), combined with a period of weak import growth of important trading partners like Germany, have created a potential export problem for France, that was not apparent before. Measures taken by France in the last few years to improve the current account balance have so far failed to produce their effects. However, a better way of readjustment would be the EA as a whole to follow the golden-wage-rule (Figure 12 below), as this is the only way to decrease the global imbalances caused by exaggerated EA current account surpluses and the social imbalance of still high unemployment levels in Europe (see iAGS 2018 report).

Even if the situation has improved quite substantially since 2008, it appears that there are still significant current account imbalances within the EA, especially between France and Germany, where all other things equal a relative nominal price adjustment of 20% is needed. Another way to look at the current situation is to compute projections for long-term net international investment positions (NIIP, or net foreign assets) if trade balances remained the same as today, i.e. if no nominal readjustment were done (and assuming constant asset prices and no other adjustments); the result of this exercise is given by Table 10.

Table 10. **Long-term projections for net international investment positions in the absence of nominal adjustments (% of GDP, 20-year horizon)**

AUT	BEL	DEU	ESP	FIN	FRA	GRC	IRL	ITA	NLD	PRT
39	15	183	9	15	-19	-72	186	57	224	-32

Source: iASES (formerly iAGS) 2019 calculations.

Interestingly, what these results show is that the situation for deficit countries is quite good, since all of them except Greece would arrive at an NIIP over the MIP threshold of -35% (and even Greece would improve its position relatively to today). The imbalances clearly come from Germany, the Netherlands and Ireland, which would accumulate huge foreign assets, close to 200% of their respective GDP. Again, this shows the asymmetric nature of the adjustment undertaken so far.

However, one should not forget that today the EA on aggregate has a large trade surplus, which may not last forever, since it creates upward pressures on the euro's value. If these pressures were to materialize, substantial external deficits could reappear in southern countries, possibly even leading to a new balance of payment crisis.

Current account adjustments therefore remain an important issue that should be addressed by appropriate policies, beginning with surplus countries which cannot say that they have no responsibility in the misalignment. The goal should be a still higher inflation in surplus countries, in particular Germany, in order to reduce nominal imbalances without pushing the deficit countries into deflation. Possible tools include a coordination of national wage policies over the long-term, a generalization of minimum wages in all countries, a better regulation of posted workers to avoid unfair competition, mandatory periodic wage negotiations at the branch level (which would include nominal readjustments) and so forth (see Section 4); the coordination of fiscal devaluations (i.e. tax shifting from social security contributions to VAT), the substitution of energy imports particularly in the south by stronger investment in renewable energy, and in particular fiscal reealuations in some countries (Germany, Netherlands and Ireland).

I.4. Wage developments and policy in the euro area

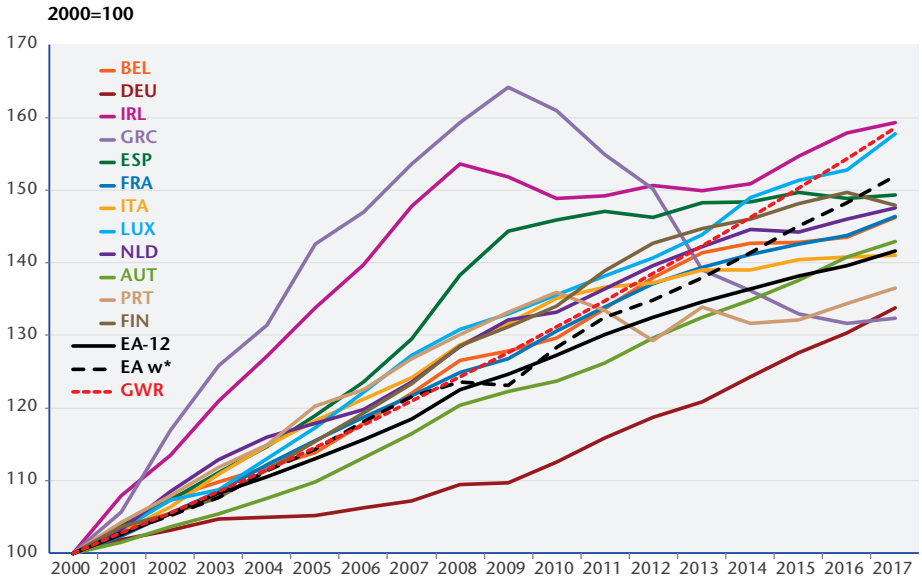
This section examines wage developments in Europe, with a focus on the twelve original (i.e. since 2000) members of the euro area. The analysis looks at both the entire period 2000-2017 and the crisis and post crisis period 2008-2017. We present nominal and real wage trends and examine how these interact with other economic variables, notably price inflation and productivity (and thus the functional distribution of income). We use two benchmarks to evaluate nominal wage trends. Nominal wage increases are measured against the sum of productivity growth and consumer price inflation (w*); this is the condition for an unchanged functional distributional income and real wages increasing in line with productivity. The second, the "golden wage rule" (GWR) takes medium-run productivity increases plus the target inflation rate of the central bank as the benchmark. This smooths out cyclical fluctuations in productivity, anchors actual inflation close to the ECB target and avoids, within the common currency area changes in competitive relations, but leaves nominal wages invariant in the face of inflation shocks.

In conclusion we look briefly at some institutional aspects of wage setting, relating both to the European and the national level, and ask how wage trends can better be anchored on a course that promotes balanced economic growth and upward convergence of living standards.

Starting with nominal wage trends (Figure 9), the most striking feature is the wide divergence in nominal wage trajectories up to the crisis, followed by a marked, but not complete, rapprochement since 2008. Very rapid nominal wage growth in Greece, Ireland and Spain was followed by a massive correction in the former, and more limited adjustment in the latter two countries. The downward adjustment has also been very pronounced in Portugal, less so in Italy, following less substantially above-average growth pre-crisis. Startling is the well-known undershooting in Germany (although working time plays a role here) and to a lesser extent Austria; only very belatedly and gradually has an upward correction been forthcoming in these two countries.

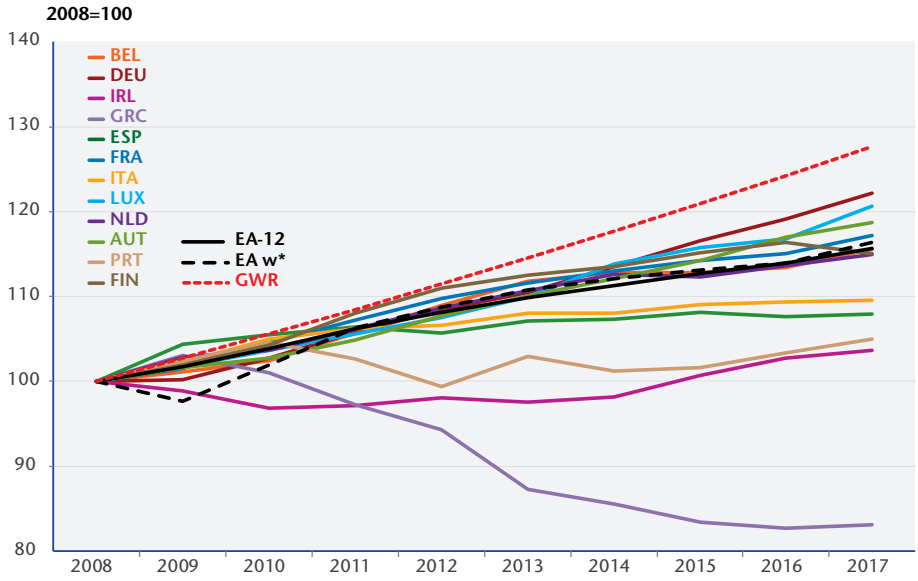
The data for the more recent period, indexed to 2008 (Figure 10), shows most countries clustering fairly close to the EA12 average, but with much lower increases in the afore-mentioned downward-correcting countries, and very substantial cuts in Greece.

Figure 9. **Nominal wage trends in the euro area 2000-2017**



Source: AMECO.

Figure 10. **Nominal wage trends in the euro area 2008-2017**



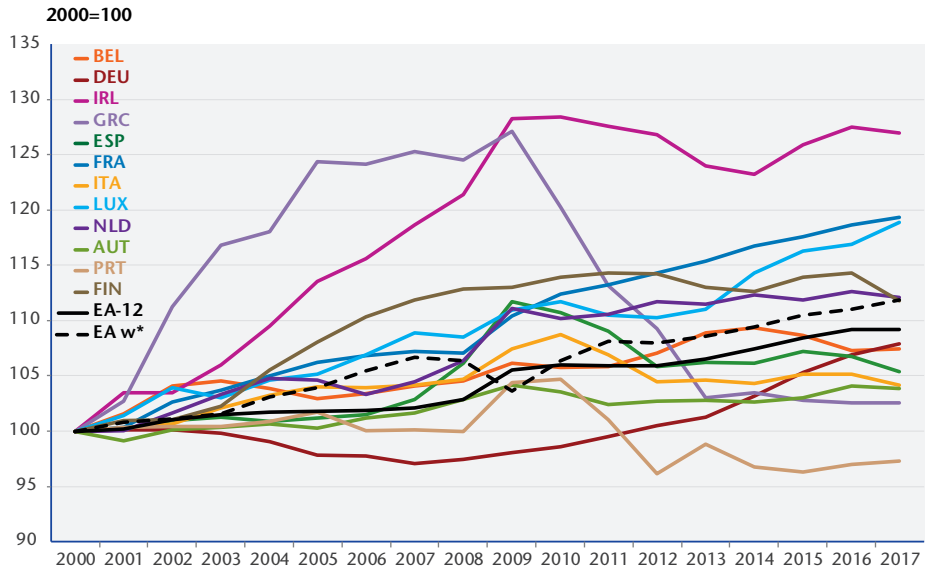
Source: AMECO.

Comparing the path of nominal wages in the euro area as a whole with the two benchmarks we see that initially wages lagged behind both measures. They began to accelerate in the immediate period before the crisis. W* dipped in the crisis (as both productivity and price inflation were hit), such that the nominal wage trajectory overtook this measure, but this was soon reversed. In the recovery period nominal wage growth has been painfully slow. By 2017 nominal wages had on average grown by ten percentage points less than the w* benchmark and a huge 17pp less than would be required according to the golden wage rule (42% compared with 52% and 59% respectively). The former gap implies a failure of real wages to keep pace with productivity and thus a falling wage share. The additional gap to the GWR is a reflection of the failure of policy-makers to anchor inflation close to the ECB target. Evidently wage-bargainers have factored in lower-than-target inflation into their pay settlements, in spite of the improving labour market situation in almost all countries. "Lowflation" is getting hard-wired into the economic system. Amongst other things this makes resolution of public debt issues more difficult and, more generally, is a factor behind still anaemic demand. In addition, it reflects the failure to correct the competitive imbalances that had built up in a symmetrical way; adjustment pressure was applied almost exclusively to the former deficit counties.

In terms of workers' incomes, real wages are, of course, what counts. Figure 11 presents nominal wages deflated using the consumer price index. In the euro area as a whole real wages per employee have increased by around 9% during the 18-year period covered. Taking actual annual productivity growth as a benchmark—the dotted black rw* line—real wages have thus lagged behind the productivity benchmark throughout the period, apart from an intermezzo in the depths of the crisis. As of 2017, real wages would need to increase by more than 2 ½% to close the gap.

Focusing just on the post-crisis years, real wages have been growing on average at a rate very close to that of productivity. Thanks to the impact of the crisis year, the overall effect has been a partial reversal of the previous, much more substantial, functional-income shift in favour of profits.

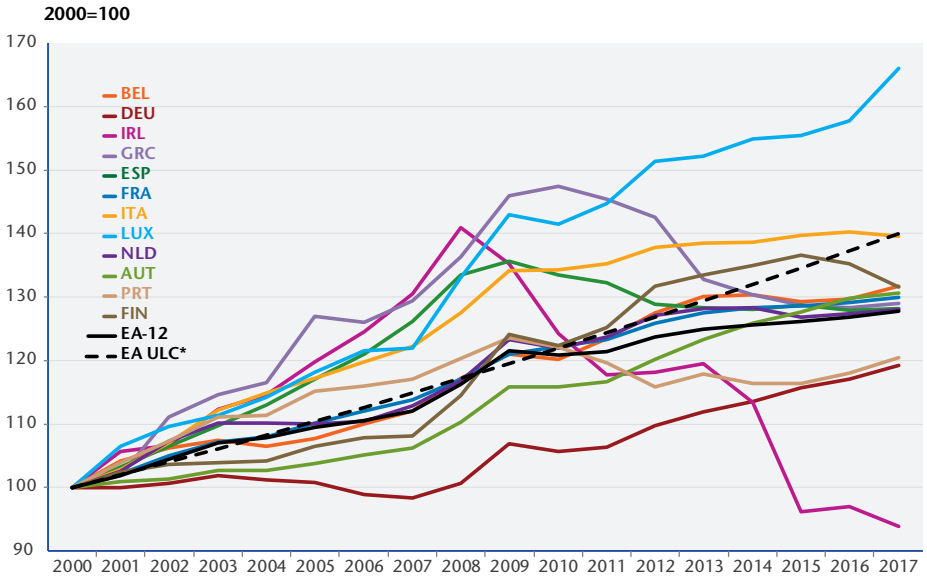
Figure 11. **Real wage trends in the euro area (deflated by GDP deflator)**



Source: AMECO.

Divergence in nominal wages need not have implications for external competitiveness, namely to the extent that they reflect productivity rather than nominal price-wage dynamics. However, a look at nominal unit labour costs shows that this has largely not been the case, as has been pointed out in previous iAGS reports (Figure 12).

Figure 12. **Trend in nominal unit labour costs in the euro area 2000-2017**



Source: AMECO.

Even allowing for productivity, nominal wage trends in Greece, Ireland, Italy and Spain (also Luxembourg), overshot considerably up to the crisis, while Germany, and Austria undershot. The increase in the relative labour cost of producing a unit of GDP in the former, and the decrease in the latter group, implied—given constant exchange rates—a real revaluation (devaluation) and thus a loss (gain) of price competitiveness respectively. This went hand in hand with current account imbalances that built up until a sudden correction in the crisis. This does not imply a simple causal link from wages to relative prices to current accounts, however. Rather a failure to keep demand trends in line with domestic potential and issues such as housing-price booms, which were not addressed by policymakers, led simultaneously to faster wage-price spirals and widening deficits in countries such as Greece and Spain and stagflation and growing surpluses in, notably, Germany.

Since the crisis a substantial, but one-sided adjustment has occurred. Most countries are now, in terms of the overall trajectory, grouped quite tightly, slightly above the euro area average. Luxembourg and Ireland (where GDP numbers especially in recent years make interpretation difficult) are upper and lower outliers. Italy and Germany are notable for having made only a very limited downward and upward correction respectively since the crisis.

Reflecting this one-sided adjustment, the current account balance of the euro area as a whole has moved very substantially and persistently into surplus. This is unsustainable, however, as recent debates and disputes at the global level regarding trade policy show. This makes it all the more important that domestic demand is underpinned from the wage side.

Equally, it is evident that, since the crisis, average ULC development has lagged far behind the benchmark increase of 2% (equal to the inflation target of the ECB; this is a condition for constant functional income distribution while simultaneously achieving the central bank policy goal, *cf.* Koll/Watt 2018: 14ff.). Over the whole period nominal ULC increased by around 27%, whereas growth of around 40% would have been compatible with a nominal wage trajectory that is compatible with the ECB target (Figure 13). Currently the gap appears to be growing by the year. As previously noted, this reflects the asymmetrical post-crisis correction process and the internalization of below-target inflation expectations. A return to the ECB target necessitates faster nominal wage growth for a given productivity trend, particularly in countries with a large undershoot in recent years.

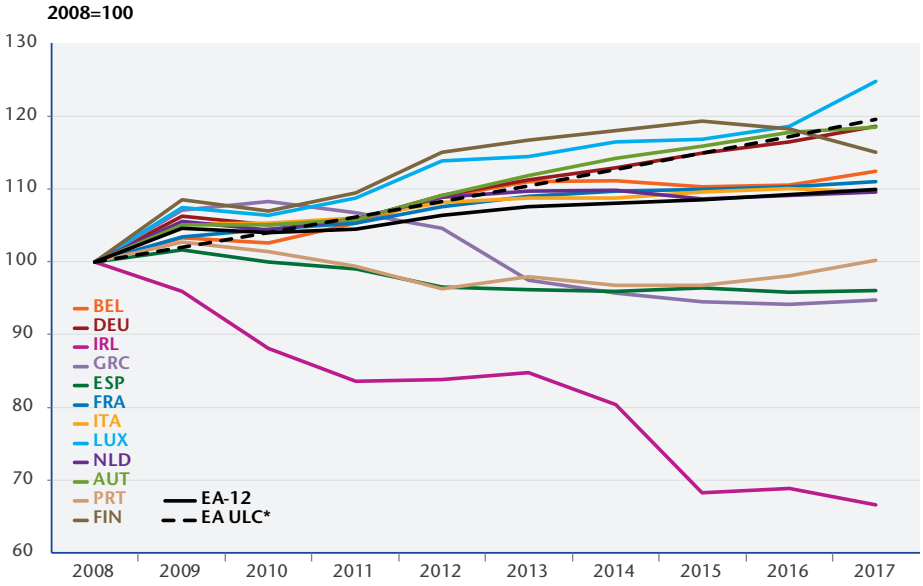
It does not follow, however, that "wage policy"—the various wage-determination mechanisms operating in member states—bears sole responsibility for ensuring appropriate wage and price trends. Rather this is the responsibility of the macroeconomic policy mix in each country. Wage policy will only be able to play a role in conjunction with fiscal (and possibly macroprudential) policies that work symmetrically to keep demand close to potential output, avoiding persistent stagnations and curtailing booms.[9]

Two main policy conclusions can be drawn from this analysis and previous work done in earlier iAGS reports. One is that the ongoing reform debate on euro area economic governance needs to pay greater attention to achieving mutually compatible nominal wage and price developments in all member states. The second is the need to strengthen national wage bargaining systems.

In order to ensure the former, euro area economic governance needs appropriate reforms. At a minimum the Macroeconomic Imbalance Procedure needs adapting so as to make it symmetrical in operation and it influence on national policy needs to be increased *vis-à-vis* the narrow fiscal rules. These should be changed to improve the focus on achieving inflation rates close to the central bank target, rather than on (arbitrary) debt ratios. A great role should be given

9. See Koll and Watt (2018).

Figure 13. **Trend in nominal unit labour costs in the euro area 2008-2017**



Source: AMECO.

in economic policy-making to the social partners, so that wage and price developments are given greater weight in economic policy deliberations. A detailed proposal involving an extension of the remit of the productivity boards currently being established and a strengthening of the Macroeconomic Dialogue – in particular their establishment in each Member State, is presented in Koll/Watt 2018.

Secondly, strengthening sometimes even reviving wage bargaining institutions is an important task to stabilise the European Union economically as well as politically. Over the last ten years 15 out of 27 countries in the European Union saw a decline in collective bargaining coverage, only four saw an increase, the remaining eight managed to have stable coverage rates. The great recession and the subsequent troika policies had a negative, sometimes-devastating effect on wage setting institutions in some European Union countries.

The decline in wage bargaining coverage is particularly concentrated in eastern and south eastern member states. This is all the more problematic as these countries need to converge to higher wage and productivity levels to close the still dramatic differences in living standards compared to northern central European countries. Relying on market forces alone will not do the job. Younger people in these countries need a realistic perspective of convergence to moti-

vate them to use their qualification and talents to help their countries caching up, instead of leaving. Without such a convergence, the risk of persistent Core-Periphery Patterns in the EU 28 is very high.

There are many instruments to foster involvement of unions and employer organisations and thereby strengthen bargaining coverage and the quality of bargaining results.

- Maintain and build Capacity: Provide social partners with the necessary expertise in Law, Economics, Management but also language, to allow them to become and or sustain a high quality knowledge base for their internal and external negotiations, on national as well as European level. Involvement and consultation with other economic policy makers is important for the positive effect on ownership of reforms and economic policy in general but also to allow for sustainable patterns of interaction.
- Allow and require public goods to be provided: To develop a culture of responsible negotiation it is necessary on the one hand to give the negotiating parties the necessary means to agree on compromises on behalf of their members and on to other hand to avoid freeriding or non-compliance by members and outsiders alike. Instruments like right to negotiate, *erga omnes* clauses and extension clauses can be useful in this respect.
- Ensure involvement and responsibility: Require social partners to ensure internal governance based on democratic principles, and to guarantee that union leaders and employer representatives are held responsible for their decisions by their members.
- Take a long time perspective on institution building: try to form larger constituencies to allow for negotiations covering topics like health, pension and social security issues with relation to the field of wage negotiations. This can avoid a single point of failure in social partner relations if wage negotiations run into problems.
- And most important of all, work with the institutions and organisations most suitable to your country.

I.5. Economic governance in the Eurozone: where do we stand?

The necessity of reforming euro area economic governance has not diminished: recovery has weakened while potential growth has been declining. The upturn will come to an end, and the euro area is not yet prepared for that. The sun has been shining – as the title of last year's report noted – but the opportunity for structural repair work has not been taken. Against this backdrop, two fundamental reform principles continue to be opposed to one another in the debate: solidarity vs. market discipline. While both have a strong tradition in EU integration, going back to the Treaty of Rome, they also have some perverse effects. Solidarity may induce moral hazard, i.e. larger risk-taking, whereas market discipline may weigh on public debts and promote the dominance of financial markets over the real economy. Thus both can create instability and divergence rather than their intended effects.

Many proposals to improve economic governance have emerged. In iAGS (2018), we grouped them according to these two views. The first gives priority to better compliance with agreed rules and faith in market discipline. The second view highlights risk-sharing and coordination between the EU Member States. These two views imply different tools. The first view requires debt-restructuring mechanisms (without transfers) for Member States to resolve legacy issues and build some fiscal space before the next crisis, whereas the second one focuses on the creation of countercyclical tools (Eurozone budget via an investment programme, European unemployment insurance scheme), new funding for common European public goods (transnational public investments, migration and refugees' policies, energy transition), and social and tax harmonization.

While convenient in terms of presentation, the two views are not mutually exclusive. An influential report by a team of seven economists each from France and Germany (Bénassy-Quéré *et al.* 2018) argued that, to some extent the two approaches can be complementary. The replacement of Wolfgang Schäuble by Olaf Scholz (SPD) has also arguably softened the dichotomy between the two basic approaches in practice too. The Franco-German agreement at Meseberg (June 2018) and the Roadmap announced there did, in principle, stress the need for risk-sharing measures. Still, the measures under consideration—some of which we analyse below—are rather weak and, since then, there has been much foot-dragging.

In this year's report we will not provide a comprehensive analysis of reform proposals, but examine a number of areas with a focus on developments during the last year.

One year after Macron's speech at La Sorbonne and one year after the German election, envisaged euro area reforms have not moved forward much: migration and defence issues have taken priority over reform proposals about how to fix macroeconomic problems like real divergence and the economic slowdown. Even on banking and financial matters, where some substantial steps forward have been made, such as EU-level supervision of the largest banks, the on-going project of the Banking Union (BU) has not made much progress. A few countries, among them Germany, are reluctant to adopt the European Deposit Insurance Scheme (EDIS). Moral hazard concerns stem from the fear that well-funded German deposit guarantee schemes (DGS) could be tapped to compensate for underfunded DGS in other member states (Howarth and Quaglia, 2018). It follows that the EDIS has not yet been adopted because of the incomplete prior harmonization of national DGS.

The incomplete adoption of the BU also highlights the lack of the political will needed to ensure the homogenous regulation and supervision of banks across the EU. Koetter et al. (2018) recall that "the success of the BU to strengthen financial stability, diminish market fragmentation, and reduce bank bailout guarantees by establishing a (credible) resolution and restructuring scheme depends strongly on the timely and adequate implementation of the new regulatory framework across countries". They show that Member States "simply delay the transposition of the multiple EU directives that underlie the BU into national law (…) which in turn can undermine the effectiveness of the financial reform". Political will has been the weakest in Belgium, Slovenia and Poland and the highest in Germany and Austria. On the other hand, as Asimakopoulos (2018) shows, before the adoption of the BU, the German authorities have imposed the choice of international law instead of EU law to bypass the European Parliament in the control of the Single Resolution Fund (SRF). He argues that this provides an example of "nationalised European Integration". This has enabled Italy, to bypass the bail-in agreement in the Single Resolution Mechanism (though an opt-out clause is legal) to bail out Monte dei Paschi in 2015.

The incomplete adoption of a BU may be insufficient to ensure banking stability. The ECB could have to come to the rescue with extended unconventional policies. Moreover, given low prospects for potential output in the euro area, the policy rate will need to be set at a low level, and tapering measures by the ECB likely postponed.[10] Yet in a low interest environment, risks of financial

instability are likely to intensify: the search for higher yields may transmit to excessive risk appetite. Consequently, macro-prudential policies would be needed to limit risk.

A positive development is growing recognition of the need for automatic stabilisation measures working across borders within EMU. The rationale is clear. Without them member states encountering a negative shock can quickly come under pressure from markets and/or due to the fiscal rules (which rely on unobservable potential output and output gaps and thus do not in practice reliably distinguish between structural and cyclical budget positions). This puts undue pressure on governments during downswings, which are forced into procyclical spending cuts or tax hikes. Cross-border stabilisers also dampen demand in booming economies, constraining governments to run tighter policies in "good times". Overall such stabilisers would help reduce the cyclical divergence that proved so damaging in the run-up to the crisis.

This approach should not be seen as being in opposition to, or a substitute for, a policy of strengthening national automatic stabilisers. This would also increase the stability of the currency area as a whole; as such each member state has an interest in other members having strong stabilisers, suggesting a need for coordination to bring about an upward convergence in this regard (Watt 2011). The fiscal rules at least the medium-term objective and the expenditure rule – would in principle take account of the greater amplitude of the swings in the government balance. Still, provisions would need to be in place to prevent automatically rising deficits in a downswing leading to market pressures on sovereign bond markets.

One often-discussed proposal is to partially Europeanise national unemployment benefit systems, such that financial flows are induced from countries with low (short-term) unemployment to those where it has risen above long-run averages. A considerable literature exists on such schemes (an overview with detailed studies is provided by Beblavy *et al.* 2017). While initial proposals involved direct pay-outs to individual unemployed persons, the debate has moved on to simpler schemes involving transfers between national funds and a central fund (so-called "reinsurance schemes"). The Franco-German agreement at Meseberg announced a willingness to explore concrete proposals in this area and make a proposal to the December Summit. The Meseberg agreement made it clear, however, that any such assistance can only be provided as a loan

10. See Blot *et al.* (2018) for a discussion.

and will be limited to severe shocks: they will be conditional on national systems being constructed so as to be self-financing across normal business-cycles. Open questions concern the volume of the fund and the modalities of both paying into and withdrawing resources from the fund.

The recently announced "Proposal on the architecture of a Eurozone Budget within the framework of the European Union" (16 November 2018) is another concrete step in the direction of the Meseberg declaration. It proposes that a Eurozone budget be established, as many, including French president Macron, have called for. However, it will be set within the EU budget, hence come under the multiannual cap of the budget (over which also non-EMU countries have a say). Euro Area countries will, though, be able to agree to make additional funds available to the budget by intergovernmental agreement. They will be able to apply for funding for specific projects. This appears to be more targeted towards investment support (which is already provided under the Juncker plan) than counter-cyclical stabilisation. As for governance, "Member States and programmes could only receive support from the Eurozone budget if they pursue policies that are in accordance with their obligations under the European economic policy coordination framework, including fiscal rules". This is problematic to the extent that the countries that are not able to fulfil the fiscal rules may also be those needing a fiscal help to dampen demand shocks, and once again points more to medium-run structural support than stabilisation.

The need for greater automatic stabilisation, including of a cross-border nature, in monetary union is undisputed. The proposals under discussion do go to some extent in this direction. One should be under no illusions, however, that—with the likely conditionality and order of magnitude—they will be insufficient to provide a substantial stabilisation capacity. There is a risk that such proposals distract attention from the need for more effective stabilisation measures, such as a larger central budget under democratically legitimate control (as floated by President Macron) and/or centralised financing of public investment (e.g. Bibow 2013) and other measures to tackle boom-bust cycles (Creel, 2018) and competitive divergence (see the section on wages and Koll/Watt 2018).

Possibly a more positive assessment can be made in a medium-term perspective. There is now some political momentum behind the unemployment reinsurance and the euro area budget proposals. If these schemes can be successfully established, even if they are initially very limited in scope, it will be possible—at the latest in the next crisis—to extend and expand them, once it becomes apparent that it can be in the interest of all member states to do so.

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Appendix I. Decomposition of public debt

In this annex, we present a decomposition of public debt evolutions between 2018 and 2035 under the baseline scenario. Debt variation depends on:

- primary surplus: a higher primary surplus slows debt progression;
- stock-flow adjustments: it includes differences in cash and accrual accounting, accumulation of financial assets and valuation and other residual effects;
- a "snow-ball" effect: it captures the impact of interest expenditure on accumulated debt, as well as the impact of real GDP growth and inflation on the debt ratio (through the denominator). Stock-flows come from Ameco for 2018-2020 and are set to zero hereafter.

Table AI. Decomposition of average annual public debt ratio variations

Country	Average annual Public debt variation	Average annual contribution to debt ratio variation between 2018 and 2035		
	2018-2035	Snow-ball effect	Primary surplus	Stock-flow
DEU	-1.3	-0.5	-0.9	0.0
FRA	-0.5	-0.5	0.0	0.0
ITA	0.6	1.3	-0.7	0.0
ESP	-0.4	-0.4	-0.2	0.1
NLD	-2.0	-0.6	-1.4	0.0
BEL	-1.6	-0.3	-1.5	0.1
PRT	-4.5	-0.2	-4.4	0.1
IRL	-0.9	-1.3	0.3	0.1
GRC	-6.6	-1.2	-6.0	0.5
FIN	-0.4	-0.2	-0.3	0.1
AUT	-2.1	-0.6	-1.4	-0.1

Source: iASES (formerly iAGS) 2019 model.

Table AI resumes the evolution of public debt-to-GDP ratio for 11 euro area countries for 2018-2035. Public debt should fall for almost all countries (except Italy). This is due to a favourable snow-ball effect (unfavourable for Italy, since this country faces a very low potential GDP growth of 0.3% each year in our projections). In all countries except Ireland, the primary surplus has a negative or null effect on debt variation. Stock-flows have a near zero impact on average on public debt variation, except for Greece. In this country, Ameco database reports a huge stock-flow adjustment for 2018-2020.

Figure AI. Decomposition of public debt variations (% of GDP)

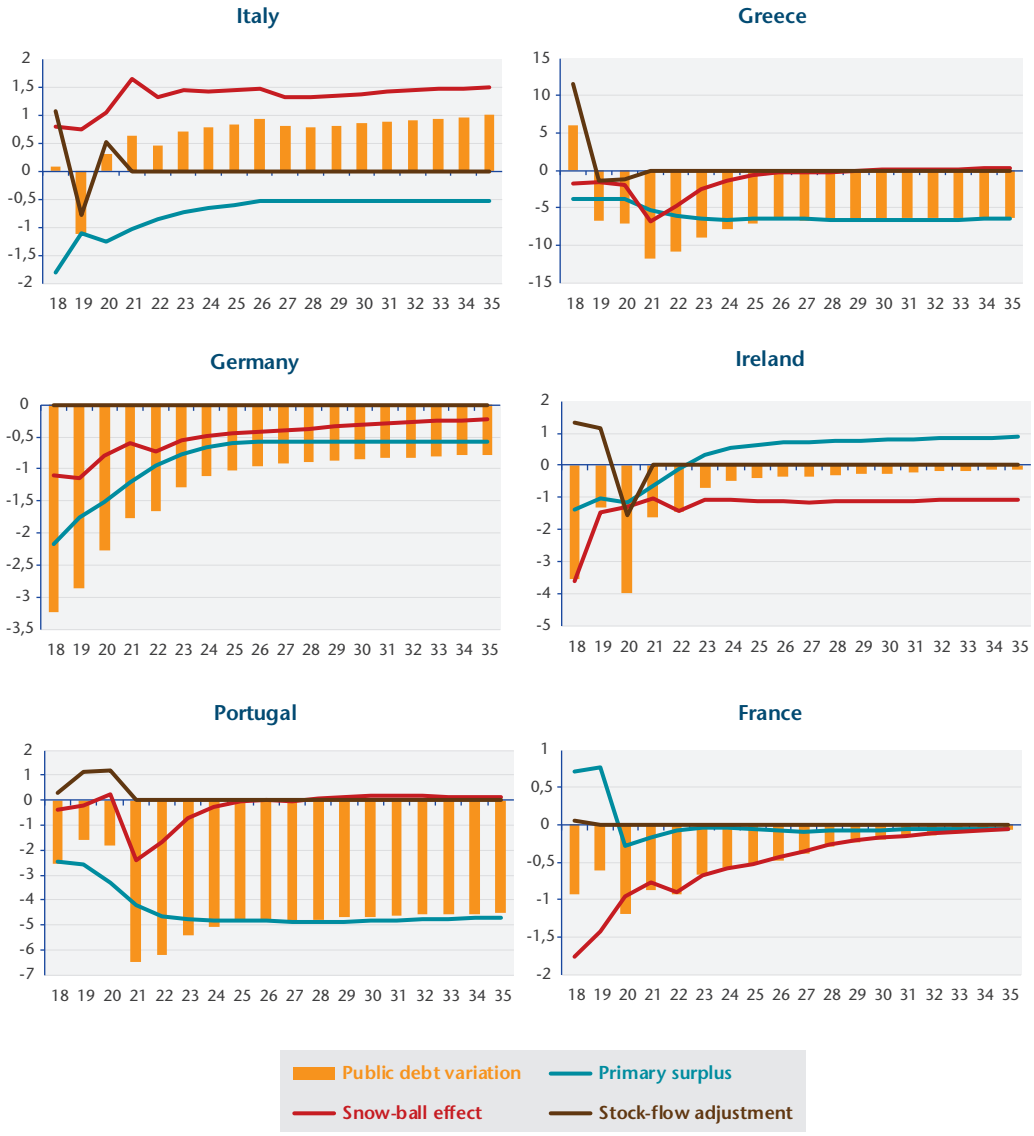
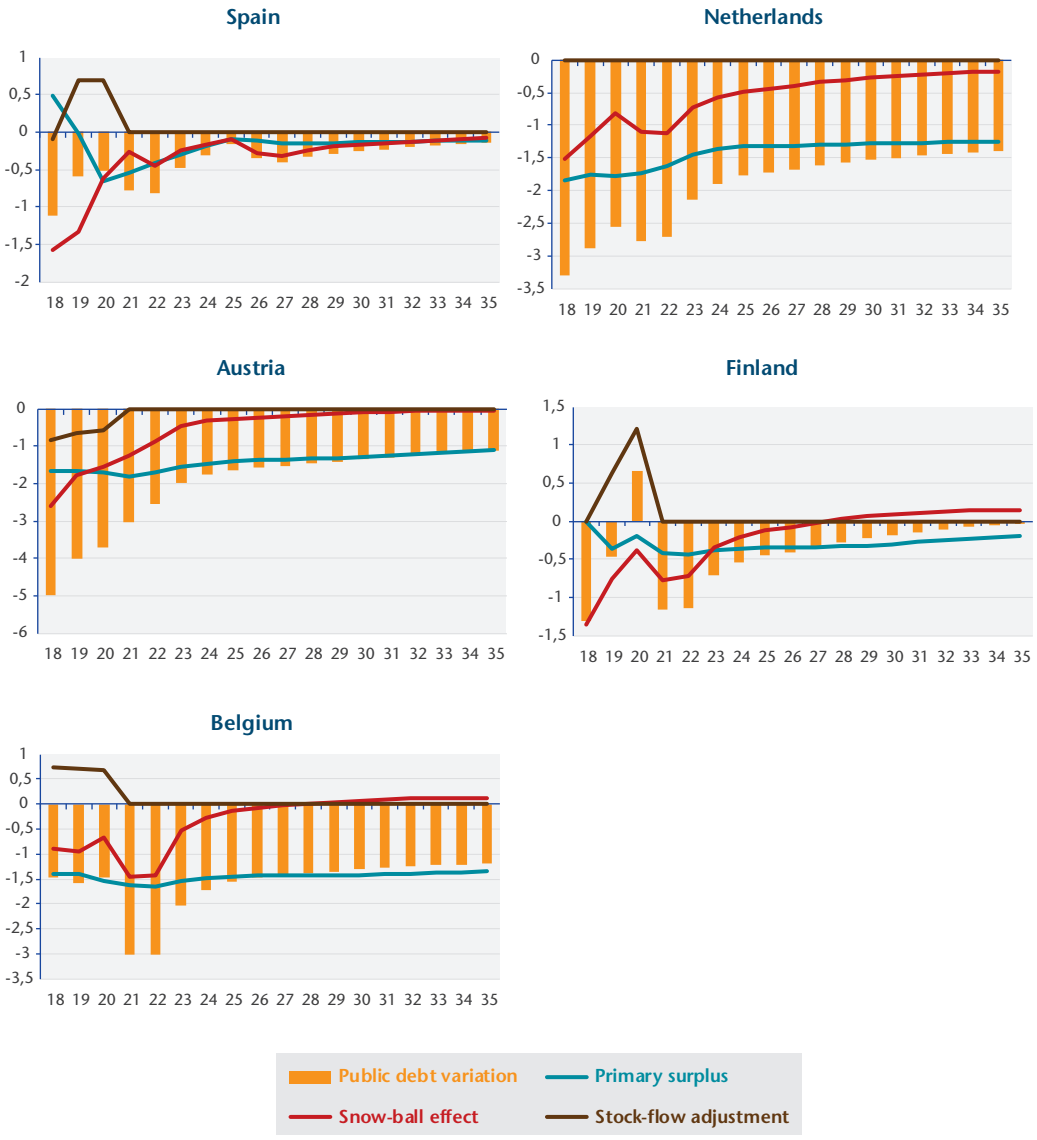


Figure AI(bis). Decomposition of public debt variations (% of GDP)



EMPLOYMENT, INEQUALITY AND WELL-BEING

The shape of the European labour markets is generally progressing. On average, unemployment is back at the levels seen before the crisis, although workers in Greece, Spain and Italy still suffer from the after-effects of the recession and the disastrous austerity politics. Across Europe, low-skilled workers also face poorer employment prospects than they used to.

At the same time, we begin to see a positive development in the share of low-paying jobs and in some aspects of job quality. However, the income security of workers has been reduced in most countries and a smaller share of the income now accrues to the households in the bottom. The income distribution between member states have been pulled in opposite directions by Eastern Europe catching up with the rest and Southern Europe struggling with the repercussions of the crisis. When we look at the access to goods determining the general material well-being, we find improvements—on average—within some aspects (education and health) and deterioration within others (e.g. access to affordable housing).

In this chapter, we analyse the progress of the European Union member states towards the goals of promoting decent work for all, reducing inequality and improving well-being. These are the three socially most important goals out of the 17 defined in the 2030 Agenda for Sustainable Development of the United Nations. We analyse the progress of the European Union member states towards these goals and related ones in terms of social progress like gender equality, no poverty and education. We also take a special look at the problem of nowcasting social indicators which is an important but rather unexplored issue if social indicators are to gain a more prominent role among the target variables determining our politics.

The discussion will not be exhaustive but merely shed light on some selected aspects of the current situation with a special focus on policy trade-offs and synergies. Concerning the indicators used in this chapter, on the one hand we

draw on the ones used in previous reports to assess the social dimension focussing on the development in labour market and social conditions in the EU. On the other hand, we pick some additional indicators from the Eurostat SDG scoreboard, especially the ones related to well-being, but leave out others for brevity.

We end with a discussion of policy synergies and possible policy measures concerning the three goals mentioned. Policies should both target the supply and demand sides of the labour market, should strengthen trade unions, upskill workers and enhance public provision of basic goods such as housing. We argue, that this should be financed by higher effective tax rates on top incomes, inheritance, capital incomes and profits.

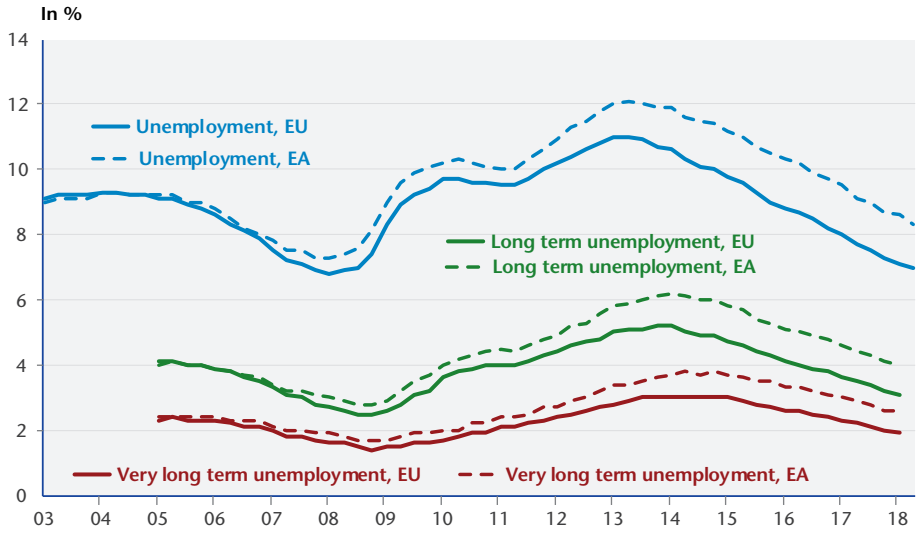
II.1. Decent work for all

On average, the unemployment rates across European countries are back at their pre-crisis levels, *cf.* Figure 14. In the second quarter of 2018, the unemployment rate was 6.8%—the same as in the second quarter of 2008. In consequence, 16.8 million people were unemployed by mid-2018, down from 27.4 million at the peak of the crisis in 2013. At the same time, the long-term and very-long-term unemployment rates are closing in at the levels which we saw just before the crisis. These numbers show that—on average—the European labour markets have recovered from the crisis.

The Euro countries are still lagging a bit behind the rest of Europe. This reflects that the Southern European countries were hit harder in the second wave of the crisis. In 2011-2013, the average unemployment rate in the euro area increased more rapidly than in the rest of the European Union. Since then, the euro area unemployment rate has recovered at the same pace as in the rest of Europe.

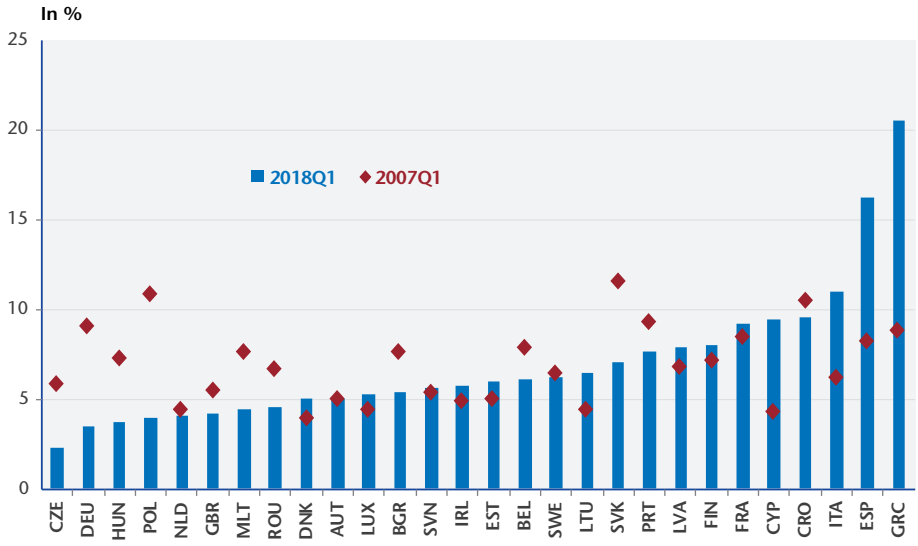
There are significant differences in unemployment outcomes across the European Union and especially across the Eurozone, *cf.* Figure 15. On one hand, the unemployment rate is now at a lower level than it was in 2007 in fifteen EU member states. In particular, the Eastern European countries are—with a few exceptions – running near full capacity. And in countries like Germany and the Netherlands there has been talk of labour shortages in some areas. On the other hand, unemployment is still markedly above the pre-crisis levels in Greece, Spain and Italy where the sovereign debt crisis hit particularly hard. And, as noted, there are still 17 million people unemployed and even more underemployed.

Figure 14. **Unemployment in the EU and the euro area**



Source: Eurostat.

Figure 15. **Unemployment in the EU countries**

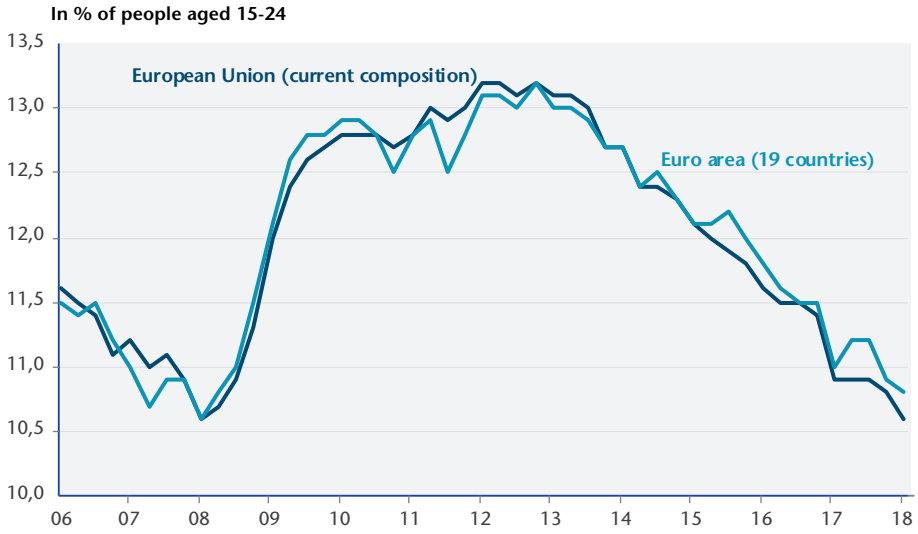


Source: Eurostat.

The economic upturn is not only reflected in headline unemployment numbers but also in falling NEET rates and underemployment rates. This means, that the upswing is now benefitting young workers and other marginal worker groups as well.

The NEET rate is the share of people aged 15-24 who are Neither in Employment nor in Education or Training. This rate increased sharply during 2008 and remained at a high level in the following years, *cf.* Figure 16. Since 2013, it has been falling and is now back at its pre-crisis level both in the euro area and in the rest of the European Union.

Figure 16. **NEET rates in the European Union and the euro area**

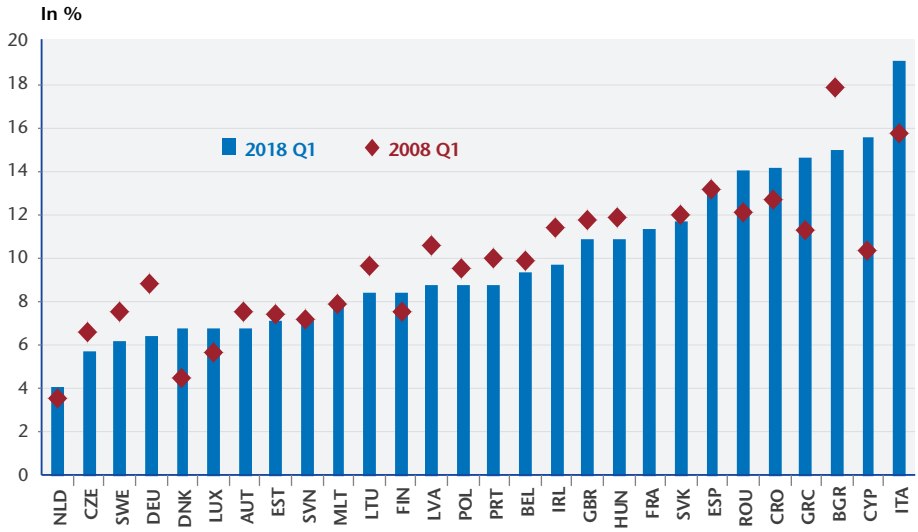


Source: Eurostat.

The current variation in NEET rates across countries resembles the variation in 2008 rather closely, *cf.* Figure 17. The most notable differences are the persistently high levels in Greece, Italy and Cyprus. In the Netherlands and Czech Republic less than 6% of young people are neither in job nor education.

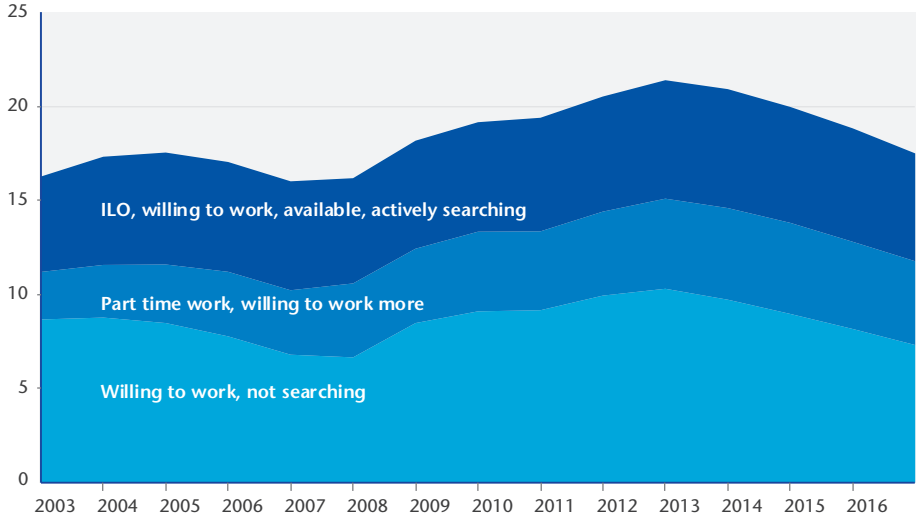
The underemployment rate measures unused labour resources in a broader way than the unemployment rate. It includes unemployed persons as well as people who would like a job but have given up finding one and workers who work part-time because they cannot get a full-time job. Like the long-term unemployment, the underemployment rate is now closing in on the level from ten years ago, *cf.* Figure 18.

Figure 17. **NEET rates, member states**



Note: For France, there is no national data for 2008.
Source: Eurostat.

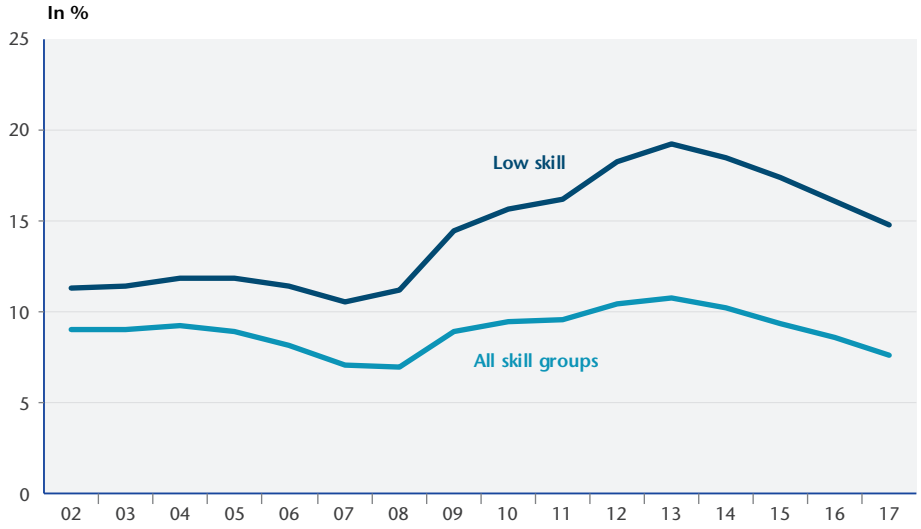
Figure 18. **Underemployment in the EU**



Note: Involuntary part-time employment is weighted by the relative difference in working hours between an average full-time employee and an average part-time employee.
Source: Eurostat.

Despite the progress for young and underemployed workers in general, the recovery is still not extending to the workers with lower education levels. Low-skilled workers in Europe face an average unemployment rate of 14.8%—more than double the average of all education groups. This is shown in Figure 19. Low-skilled workers were hit the hardest by the crisis, while in the subsequent recovery their unemployment rates have decreased at roughly the same pace as everybody else's. Consequently, the unemployment gap between low-skilled workers and other workers has widened during the last ten years. With the current pace of the upswing the unemployment rate of low-skilled workers will not return to pre-crisis levels before 2021.

Figure 19. **Low skill unemployment and unemployment in the EU, 2002-2017**



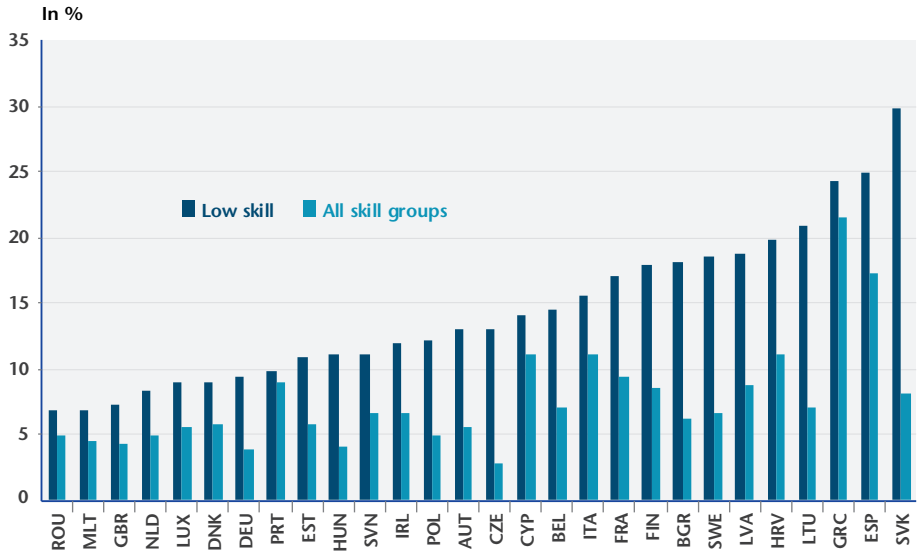
Source: Eurostat.

Unemployment among low-skilled workers is high in Spain and Greece as is seen in Figure 20. This comes as no surprise as the unemployment rates across skill groups are, of course, related (there is a correlation of 0.67 between unemployment rates for the low-skilled workers and other skill groups). However, the unemployment among low-skilled workers remain high also in countries with near full recovery such as Slovakia, Lithuania, Latvia and Sweden.

This indicates that at least for some countries the growing divide in employment opportunities is not just a result of the crisis. Other factors have been at play pushing low-skilled workers out of the labour market. The academic

research has pointed to changes in the labour markets as well as changes in production technology and production chains.

Figure 20. **Low skill unemployment and unemployment in the EU, 2017**



Source: Eurostat.

First of all, worker protection has been hollowed out and wage bargaining has been decentralised in many European countries during the last decades—in part due to OECD's and IMF's recommendations. However, OECD has recently shown that labour markets are more sensitive to adverse shocks when there is less regulation protecting workers and when wages and worker rights are negotiated at firm-level rather than sector-level (OECD 2018). In deregulated and deunionised labour markets, low-skilled workers, female workers and young workers are particularly vulnerable when labour demand declines—and they tend to struggle more getting back to work (OECD 2018). Therefore, the persistently high unemployment rates of low-skilled workers following the crisis could, likely, result from deregulation and deunionisation. Moreover, IMF has recently shown that deregulation of labour markets decreases the workers' share of his/her output (Ciminelli *et al.* 2018). In keeping with traditional economic thinking this means that in the long run deregulation will affect wages rather than employment. To redress the low employment resilience and poor earnings prospects of low-skilled workers, it is crucial to strengthen trade unions and employment protection.

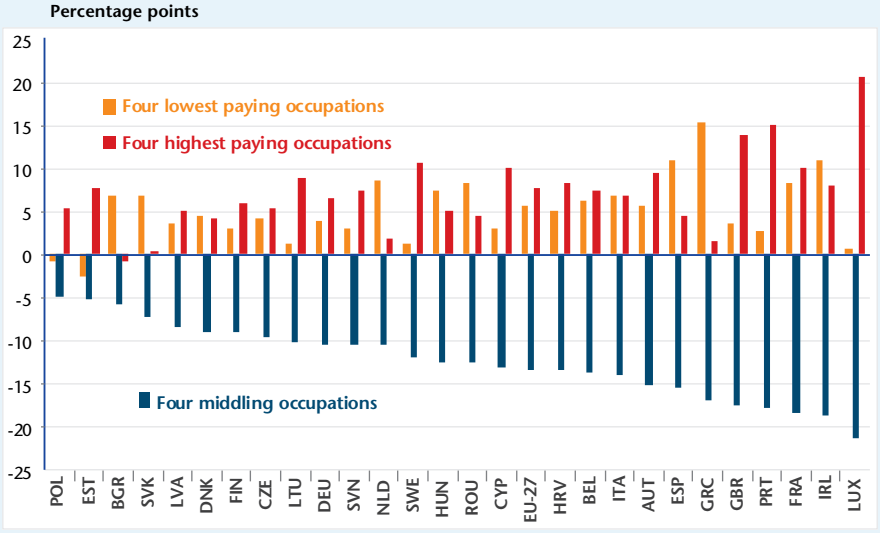
Secondly, the research literature sees the slow recovery of low-skilled workers as a result of globalisation as well as technological progress disfavouring workers with routine jobs. These factors have, jointly, given rise to a development known as job polarisation where occupations in the middle-range of the income distribution are offshored or automatized, Box 1. This development has increased the competition for the jobs in the bottom of the income distribution.

Box 1. Job Polarisation in European Countries

During the last thirty years, the jobs in EU countries have to an increasing extent been 'polarising' into high-paying jobs on the on hand and low-paying jobs on the other. In other words, there has become fewer jobs with wages in the middle-range. The development in 2002-2016 is shown in Figure 21 below.

This development is in part a result of technological change being 'skill-biased'. That is, the technological advance tends to favour the productivity of skilled labour and, in consequence, the demand for skilled labour has gone up. At the same time, routine tasks of middle-paying jobs have to an increasing extent been automatized or offshored. Finally, the aging of populations and the sectoral shift towards service jobs have kept up the demand for low-skilled jobs.

Figure 21. **Development in the share of workers working in the lowest paying, middling and highest paying occupations 2002-2016**



Source: European Commission.

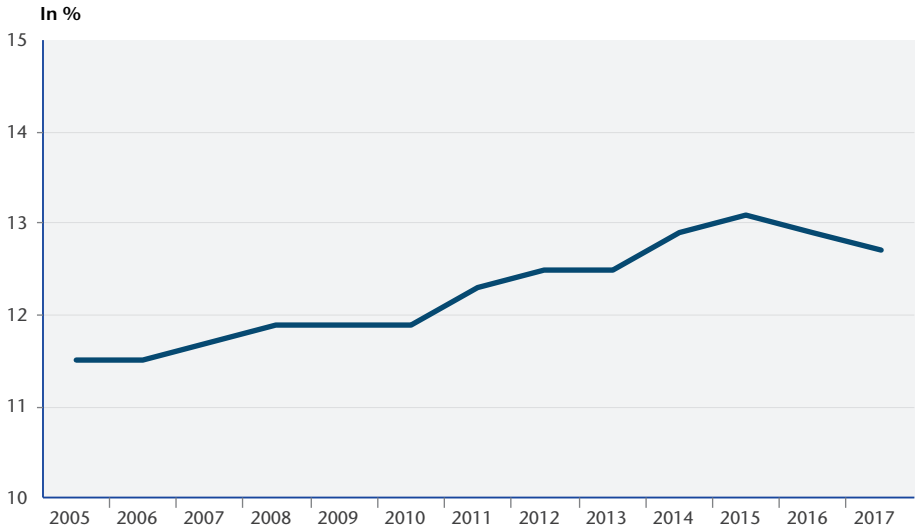
The falling demand for middling jobs has meant that workers with skill levels in the middle range have to an increasing extent competed with low-skilled workers over the jobs they used to hold. To make matters worse, the polarisation process accelerated temporarily during the crisis years (European Commission 2018). For many jobs that used to be low-skilled the employers now require higher qualifications than they did before—perhaps as a result of increased complexity of tasks in former 'low-skilled' jobs (Beblavý & Veselková 2014). This has made recovery from the crisis harder for low-skilled workers and increased income inequality.

These changes increase the need for education and re-education efforts at all levels. On the one hand, the increasing demand for highly educated workers should be met by securing that more young people take a long education. On the other hand, the increased demand of skills within the former 'low-skilled' jobs should be met by upskilling workers at low education levels, not least among the unemployed. Furthermore, many observers point out that we must strengthen the quality of elementary schools and the preventive measures against early school leaving in order to provide all workers—especially those at low education levels—with the ability to gain new skills in a labour market with shifting demands.

While employment has increased since the crisis so has the share of low-paying jobs. This is indicated by a steady increase in the in-job-risk-of-poverty-rate which measures the share of workers living in households with an income below 60% of the national median. However, this rate improved in 2016 and 2017 following a decade of steady increases, *cf.* Figure 22. As we discussed in the iAGS 2018 this indicator should be interpreted with caution as there are a number of problems with this way of measuring the population share of the working poor. For example, poverty is not measured for individuals but for households, meaning that e.g. low-wage women are not counted as working poor if their spouse's income allows the household to escape poverty.

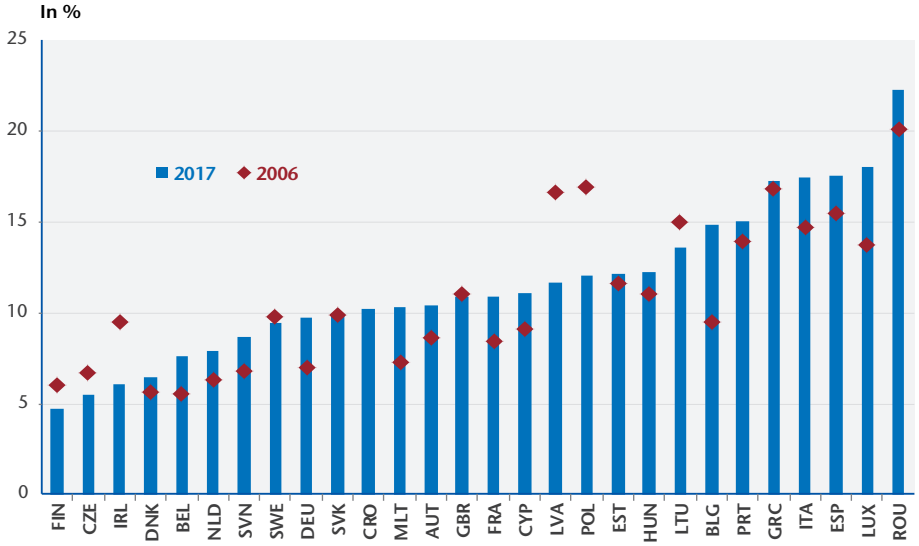
In most countries, the in-work risk-of-poverty-rate has increased since 2006, *cf.* Figure 23. However, some countries (Ireland, Latvia and Poland) have seen marked improvements. The share of low-paying jobs is above 15% in Romania and Luxembourg as well as the three countries hit hardest by the sovereign debt crisis. On the other hand, in Finland, Czech Republic, Ireland and Denmark, the share is currently below 7%.

Figure 22. **In-work at risk of poverty**



Source: Eurostat.

Figure 23. **In-work at risk of poverty**



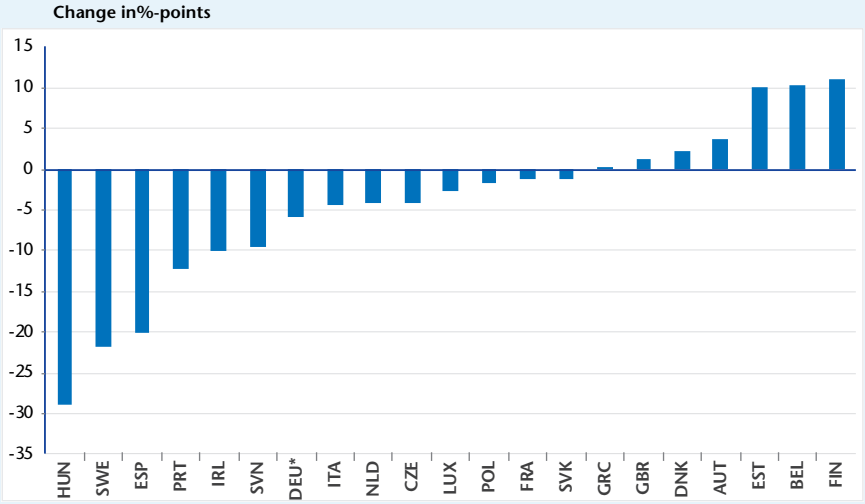
Note: For Romania, data for 2007 is used instead of data for 2006. For Ireland, Great Britain and Croatia, data for 2016 is used instead of data for 2017.
Source: Eurostat.

The increase in the share of low-wage jobs has coincided with a general decrease in the generosity of unemployment benefits across Europe, with the crisis triggering numerous reforms lowering the compensation rate of unemployment (Turrini *et al.* 2014). In the public debate on these reforms it has often been stressed that there is a trade-off between high unemployment rates and high unemployment security, as low unemployment benefits impel the unemployed to take a job. However, as we show in Box 2 this trade-off can and should be avoided.

Box 2. **The development of Income Security in European Countries**

In the wake of the Great Recession, the importance of the automatic stabilisers has been rightly emphasised (*cf.* e.g. Furman 2016). On that account, recent trends in the compensation rate of unemployed seem misguided. In fact, the compensation rate for the unemployed has been reduced in many countries, as witnessed by Figure 24. This has contributed to weakening the already weak aggregate demand during the crisis.

Figure 24. **Change in compensation rates, 2007-2015**



Note: For Germany, data for 2013 is used.
Source: OECD.

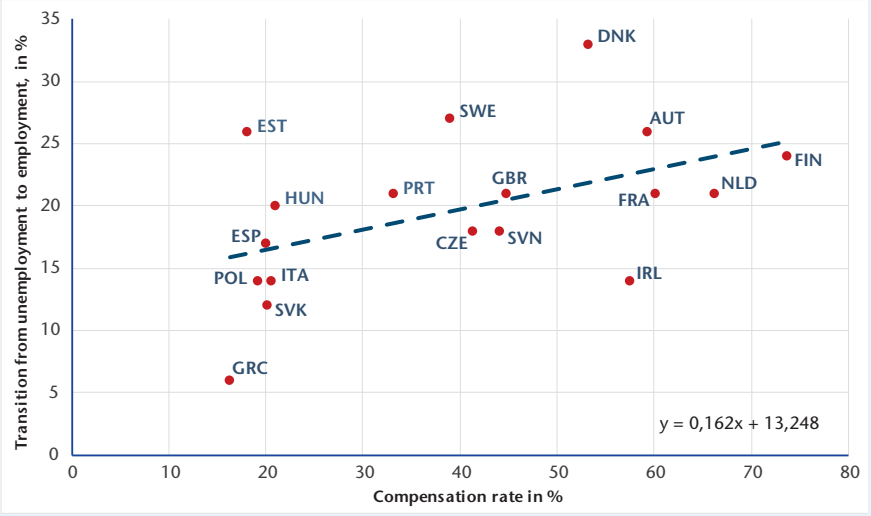
In the public and academic debate on unemployment benefits, the orthodox view is that high compensation rates lead to higher unemployment. The intuition is that high compensation rates induce the unemployed to raise their reservation wage and lower their search effort.

Theoretically, however, there could be other effects. Generous benefits can, for instance increase the resources that unemployed persons can invest in job search. Whether or not there is a trade-off between employment and income security is, therefore, an empirical question. In recent years, numerous studies have revisited this issue both from a macro perspective and at a micro level.

The macro literature relies mostly on cross-country comparisons. However, there is good reason to be sceptical about the canonical macro findings. A great deal of these studies suffers from statistical problems—especially of timing and causality (Howell & Rehm 2009, Zettergren 2013, Andersen *et al.* 2015). Further, Howell & Rehm (2009) have shown that most older studies rely heavily on more or less simple correlations using outdated compensation rate indicators. If we use OECD's improved data on compensation rates, we actually find that benefit generosity correlates positively with job finding rates of unemployed persons, *cf.* Figure 25.

Such findings should be interpreted with caution as benefit reductions in some countries have been induced by the debt crisis (that is, indirectly by high unemployment). However, the simple correlations echo the results of more stringent analyses (Howell & Rehm 2009). Also, the simple comparisons capture the fact that other features of the unemployment system can affect the importance of compensation rates. In particular, high compensation rates do not induce the unemployed to lower their search effort if the search effort is already monitored effectively. Therefore, unemployment systems should be viewed as a whole. This stance is now also taken by OECD who find no trade-off between employment and income security (OECD 2017).

Figure 25. **Unemployment and compensation rates, 2015**



Source: Eurostat and OECD.

The problems with investigating the relationship between unemployment and compensation rates on a macro level have made researchers resort to micro studies. In general, micro studies find that lower unemployment benefits make the unemployed leave unemployment faster (Andersen *et al.* 2015, Schmieder & Wachter 2016). In recent years, however, research has shown that it is crucial to distinguish between moral hazard effects, a 'liquidity effect' and a 'discouraged worker effect'.

The moral hazard effects are the effect mentioned above that a high benefit level makes the unemployed lower their search effort and raise their reservation wage. The liquidity effect is the fact that at low benefit levels, job-seekers cannot wait for a good job match as they will run out of liquidity. The discouraged worker effect represents the fact that low benefit levels can induce unemployed workers to leave the workforce altogether.

All of these effects imply that the exit rate from unemployment is higher when the unemployment benefits are less generous. But only the moral hazard effect is unambiguously reducing social welfare. Conversely, there are important upsides of allowing people to wait for a good match. And it is clearly beneficial if workers stay in the workforce. Chetty (2008) shows that in the US, the liquidity effect explains 60% of the total relationship between unemployment benefits and the exit rate. Although the liquidity effect is probably smaller in European countries, there is evidence that lower unemployment benefits lead to poorer job matches in Europe as well (*cf.* the studies cited in Andersen *et al.* 2015). Moreover, the micro studies do not, in general, isolate the moral hazard effect when there are active policies in place to upskill the unemployed and monitor their job search effort.

As noted above, the macro studies indicate that the adverse effects of unemployment benefits on exit rates can be mitigated through ALMPs. Of course, such a solution requires public expenditures. Therefore, there is undoubtedly a public finance trade-off between unemployment benefits and income security. But there do not seem to be an efficiency trade-off between unemployment and income security if a high benefit level is supplemented by ALMPs and upskilling efforts.

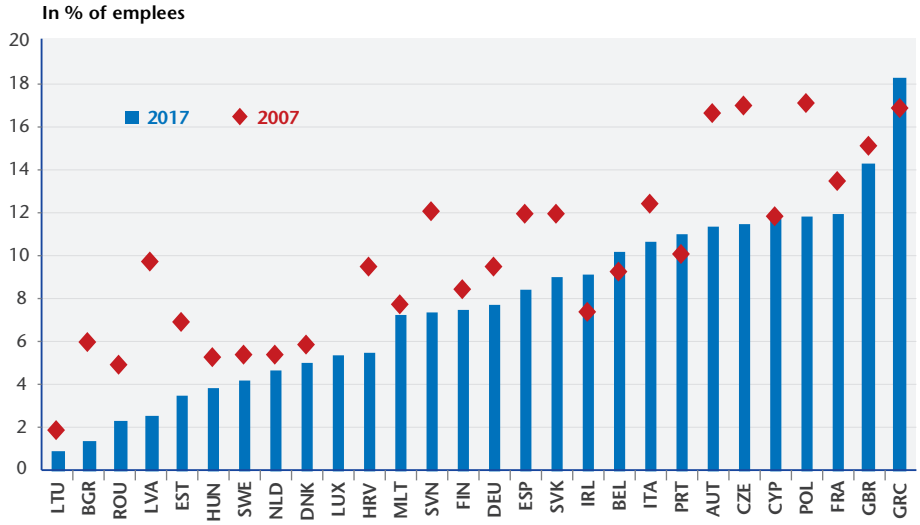
In other respects, working conditions seem to be improving. In most countries, the share of employed persons usually working more than 50 hours a week is declining, *cf.* Figure 26. This share is particularly low in the Baltic countries and in Bulgaria, Romania and Hungary. In Greece and Great Britain, on the other hand, more than 14% of workers have long working hours.

There are also general improvements in OECD's job strain index which is a unifying measure of the quality of the work environment. This indicator is based on a distinction between job demands (such as high working speed or tight deadlines) and job resources (such as employer-provided training) where OECD counts job demands as factors of strain when the employee has insufficient

resources to meet them. Therefore, OECD calculates the job strain index from the joint occurrence of high demands and low resources based on several survey answers. The total experience of job strain is, of course, not objectively observable so the numbers are merely indicative.

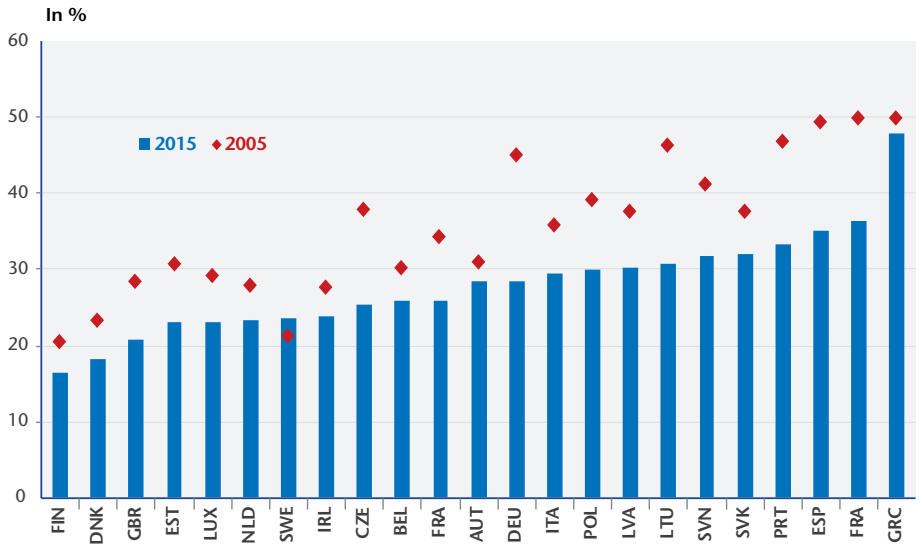
According to the numbers, the job strain index improved between 2005 and 2015 in all the included countries except Sweden, Figure 27. In Finland, Denmark and Great Britain 1 in 5 workers or less experienced job strain. But this is the case for more than ⅓ of workers in Greece, France and Spain.

Figure 26. **Share of employees working above 50 hours**



Source: Eurostat.

Figure 27. **Job strain index in the EU**



Source: Eurostat.

II.2. Reducing inequalities

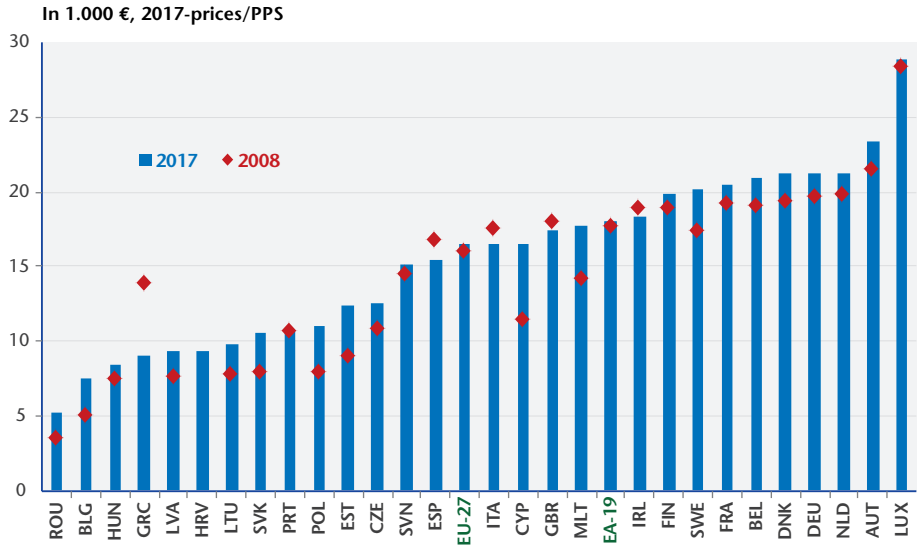
In this section we will describe how living standards are distributed among Europeans both within the member states and between European countries.

The median equalized income is the best indicator at hand to measure the typical material living standards within and between Member States, although it has the notable weakness that it does not include direct public services. This measure corrects for price-level difference and is reported in Figure 28. The median income is highest in Luxembourg, followed by Austria, Netherlands, Germany and Denmark. The figure shows that there are still marked differences across Europe with a typical person in e.g. Germany earning more than twice the median income of citizens in e.g. Romania, Bulgaria and Hungary.

The median income in Eastern Europe has converged towards the high levels elsewhere in Europe. All Eastern European countries except for Slovenia have seen the real median income grow by more than 1 percent per year since 2008 and most of these countries have seen annual growth rates above 2 percent. In many other countries, the effects of the crisis dominate the convergence effects. With an aggregated real increase of just 2.5% in the Euro area, the crisis

brought nearly a lost decade in terms of progress in material living standards on average. With the exception of Portugal, the countries in the periphery hit hardest by the crisis have even suffered income losses, first of all Greece, where the recession and the disastrous austerity politics has caused the median household to lose one third of its income since 2008.

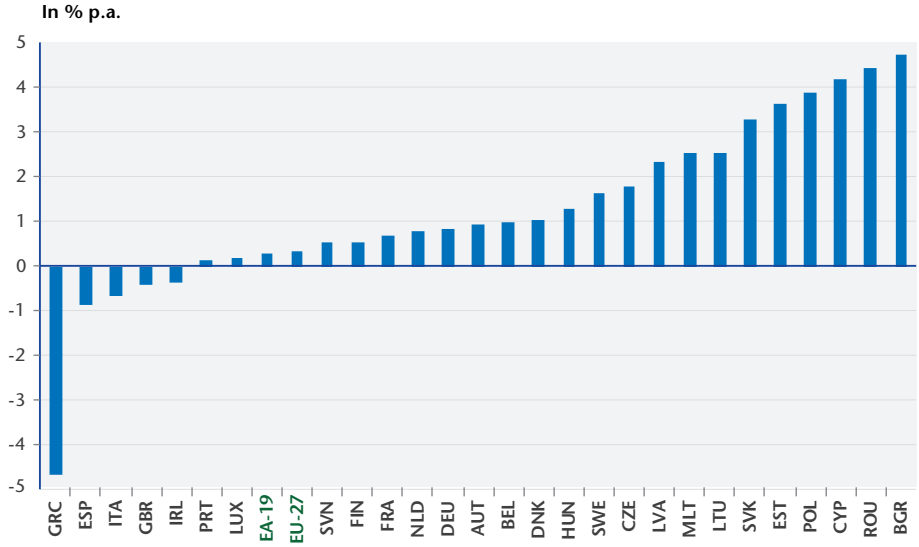
Figure 28. **Median household equalized income**



Note: For Great Britain and Ireland, data for 2016 is used.
Source: Eurostat.

The distribution of incomes can be assessed by income decile ratios or by the Gini coefficient. The Gini coefficient summarises the dispersion of all incomes while income decile ratios distinguish between dispersion among low incomes and among high incomes. Here, we report income decile ratios which are the most intuitive. Income decile ratios divide the households into ten equally sized groups (deciles) where households in decile 1 have the lowest disposable income and households in decile 10 earn the most after taxes and transfers. The income decile ratio D6/D1 compares the income of a typical household in decile number 6 with the typical income among the poorest tenth of households. As the median income is the highest income in decile number 5, households in decile number 6 earn slightly more than the median income. Similarly, the ratio D10/D6 compares the typical household income among the richest 10% with the income among households earning slightly more than the median income.

Figure 29. **Growth in median household equalized income, 2008-2017**

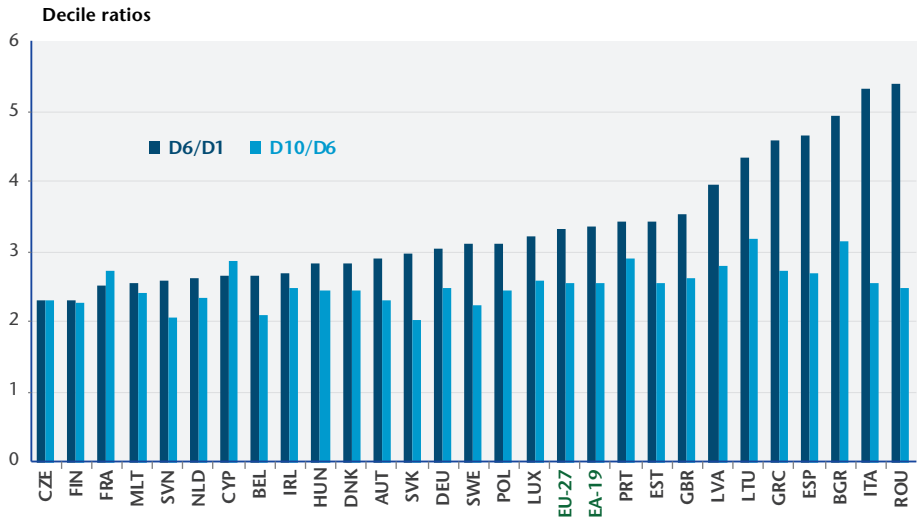


Note: For Great Britain and Ireland, data for 2016 is used.
Source: Eurostat.

In the EU, a household in the sixth decile earns about three times more than a household among the poorest tenth, *cf.* Figure 30. In Finland and Czech Republic, a household just above the middle of the income distribution earn twice as much as a household among the poorest tenth. In Romania, Italy and Bulgaria, on the other hand, a household in the sixth decile earns five times more than a household in the poorest decile.

The differences between European countries are much smaller when we look at income inequality in the upper half of the income distribution. This is not surprising as a general result of the literature is that most of the dispersion in the upper half of the income distribution lies within the top decile. For all countries, the richest 10% of households earn about 2-3 times more than households in the sixth decile. France and Cyprus are the only countries where income is more unevenly distributed in the top of the income distribution than in the bottom.

Figure 30. **Inequality in living standard, 2016, decile ratios**

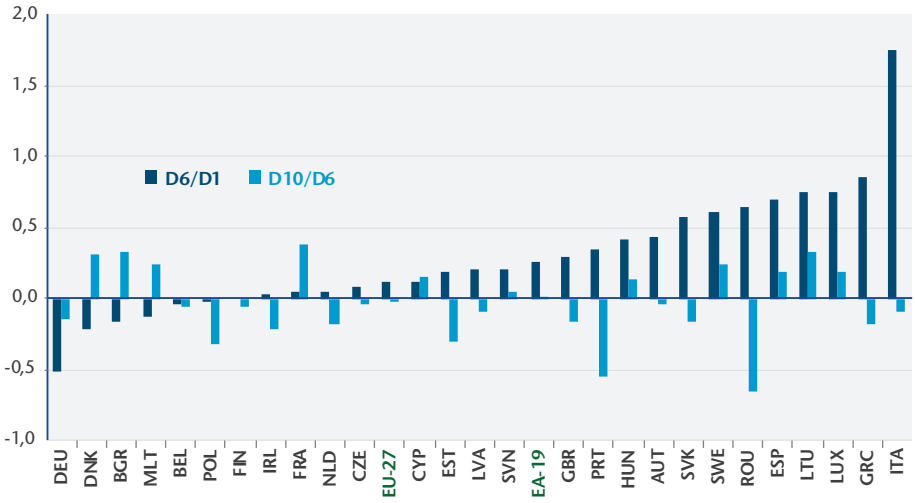


Source: Eurostat.

Compared with 2007, income is now distributed in a slightly more uneven way among the poorest half of the population: the D6/D1 ratio has increased a bit, *cf.* Figure 31. In Italy, the differences between middling households and the poorest 10% has increased markedly. The income inequality in the bottom has increased as well in countries like Greece, Luxembourg, Lithuania and Spain, but to lesser extent than in Italy. In the top of the income distribution, incomes have increased at roughly the same pace meaning that inequality has neither increased nor decreased. It should be noted, however, that survey data like these have difficulties capturing the very rich. In a number of the countries (Denmark, Bulgaria and Malta) the middling household incomes have grown at a slower pace than both the lowest and the highest incomes.

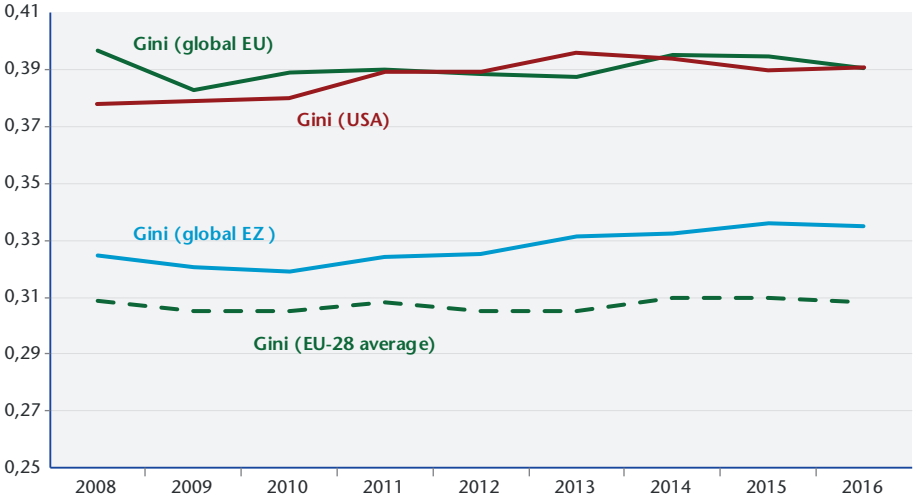
How does the European Union compare to the United States in term of overall inequality? There are several ways to adress this question. Eurostat calculates an average Gini across European Union member states. This average figure is much lower in the European Union (0,31) than in the United States (0,39), which means than on average European Unions member states are less unequal than the US. However, it is also possible to treat the European Union as a whole, as if it was one nation. If we calculate a Global Gini for the European Union, we see that inequality in the EU is as high as in the US, *cf.* Figure 32.

Figure 31. **Evolution of inequalities in the bottom and the top of the living standard distribution in the EU, 2007-2016**



Source: Eurostat.

Figure 32. **Average and Global Gini of equalized disposable income for the European Union, comparison with the US**



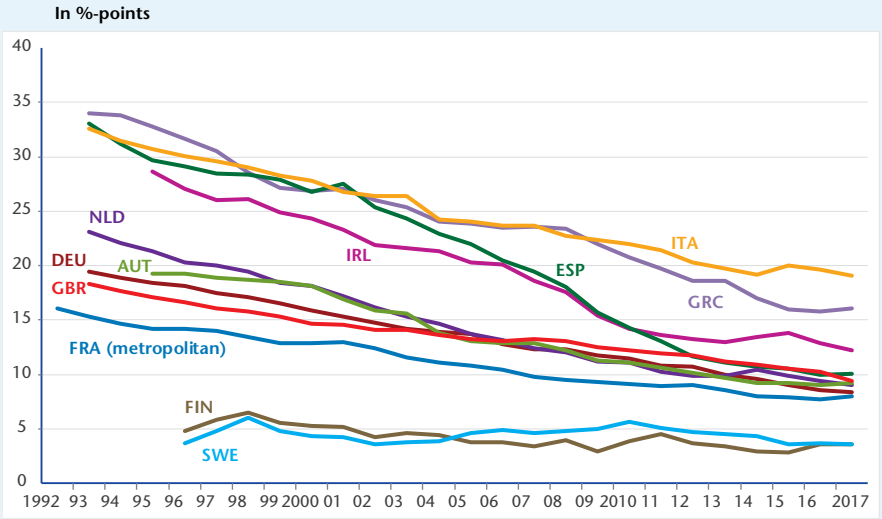
Sources: EU-SILC, OECD, iASES (formerly iAGS) 2019 computations.

A particularly pressing issue of the income inequality is the inequality between men and women. Overall, this dimension of inequality has decreased over the past 25 years. The drivers behind this development are explored in Box 3.

Box 3. Female participation, education and gender equality in Europe

Narrowing the gender gap in participation rate is a major factor toward gender equality, even though it is not sufficient to fulfil this goal. The type of public policies implemented in European Countries have been more or less efficient to support this trend. The specific interrelation between the type of welfare state and the sexual division of labour defines the type of "gender regime" (Lewis, 1992, 2002). The female participation in the labour market and the gender gap in participation are two indicators to describe the type of gender regime each country can be associated to. Analysing the evolution of these indicators is a first step to characterize the change in gender regime. The graph gives the long-term evolution of the gender gap in participation rate for persons aged from 15 to 64 years. In Sweden and Finland, the gap is low and stabilized below 5 points of percentage. The group of countries that gathers France, Germany, the UK, the Netherlands, and Austria are characterized by a gender gap between 8 and 10 points of percentage at the end of period. Italy and Greece have the highest gender gap with respectively 19 and 16 points of percentage in 2017. Spain and Ireland have both experienced a dramatic decrease of the gender gap during the 2000 decades: in Spain (respectively in Ireland) the gap went from around 15 points (25 points) at the end of the 1990's to 8 points (12 points) in 2017. The evolution of these gender regimes has been driven both by societal changes and by the economic growth those countries have experienced before the Great recession. These trends indicate that in most countries under review female labour force participation has led to more gender-equity and the male bread-winner model is one of the past. The implementation of public policies to work life balance and the development of childcare and the subsidies to cover the cost of childcare for parents have played a key role to strengthen the position of women on the labour market (Akgunduz & Plantenga, 2015; Brilli, Del Boca, & Pronzato, 2016; Vuri, 2016). Even though women are still performing a large part of family and domestic tasks, part of the care work is externalized outside the family. Beside the important role played by the institutional environment, the increase of the level of education of women with respect to men is a factor to be taken into account.

Figure 33. **Evolution of the gender gap in participation rates in a panel of European countries**



Source: Eurostat.

The increase in women's education has played a specific role in the dynamic of their participation in the labour market. The levels of education in the last decades have increased rapidly in Europe, in particular for women. The consequences of this education expansion on the wage structure have been analyzed for Spain (Carrasco, Jimeno, & Ortega, 2015) and France (Verdugo, 2014). The Table 11 illustrates the increase of the level of education that is more marked for women than for men: the share of women with tertiary education has grown more than the share of men between 1995 and 2013. As the labour force participation rate (LFPR) of women depends strongly on the education level, this dramatic increase in education could explain part of the increase in female participation rate in Europe.

To assess the role of education, the table reports the results of regressions of the labour force participation rate in 1995, in 2005 and in 2013 for people aged 25-54. In column 1, we regress the LFPR on a constant and a dummy variable for 2005 for the 1995-2005 period and respectively a dummy variable for 2013 for the 2005-2013 period. By definition, the dummy captures how the LFPR changed respectively between 1995 and 2005 and between 2005 with respect to 2013. To assess how controlling for education affects this change, we add three education dummies to the regression in column (2) which implies that changes captured by the time dummy in this specification are net of the effect of education. In column (1)-(2), we report the difference between the two parameters that indicates how the growth in education contributed to the increase in the LFPR for the two periods under review. The 1995-2005 period illustrates the general trend in LFPR and the role of education, whereas the 2005-2013 period describe the trend during the crises.

Table 11. **Contribution of education to the evolution of the Labour Force Participation rate between 1995 and 2005, and between 2005 and 2013 for prime age workers, by sex**

WOMAN						
	1995-2005			2005-2013		
	Observed (1)	Adjusted (2)	Contribution of education to the evolution of the LFPR (1) – (2)	Observed (1)	Adjusted (2)	Contribution of education to the evolution of the LFPR (1) – (2)
AUT	7.8	5.1	2.7	6	5.3	0.7
BEL	8.3	4.3	4	3.1	0.7	2.4
DEU	5.5	4.5	1	3.1	2.2	0.9
ESP	12.3	6.1	6.2	12.9	10.1	2.8
FIN	3	0.8	2.2	-0.6	-1.6	1
FRA	3.2	1.6	1.6	2.9	1.1	1.8
GRC	12.9	9.3	3.6	6.3	4.1	2.2
IRL	15.1	9.1	6	3.9	-1.3	5.2
ITA	8.7	3.7	5	3.6	1.1	2.5
PRT	7	6	1	4.7	1.9	2.8
SWE	-0.5	-4.1	3.6	0.7	0.5	0.2
GBR	3.5	-0.1	3.6	1.6	-1.2	2.8

MEN						
	1995-2005			2005-2013		
	Observed (1)	Adjusted (2)	Contribution of education to the evolution of the LFPR (1) – (2)	Observed (1)	Adjusted (2)	Contribution of education to the evolution of the LFPR (1) – (2)
AUT	-0.2	-1	0.8	-0.3	-0.6	0.3
BEL	0.1	-0.8	0.9	-1.3	-1.9	0.6
DEU	0.5	0.4	0.1	-0.7	-0.8	0.1
ESP	-0.4	-1	0.6	-0.4	-0.6	0.2
FIN	2.4	1.3	1.1	0.9	0.2	0.7
FRA	-1.2	-1.4	0.2	-1	-1	0
GRC	0.1	-0.1	0.2	-1.3	-1.4	0.1
IRL	1.7	-0.2	1.9	-2.6	-4	1.4
ITA	0.7	0.5	0.2	-2.4	-2.7	0.3
PRT	-0.9	-0.9	0	-2	-2.3	0.3
SWE	0	-2.4	2.4	-0.3	-0.4	0.1
GBR	-1.6	-2.9	1.3	0.5	0	0.5

Sources: EU-SILC, OECD, iASES (formerly iAGS) 2019 computations.

The results show that the contribution of education to the evolution of the LFPR for men is tiny during the two periods under review (less than 2 pp in most countries except in Sweden for the 1 low between 1995-2005). In contrast, the increase in education explains more than 5 p.p. of the dynamic of LFPR of female between 1995 and 2005 in Spain, Ireland and Italy. The growth of female education to their LFPR is of 3.6 pp in Greece, Sweden and the UK. During the following period the (2005-2013), the contribution is lower (except in Ireland).

The increase in the level of education is not the only factor explaining the trend in participation as the business cycle and especially public policies affect also the participation in the labour market. However, the growth in the share of university graduates observed is likely to reflect in large part secular factors.

This shows that there are clear synergies between education, employment and gender equality. Gender equality objective requires to integrate in European policies different dimensions. This objective requires a combination of quantitative and qualitative components to insure women's emancipation and gender equality in the European Labour (Fagan & Rubery, 2018). This demands a strong commitment of European Institutions to put gender back at the core of the European Employment Strategy.

Poverty rates focus on the aspect of income inequality with the greatest potential of generating social exclusion and economic distress, namely deprivation of income and consumption among the least fortunate. Poverty rates include the material deprivation rate and the at-risk-of-poverty rate.

The severe material deprivation rate focuses directly on the experience of material hardship at the bottom of the income distribution. It measures the share of the population who cannot afford four out of seven specific goods deemed by most people to be desirable or indispensable. These goods include the ability to pay unexpected expenses, afford adequate heating, a telephone etc.

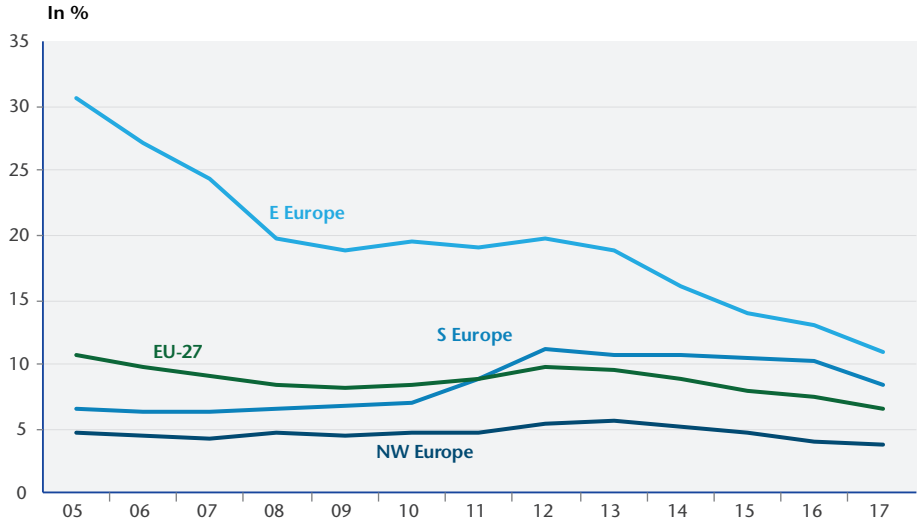
The at-risk-of-poverty rate measures the share of inhabitants having an equivalised disposable income below 60% of the national median. Below we have focussed on the so-called 'unanchored risk-of-poverty rate' in 2016 where the cut-off point is 60% of the median income in 2016 (in contrast, anchored rates fix the cut-off point to an income level in a specific year). The cut-off point varies with the national median income level which varies substantially between countries (*cf.* Figure 28 above).

The severe material deprivation rate in Europe has decreased since 2005, *cf.* Figure 34. The development has been driven mainly by the Eastern European countries catching up with the original EU member states. In the Eastern Europe a steep fall in the severe material deprivation rate was interrupted during the crisis years of 2008-2013. In the Southern-European countries the severe

material deprivation rate increased during the crisis and remained constant at a high level in 2012-2016. In 2017, the severe material deprivation again fell in the Southern-European countries and is now a bit above pre-crisis levels. In North-Western Europe, the severe material deprivation rate is almost constant.

Figure 35 shows that the severe material deprivation rate varies widely between countries. In Romania, Greece and Bulgaria, 20% of households or more could not afford four of the basic goods. In most of the North-Western European countries, this is the case for less than 5% of the households.

Figure 34. **Severe material deprivation rate in the EU**



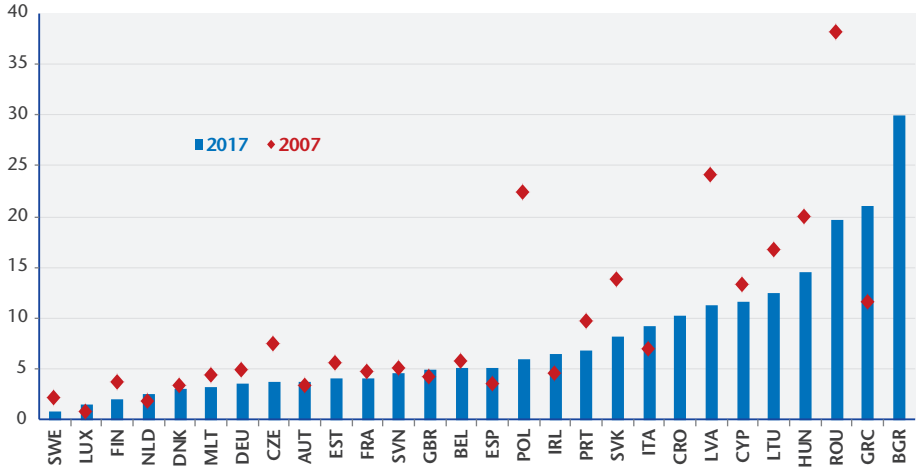
Source:

The unanchored risk-of-poverty rate is below 10% in Czech Republic, *cf.* Figure 35. Finland, Denmark and the Netherlands have relatively low poverty rates as well-both as measured by the material deprivation rate and by the at-risk-poverty-rate.

In Romania, on the other hand, more than ¼ of the households are at-risk-of-poverty. In the Baltic countries as well as Italy, Greece, Spain and Bulgaria the share of households at-risk-of-poverty is above 20%.

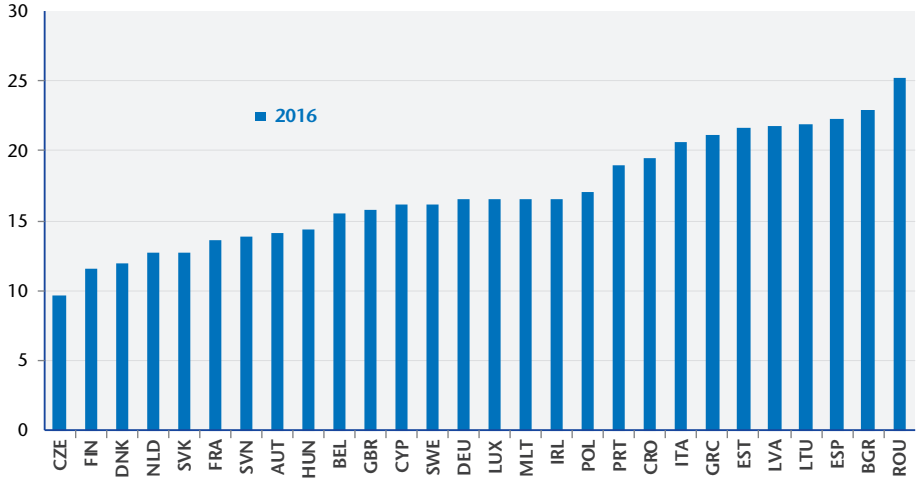
Contrary to the material deprivation rate, the risk-of-poverty-rate is only determined by the income distribution. This means, that it does not capture the effect of prices on the living standards which the poor can afford. In Box 4, we discuss the social consequences of the most pressing issue, namely the effect of housing price increases.

Figure 35. **Severe material deprivation rate**



Note: In 2007, the severe material deprivation rate in Bulgaria was 57.6%. This datapoint is excluded to highlight differences among other countries. For Sweden, Luxembourg, Ireland and Slovakia, data for 2016 is used instead of data for 2017.
Source: OECD.

Figure 36. **Unanchored at-risk of poverty rate, 2016**



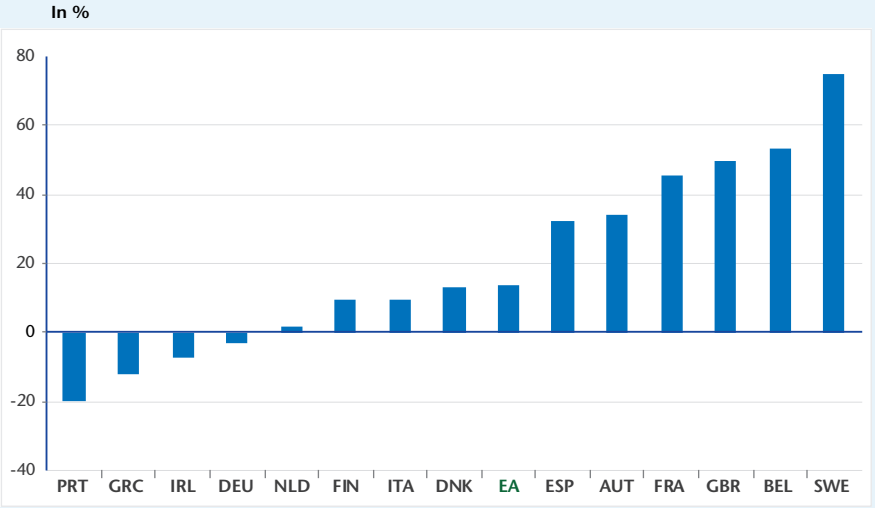
Source: Eurostat.

Box 4. Increasing housing prices increase poverty

The living standards of the poor are, of course, not only determined by their income level but also by the prices of basic goods. When the prices of necessities such as housing increase the poor effectively get poorer. Across European countries, housing prices are increasing at a faster pace than wages, *cf.* Figure 37 below. In some cities, this has raised concerns of price bubbles, whereas the social consequences of the increasing housing prices have gained less attention.

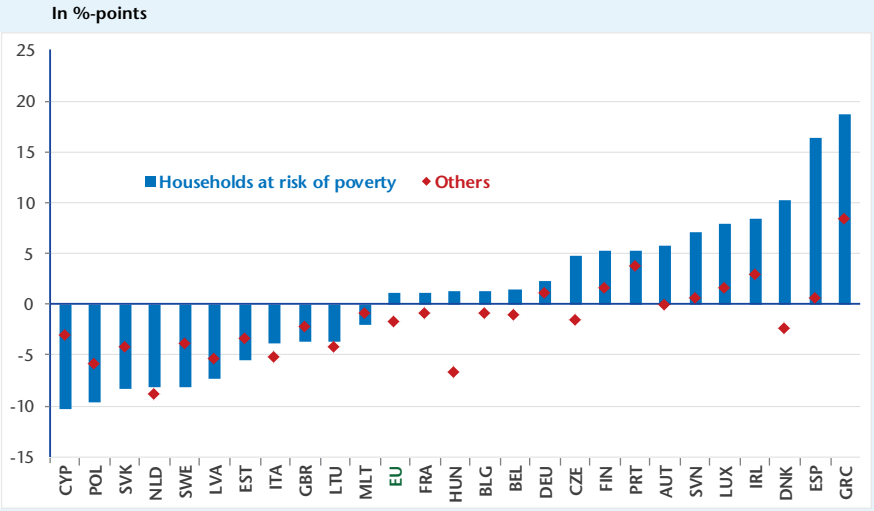
In many countries, the increase in housing prices implies that the costs of housing take up a larger share of the income, *cf.* Figure 38. It should be noted that EU Member States do not all follow the same pattern in this respect. In general, low-income households have suffered disproportionately from increases in the housing costs (and have benefitted disproportionately in countries where housing costs has fallen). To avoid spending more on increasingly expensive housing, low-income families often have to settle in cheaper neighbourhoods when housing prices increase. This can imply that neighbourhoods and public schools to a lesser extent mix citizens and children of different social backgrounds (this has for example been the case in Denmark, *cf.* ECLM 2018). Finally, the increasing housing prices tend to create a generation gap where young people are to an increasing extent indebted to the older generations (as seen some countries, *cf.* Rahman & Tomlinson 2018).

Figure 37. **Change in housing price to income ratio, 2001-2017**



Source: OECD.

Figure 38. **Change in the share of housing costs to disposable income, 2005-2017**



Note: The EU average is weighted by population size.
Source: Eurostat.

II.3. Nowcasting poverty

The indicators on poverty and income inequality calculated by Eurostat are based on the European Union Statistics on Income and Living Conditions (EU-SILC) survey. Using this survey, Indicators for year T are now available in the autumn of year T+1. The purpose of nowcasting is to estimate the indicators for year T during year T. There are two different approaches to nowcast income inequality and poverty indicators (Eurostat, 2017): (1) Microsimulation; (2) Macroeconomic time series modelling. Microsimulation should be the preferred approach. It is however cumbersome. Macroeconomic time series are used here but it has severe limitations.

3.1. Microsimulation

This approach consists in updating a micro dataset (here, the EU-SILC survey) in order to account for changes that impact income variables. There are usually three stages: 1) adjustment for changes in population characteristics (demographic and labour market); 2) updating non-simulated earnings; 3) simulation of tax-benefits policy changes.

A first step in the microsimulation approach is to age the survey sample in order to reflect new population characteristics and notably labour market outcomes (employment rate, unemployment rate, long-term unemployment…). Evolutions in the labour market are known in advance of evolutions in income inequality. There are two main techniques to age the sample: simulating transitions or reweighting. In the first technique, in a first step, transitions between labour market states (mainly employment and unemployment) are explicitly simulated. A logit model can be used using demographic variables (age, sex, education, country of birth, number of children, employment status of partner…) as explanatory variables. In a second step, income needs to be simulated. For newly employed, labour earnings need to be simulated either via a labour income equation or by setting labour income equal to the mean among those already employed in the same stratum. For the newly unemployed, unemployment benefits need to be simulated according to country rules. Similarly, those who remain unemployed might lose their benefits according to country rules (length of unemployment benefits). A second technique, less complex, consists in reweighting the sample. New weights are calculated for each household in order to replicate the new socio-demographic outcomes including labour market outcomes. This allows for finer distinctions on the labour market (for example, it is possible to follow closely the evolution of part-time work or temporary contracts). However, reweighting only works for marginal changes: for example, if unemployment is divided by two, reweighting will not be able to replicate the structural changes within the unemployed. Reweighting seems adequate to age a population for one or two years as done in nowcasting exercises.

A second step in the microsimulation approach consists in updating non-simulated earnings. This can be done using available indices (evolution of labour earnings, inflation), official projections and statutory rules (indexation rules for pensions). However, disaggregation is usually not available, or only at the sectoral level. The distortion of labour earnings is therefore not accurately modelled: at best, it only takes into account the new demographic characteristics of employed individuals (age, eduation, duration of employment…), differential earnings evolution for managers, full-time employees and part-time employees will typically not be taken into account.

The final step is the microsimulation of tax and benefits policy changes. A microsimulation model is needed (EUROMOD is used for EU-wide microsimulation). Elements simulated in EUROMOD include income taxes (national and local), social contributions, family benefits, housing benefits and social assistance. The new tax and benefit legislation needs to be coded for each country.

For poverty and inequality nowcasting, it is also important to take into account non-take up where and when information is available.

Box 5. Measuring the distributional impact of reforms using micro-simulation models for better policies

Income inequalities are driven by a multitude of factors. We can cite particularly macroeconomic dynamics (employment, price inflation, …) and legislative shifts in fiscal and social policies. A change in those variables affect individuals in heterogeneous ways, depending on their initial endowments (specially on human capital but also on other assets) and their socio-demographic characteristics (gender, family composition, age, diploma, etc.). This makes it difficult to predict the evolution of inequalities using exclusively aggregate data.

The availability of detailed micro-data and the improvement of computing power has allowed the development of micro-simulation models (MSM). Those models relate micro-data to the rules of the policies to be simulated (taxes, subsidies, pensions). Even if they usually lack of behavioural response to a legislative change (i.e. on labour supply, on portfolio decisions, …), MSM permit to analyse the full ex-ante distributional impact of a policy change. So MSM are useful for policy analysis as they assess the impact on the distribution of disposable income, the quantification and the identification of winners and losers or the impact on the poverty rate of a policy change.

An example with the 2018's French Budget

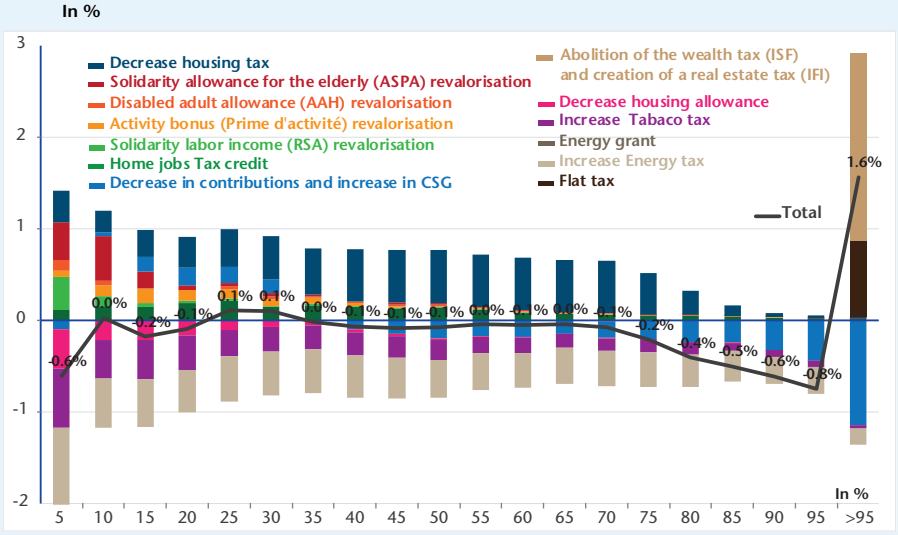
When some independent research institutes developed their own MSM, like the IFS in the UK, MSM were mostly used by public administrations. The development of the open-government agenda and the availability of detailed data has permitted the diffusion of micro-simulation models to a broader audience. For example, in France, public administration has recently published their open source MSM, called Ines. This allowed independent researchers to evaluate the 2018 Draft Budget Law during the legislative procedure. In particular, OFCE published number of policy evaluations nurturing continuously the budgetary debate.

For example, the analysis showed that the introduced discretionary measures in 2018 were globally neutral on average for the household's purchasing power. However, the expected distributional impact of the 2018 budget was significant. With the reduction of the taxation on wealth and capital incomes, the gains from new measures were concentrated among the richer 5%. They concentrated 42% of the total gains. On the other side, poorer households were penalized by the rapid rise of behavioural taxes (on energy consumption and on cigarettes) and the households of the 8th and 9th decile were affected by the tax rises while they did not beneficiate of any significant measure.

If independent researchers can improve public debate, they have to wait for the publication of budgetary documents to take notice of the detailed parametric

changes generated by the new measures. As analysing data is time consuming, robust analysis can be published with significant delay and may be available late to influence the legislative debates. Those debates could be richer if the MSM results are published at the same time as the budgetary documents. This can be achieved by forcing the government to micro-simulate all new measures or by creating new forms of cooperation between researchers and public administrations, granting—with confidentiality clauses of course—detailed information in advance to researchers.

Figure 39. **Impact on 2018's household income of fiscal and social reforms included in the 2018 Budgetary Law by ventiles of standard of living**



Source: OFCE (2018) using Ines model.

Incorporating MSM simulations in the European Semester to improve policy making

The coherence of economic policy could be improved with the publication of the expected distributional impact of reforms using MSM simulations. In particular, publishing these results can help policy-makers and can show explicitly the trade-offs generated by the new reforms, in particular in a context of fiscal adjustment. If it is not granted that more equilibrated policies will emerge, at least the choices made will be more transparent. Independent researchers, NGOs and opposition parties will be able to discuss openly those results, made with a common agreed methodology.

Of course, MSM are not perfect but models in general are never perfect. They remain an imperfect representation of reality. Models currently play an important role during the European Semester. For example, in their Stability Program, Member States (MS) publish the sensibility of their forecasting model to shocks on some international variables as oil prices or foreign exchange. Moreover, the

National Reform Program should include model-based simulations of the impact of the planned reforms—in particular if MS want to beneficiate from fiscal rules flexibility. Meanwhile ECFIN publishes its own evaluations of structural reforms using the QUEST model. Last but not the least, statistical models are used to measure the potential GDP, fundamental to compute the structural balance.

Moreover, MSM can be improved. Academic research focuses on the integration of behaviour responses into MSM and the integration of macro models and micro-simulation models in order to assess general equilibrium effects . The development and the use of MSM during the European Semester seems fundamental to improve the quality of policy making in the EU. More explicit trade-offs can lead to more equilibrated policies and richer democratic debates. Cooperation between academia and public administration is fundamental for a successful use of MSM.

3.2. Macro-economic time series modelling

A second method for nowcasting uses macro-economic time series data. We apply that method to nowcast the poverty rate in the European Union. The poverty rate is defined as the proportion of individuals in poor households, which are those whose equivalised disposable income is below 60% of the median equivalised disposable income. We run a panel regression between 2005 and 2017 with the poverty rate as an independent variable. We test different dependant variables from two sources: Eurostat and the OECD economic outlook. Dependant variables tested include GDP, output gap, unemployment gap, inflation household consumption from the OECD database, and activity rate, employment rate, temporary employment rate, unemployment rate, long-term unemployment rate, wage compensation as a % of GDP, social benefits as a % of GDP from Eurostat. We find that the output gap and social benefits as a % of GDP are significant (see Table 12). Table 13 shows actual and nowcasted poverty rates for European countries where relevant data is available.

Compared to microsimulation, this method of nowcasting has limitations. Whereas inequality and poverty is a microeconomic phenomenon, it only takes into account changes at the macro level. For example, new social benefits spending can be more or less concentrated on the poorest households: contrary to microsimulation, this will not appear in macro-economic time series modelling. Also, the poverty rate, like other inequality measures, does not vary much from year to year, which makes the identification of predictive variables more difficult. Nevertheless, this nowcasting exercise has some information value.

Table 12. **Panel regression, 2005-2017. Dependant variable is the poverty rate**

Number of obs.	205	Obs per group	
Number of groups	16	min	4
		avg	12,1
R-square		max	13
within	0,1514		
between	1	Wald chi2(19)	2207,15
overall	0,9219	Prob>chi2	0,0000

PovertyRate	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Social Benefits as % of GDP	-0.388	9.023	-4.300	0.000	-0.565	-0.211
Output Gap as % of GDP	-0.183	0.032	-5.750	0.000	-0.245	-0.120
Country						
BEL	0.735	0.410	1.790	0.073	-0.068	1.538
CZE	-7.395	0.791	-9.350	0.000	-8.945	-5.844
DEU	0.454	0.466	0.970	0.330	-0.460	1.368
DNK	-2.338	0.420	-5.560	0.000	-3.162	-1.515
GRC	5.349	0.521	10.260	0.000	4.327	6.371
ESP	4.837	0.584	8.280	0.000	3.693	5.981
FRA	-0.639	0.399	-1.600	0.110	-1.421	0.144
IRL	-0.478	0.814	-0.590	0.557	-2.073	1.117
ITA	4.692	0.442	10.620	0.000	3.827	5.558
NLD	-3.909	0.458	-8.540	0.000	-4.806	-3.012
POL	1.408	0.632	2.230	0.026	0.169	2.647
PRT	2.889	0.536	5.390	0.000	1.838	3.941
SWE	-1.399	0.568	-2.460	0.014	-2.512	-0.285
SVN	-2.407	0.523	-4.610	0.000	-3.431	-1.383
GBR	2.161	0.489	4.420	0.000	1.204	3.119
Constant	21.870	1.876	11.660	0.000	18.194	25.546
sigma_u	0.000					
sigma_e	1.018					
rho	0.000					

Source: iASES (formerly iAGS) 2019 computations.

Table 13. **Poverty rate, actual and nowcasted (n)**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	201 8(n)	2019(n)	2020(n)
BEL	14,7	14,6	14,6	15,3	15,3	15,1	15,5	14,9	15,5	15,9	15,8	15,7	15,7
CZE	9,0	8,6	9,0	9,8	9,6	8,6	9,7	9,7	9,7	9,1	9,0	8,9	9,0
DNK	11,8	13,1	13,3	12,1	12,0	11,9	12,1	12,2	11,9	12,4	12,3	12,2	12,2
DEU	15,2	15,5	15,6	15,8	16,1	16,1	16,7	16,7	16,5	16,1	16,1	16,1	16,1
IRL	15,5	15,0	15,2	15,2	16,6	15,7	16,4	16,3	16,6	16,4 (n)	16,8	16,8	16,8
GRC	20,1	19,7	20,1	21,4	23,1	23,1	22,1	21,4	21,2	20,2	19,9	19,6	19,4
ESP	19,8	20,4	20,7	20,6	20,8	20,4	22,2	22,1	22,3	21,6	21,3	21,0	20,8
FRA	12,5	12,9	13,3	14,0	14,1	13,7	13,3	13,6	13,6	13,3	13,2	13,1	13,1
ITA	18,9	18,4	18,7	19,8	19,5	19,3	19,4	19,9	20,6	20,3	20,1	20,0	20,1
NLD	10,5	11,1	10,3	11,0	10,1	10,4	11,6	11,6	12,7	13,2	13,2	13,1	13,0
AUT	15,2	14,5	14,7	14,5	14,4	14,4	14,1	13,9	14,1	14,4	14,3	14,2	14,2
POL	16,9	17,1	17,6	17,7	17,1	17,3	17,0	17,6	17,3	15,0	14,6	14,6	14,6
PRT	18,5	17,9	17,9	18,0	17,9	18,7	19,5	19,5	19,0	18,3	18,2	18,0	17,9
SVN	12,3	11,3	12,7	13,6	13,5	14,5	14,5	14,3	13,9	13,3	12,9	12,6	12,5
SWE	13,5	14,4	14,8	15,4	15,2	16,0	15,6	16,3	16,2	15,8	15,8	15,9	15,9
GBR	18,7	17,3	17,1	16,2	16,0	15,9	16,8	16,6	15,9	16,3 (n)	16,4	16,4	16,4

Sources: Eurostat, iASES (formerly iAGS) 2019 computations.

II.4. Promoting well-being and quality of Life

Certainly, having a good job and an appropriate income is important for the quality of life, but there are several other issues associated with the well-being of individuals and a "good" society as a whole. The Stiglitz-Sen-Fitoussi-Commission (Stiglitz *et al.* 2010) addressed this topic. Furthermore, it plays a crucial role within the attempts to bring the aspects that matter to people on the top of the agenda. The SDGs are the most prominent current example. Especially, features shaping the quality of life, which are strongly influenced by public institutions, should be included in an analysis of the current social situation. Important areas include health care, education, leisure, social and personal security, environmental conditions or housing. Topics, which are to some extent included in some analysis relevant within the European governance, but —with the exception of education—mostly not in the context of its positive impact on well-being, but instead their negative aspect as important items

within public expenditure. Framing health care and social security as costs creates pressure to limit their provision. This is one of the channels where the wrong economic governance focus—fiscal rules instead of the overarching goal of well-being—becomes obvious.

The best source to evaluate the quality of life in the EU at the moment is the survey conducted by Eurofound (for the most recent update, see Ahrendt *et al.* 2018). It delivers a lot of relevant cross-country and qualitative analysis, but it has a significant time lag and a publishing period of four years, so it is not suitable for a yearly monitoring exercise. Screening the Eurostat SDG dataset gives a lot of possible indicators with relation to the quality of life aspects mentioned above and a yearly data basis. We choose some of them, which are most significant for us.

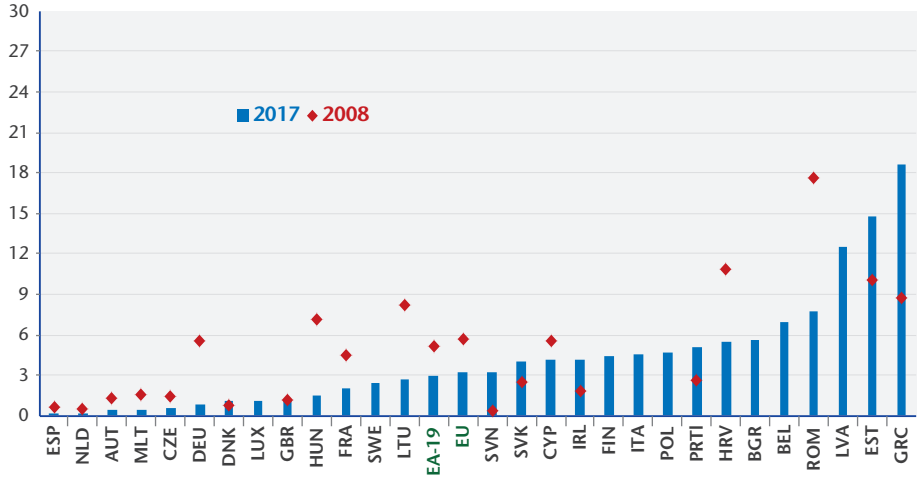
Concerning health, we do not select what are actually the most important factors like life expectancy or self-perceived health, as many factors that are largely independent of public health services (like a balanced diet, many sun hours, consumption of alcohol and tobacco) determine the outcome. Therefore, we choose the indicator "self-reported unmet need for medical examination and care" (Figure 40).

Although health services are overwhelmingly open to all citizens in the EU, 1.6% of total population self-report unmet needs, either because they are too expensive, the provider is too far away or a long waiting list. For persons in the bottom quintile of the income distribution the ratio doubles. While the proportion is below 1% in Spain, the Netherlands, Austria, Malta, Czechia and Germany, it exceeds 10 % in Latvia, Estonia and Greece.

In most countries, the proportion with unmet needs decreased compared to 2008. However, this is not the case for Estonia and Greece, which both experienced a significant increase after the crisis due to austerity measures. Also, Slovenia, Ireland and Portugal, ratios increased moderately.

Concerning education, various issues arises. First, children should, obviously, get a good education beginning in their early childhood. Second, people should have access to higher education and life-long learning. And third, pupils should not leave the education system too early, as they are worse prepared for the labour market—especially in the long run, as adult participation in learning is correlated with the initial education level. Therefore, one measure with growing attention is the "early leavers from education and training" indicator.

Figure 40. **Unmet needs for medical examination, lowest income quintile**



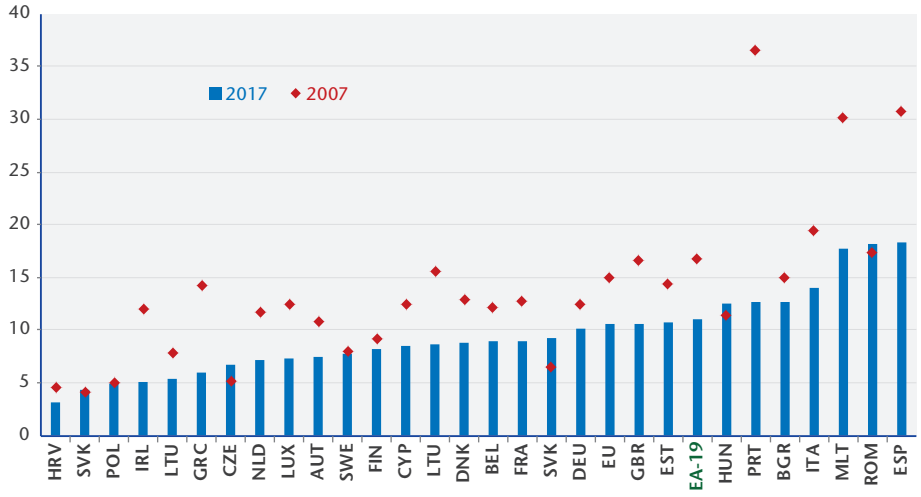
Note: IR and UK 2016, HR starts in 2010. If there was a break in the time series, initial values are not displayed.
Source: Eurostat.

In 2017, Germany and all other member states to its right in Figure 41 were still missing the target of max. 10% by 2020. Compared to the initial values in 2007,[1] there has been significant progress, except in some Eastern European countries. This development can be seen as an example of the value of political priorities set out in a medium term strategy, creating momentum for change. However, for countries like Spain, Romania, Malta or Italy, it will almost certainly not be sufficient to reach the target in 2020. Furthermore, it should be mentioned that a dropout rate of 10% is still quite high and will induce future qualification problems.

Another substantial factor for a good life is housing and topics related to the place of living, like energy supply, personal security, environmental problems, noise, etc. As the quality of housing like proper sanitation (accomplished for 97.8% of population within the EU and 99.4% of the Euro area) is getting a less pressing issue, indicators like the housing costs get more important (*cf.* Box 4 above). Furthermore fuel poverty, the inability to keep one's home adequately warm, gains attention, also because of the obvious trade-off with climate goals and the impact of green taxation.

1. Although there are several breaks in the time series and a common one in 2014, there impact seems to be rather small. It is likely that the general reduction is slightly exaggerated, but that the overall picture is not effected.

Figure 41. **Share of early school leavers (18-24years)**

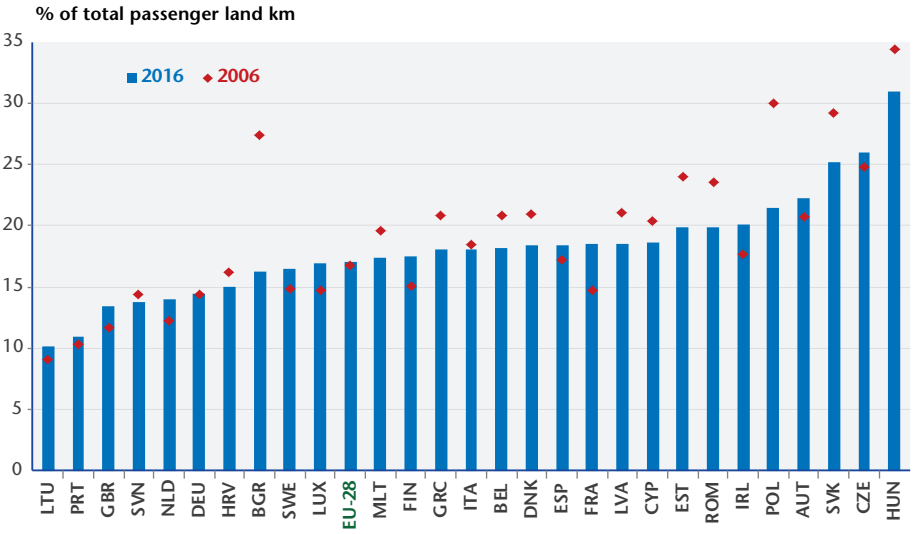


Source: Eurostat.

One aspect that brings together many issues is public transport. As Stiglitz *et al.* (2010: 175) stated, "the accessibility of transport and its affordability, which may affect people's right to daily mobility" as well as a short commuting time is important for well-being. At the same time, mobility probably has the most negative side-effects on other aspects relevant for well-being, like air pollution, noise and high non-renewable energy consumption. Public policies play a key role in minimising the negative side-effects and offering mobility for all groups. Typically, it is public infrastructure enabling mobility—and therefore the type and the magnitude of public investment, which determine future sustainable well-being related to mobility (e.g. more roads fostering more energy-intensive individual mobility or railways fostering more efficient common transport by train, tram or subway). The two indicators related most to this topic within the Eurostat SDG Dataset are the "share of collective transport modes in total passenger land transport" and the share of population with difficulty in accessing public transport. We focus on the first one, as it is the more important one concerning synergies and trade-offs with climate goals.

The share of collective transport modes differ substantially between EU member states, but within the 10-year period, there was some convergence while the EU as whole remained broadly unchanged (Figure 42). Typically, in Eastern European Countries the initial share was relatively high and decreased afterwards, while we saw increases in the EU-15, especially in France. Outliers are Austria

Figure 42. **Share of collective transport modes**



Source: Eurostat.

with a high share of public transport or Lithuania with the lowest value. Compared with public expenditure on transport, there is a quite clear correlation: While the top-3 countries are also the top-3 in expenditure (with around 3.5% of GDP), the bottom-3 are at least in the bottom-10 in spending. So if European societies want to retain mobility for everyone and become more sustainable, they need to raise public expenditure—especially public investment—for public transport modes fuelled by renewable energy or promote walking or biking.

The figures given in this sub-chapter lead to the conclusion that various aspects of the quality of life have become better in the last decade. Although the crisis had an impact and worsened the quality of life, especially in Greece, it did not have significant effects in all areas. However, the quality of statistics as well as scientific agreement on of how to measure well-being are areas in need of improvement.

II.5. Policy measures

5.1. Synergies

Policy makers need to be aware of possible trade-offs and synergies between sustainable development goals. Table 14 illustrates some of these trade-offs and synergies between the goals discussed in this chapter. For a discussion of synergies and trade-offs between mitigation of climate change, climate adaptation and Sustainable Development, see IPCC (2018).

Table 14. **Synergies between social goals and economic growth**

	Ppoverty/ Inequality	Employment / Unemployment	Education	Gender inequality	Growth
Poverty/Inequality					
Employment/Unemployment	0				
Education	+	+			
Gender inequality	++	+	+		
Growth	0	0/+	+	0	

Interpretation: + : existence of synergies ; 0 : ambiguous or no relationship.

The relationship between poverty and labour market outcome (employment / unemployment) is ambiguous. On one hand, unemployed tend to be poorer: everything else being equal, a reduction in unemployment should decrease poverty. A reduction of unemployment attained by a reduction of the output gap (growth higher than potential growth) will reduce poverty and inequality. However, everything else is not always equal. Policies that promote employment at all cost, via the promotion of precarious and low-paid jobs (for example mini-jobs in Germany), tend to increase poverty and inequality.

Education and reduction of poverty are usually seen as mutually reinforcing. Poverty has been showed to impact the educational outcome of children and thus increase their probability of remaining poor in their adulthood. Better educated individuals have a greater probability of being employed and earn higher incomes. However, caveats should be introduced. First, technology used to be skill-bias: it decreased demand for low-skilled labour and increase demand for high-skilled labour. Today, technology seems to be routine-biased and therefore polarizing: it favours the occupations which traditionally was low or high skilled occupations and reduces the demand for labour in the middling occupations. However, it has been the low-skilled workers who have taken the hit, as the competition for their jobs has increased—perhaps together with the

complexity of these jobs. Therefore, upskilling still seems to be the answer, even though it might be less effective than it used to. Second, education can only have an impact on poverty in the long-run, and if its aim is to reduce the number of individuals who leave the education system with low-skills.

Combating gender inequality and poverty /overall inequality is mutually reinforcing. Countries with low levels of gender inequality have also low levels of poverty and overall inequality as measured by the Gini. Promoting employment of women with children reduces both poverty and gender inequality. Lone women with children usually have a high risk of poverty, which is reduced when they can combine care and paid work. We have seen that the increase in women's education partly explains the rise in their participation on the labour market.

The relationship between inequality and growth is complex. For a long time, it was assumed that inequality was good for growth, mostly for incentive reasons. It was thought that there was a trade-off between equality and efficiency (Okun, 1975). More recently, Stiglitz emphasized the price of inequality: he suggests that inequality induces rent-seeking, which is bad for growth. The empirical literature finds mixed results; recent work by IMF and OECD conclude a that countries with higher income inequality over the last decades experienced lower economic growth rates than countries with lower income inequality (IMF, 2015; OECD, 2015). In a recent article using US data, der Weide and Milanovic (2018) find that inequality is bad for subsequent income growth of the poor, but helps the growth of the rich.

To conclude, there seems to be more synergies than trade-offs between the goals analysed here. However, the synergies are not policy independent: some policies might help attain several goals (for example promoting employment with ALMPs or promoting mother employment with childcare) while others imply trade-offs (for example promoting low-paid precarious jobs with flexibilisation of labour market).

5.2. Policy recommendations

In line with the SDGs (see introduction) and intended goals of the European Pillar of Social rights with its three main dimensions of equal opportunities and access to the labour market, fair working conditions and social protection and inclusion, we aim to promote policies which address these goals.

Several previous iAGS analyses show that issues of unemployment and inequality can be tackled at the same time. As e.g. the Nordic model (Denmark,

Sweden, Finland) exhibit a low share of low wage earners and only a moderate unemployment rate. This indicates that well designed policies are able to establish synergies to improve social protection, low unemployment and fair working conditions simultaneously. The subsequent parts take up these synergies and formulate policies that qualify for such purposes.

Employment

First, we focus now on potential policies towards the goal of decent work for all. Although the unemployment rates across Europe are on average back at pre-crisis levels, this does not mean that pre-crisis levels were the goal we are aiming at. There are still 17.0 million people looking for jobs. Especially Southern European countries like Greece, Spain and Italy still face high headline unemployment numbers paired with alarming NEET rates which are still above pre-crisis levels.

Proposing policies to tackle such macroeconomic issue always requires tailor-made concepts for the very different welfare regimes and country specifics in order to properly address the needs of the local conditions. Although we are not able to cover all the country-specific standards, norms and regulations, we aim to make some general policy recommendations which allow for national specifications but still are concrete enough to give a clear direction for potential policies.

Given the large number of unemployed people in the European Union and keeping in mind that the labour force potential could be substantially higher, at least in several countries, it is necessary to combine active labour market policies with other innovative measures to overcome the direct and indirect negative consequences of unemployment. They have to jointly address the demand and supply side on the labour market and the main policies are presented in the overview and described in more details below.

Table 15. **Overview: Main policies**

Demand side policies	Supply side policies
■ Expanding social investments ■ Fostering the socio-ecological transition	■ Active labour market policies ■ Working time reductions ■ Strengthen collective bargaining

a) Demand side policies

- The European society is facing an aging population along with an increasing demand for care. There is also an increasing demand for social services like childcare and similar labour-intensive jobs. These socially important tasks tend to produce relatively low emissions and further promote more gender-equality when shifting from unpaid care work, which is for the most part done by women, to formalized paid jobs. Therefore, expanding social investments addresses several key principles of the European Pillar of Social Rights and also helps to reduce emissions. This means higher public spending and tax ratios. Those can be attained through higher taxation on top income, corporate profits and wealth (see below).
- The environmental boundaries require pro-active industrial policies fostering the transition towards more ecological investments in order to reach the 2°C goal. The results of chapter 3 already give an indication of the magnitude for the future demand for investment and trained personnel. Furthermore, growing cities need affordable housing and public infrastructure which increases the demand for labour.

These policies should be embedded in a modified European (economic) governance—already discussed in the introduction— so as to avoid demand shortfalls leading to mysterisis problems.

b) Supply side policies

Apart from the commonly mentioned demand side related policies and active labour market policies which were extensively discussed in the former iAGS, progressive labour market policies should also take into account other ultimate policy goals like the quality of life:

- Active labour market polices consist of several aspects, ranging from active reintegration policies to reducing precarious job contracts which have become the default form of employment in selected countries. Binding Europe-wide minimum requirements concerning national unemployment insurance schemes (e.g. concerning coverage or generosity) should also be implemented and continuing training should be a legal right. These measures could support labour market transitions.
- Leisure is a central component within the concept of personal well-being and although significant productivity increases has been taking place since the industrial revolution, the reduction in working hours did not develop in the same pace. Whereas part-time working employees often

want to increase their working hours, fulltime employees with many overtime hours want to decrease their workload (Schwendinger, 2015). As stress-related diseases like occupational burnout are becoming a widespread phenomenon, innovative concepts to reduce the individual working hours are highly welcome and could be implemented in various forms. They range from a general working time reduction to the extension of paid holidays and sabbaticals to improve skills required due to the ongoing process of digitalization. At the same time, this might allow more people to participate in the labour market, increase the quality of life and may also improve the balance of paid and unpaid work within families. The latter contributes to a reduction in gender pay gaps.

- Redistributing the total volume of working hours requires decent incomes. Therefore, it is necessary to increase the collective bargaining coverage and bring down low-paid work. Such labor market institutions could further strengthen the domestic demand by substantially raising lower and middle incomes. Subsequently, households with solid consumption expenditures backed by decent incomes, promote a macroeconomic stabilization via reliable domestic demand that is more resilient to macroeconomic shocks.

Inequality

Policies like the redistribution of paid work also requires decent incomes which is strongly linked to policies to lower the inequality among the European countries. Several instruments on different levels are suitable to do the job.

- Following a path of inclusive growth reduces the job and income polarization, which requires strengthening the wage-setting mechanisms (Alvarez et al 2018). A number of measures can be deployed depending on country priorities and structures. Raising collective bargaining coverage has been shown to reduce the incidence of low-paid work, minimum wages can be raised. Bringing in (pseudo-)independent workers and so-called "gig" workers under legal provisions and/or collective bargaining agreements is also important.
- Several measures within the employment policy section already aim at narrowing the gender pay gap. On an institutional level, gender should be put back at the center of the European Employment Strategy.
- Poorer households benefit most from public assets as they are less dependent on private savings for exceptional financial burden. With reference to Box 3 public investments in housing could reduce the exposure of

financially vulnerable families and stabilize property prices in urban regions and help to counteract the tendencies of residential segregation.

- So far, the suggested policies only focused on strengthening middle-income households as well as reducing poverty, but—as the iAGS 2018 puts it—also the strong have to be tied in. They should contribute a fair share of the efforts needed to promote social cohesion. Policies most prominent to do the job can be located in the tax system.
  - — The deterioration of top income tax rates as well as the taxation levels of capital income over the recent decades are harmful to the welfare states. We have to reverse that trend and make sure that these income groups as well as capital owner pay their fair share.
  - — We have to end the race to the bottom when looking at corporation taxation and it is required to put a floor to those developments by introducing a binding minimum rate of corporation tax. At first, this rate could be equal to the lowest rate in the European Union (10% in Bulgaria and 12.5% in Ireland) to avoid the negative consequences of a future race to the bottom and in order to obtain the needed unanimity of the Council.
  - — Wealthy individuals as well as companies also tried to avoid or at least reduce taxation by legal and illegal practices, often in conjunction with tax havens. Within Europe, information exchange between fiscal authorities and common reporting standards need to be implemented and quasi-tax havens within Europe, like the Isle of Man have to be shut down.
  - — In order to prevent tendencies like plutocracy (Milanovic, 2016) it is necessary to tackle rising wealth inequality. Some countries (including Sweden and Austria) have abandoned attempts to tax wealth or inheritances. In these countries, wealth is passed over from generation to generation, which proliferates wealth inequality even more. Appropriate tax exemption thresholds reduce administrative costs and allows dampening the accumulation process at the top of the distribution. But inheritance taxes are only one part of a broader strategy to reduce wealth inequality and gain more social and economic mobility, including wealth and capital-income taxes.

5.3. Linking Policies and SDGs

So far, policies were described to address issues related to unemployment as well as inequality. Each of them contributes to one or more Sustainable Development Goals and the effects of these measures could be captured by several indicators lying behind the SDGs.

Table 16. **Linking Policies and SDGs**

Policy recommendations	Targeted SDGs
Increasing demand for labour *via* ■ Expanding social investments (e.g. child and elderly care services, ..) ■ Fostering the socio-ecological transition (e.g. housing, public infrastructure, ..)	**1. No Poverty** **3. Good Health and Well-Being** **4. Quality Education** **5. Gender Equality** **7. Affordable and Clean Energy** **8. Decent Work and Economic Growth** **9. Industry, Innovation and Infrastructure** **10. Reduced Inequalities** **11. Sustainable Cities and Communities**
Supply side related labour market policies ■ Working time reductions ■ Strengthen collective bargaining	**1. No Poverty** **4. Quality Education** **10. Reduced Inequalities**
Inequality related measures ■ reverse that trend of decreasing top income tax rates, capital income taxes and corporation tax ■ tackle rising wealth inequality *via* wealth and inheritance taxes ■ shutting down tax havens	**1. No Poverty** **10. Reduced Inequalities**

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AN EXPLORATIVE EVALUATION OF THE CLIMATE DEBT[1]

Climate change and global warming are often spoken of in the same breath as limited natural resources and the optimal way to manage the small amount that is still available. Understanding how we should use and share what is left in order not to put human life at risk is of cardinal importance, if not the cornerstone of nowadays debates. Despite all the pledges that have been made so far, both on the national and global stages, there is still a lot to be done before countries dedicate sufficient economic and political means to really tackle this issue.

The 24th Conference of Parties that will be launched on the 3rd of December in Katowice, Poland, is part and parcel of the traditional diplomatic apparatus aiming at promoting fruitful talks and agreements relative to this paramount topic. The location of this 24th summit is sufficient in itself to shed light on active fault lines of such negotiations. Indeed, Katowice is nothing but an example of how coal mining cities remain vital for some national European economies to stay away from deep crises. More specifically, it helps keeping in mind that entire economies, even in what is thought to be the "developed" world, still depends hugely on fossil fuels. Above all, this will surely be an additional occasion to realize that some countries are not especially welcoming structural changes in their energy mixes. To be more precise, it may be the place where countries will try and advocate one more time for differentiated historical responsibilities in the global warming phenomena currently happening as well as differentiated capabilities to address these issues. For instance, Katowice's mayor has allegedly admitted that "it would be difficult to

1. All data, source code and spreadsheet files used to calculate elements in this chapter are available on request to xavier.timbeau@sciencespo.fr. Commercial data and software cannot be transmitted.

convince representatives of other countries to continue using energy from fossil fuels, but that he can't imagine the same to hold for Poland itself".[2]

In such a framework, it seems more urgent than ever to delineate countries' relative responsibilities and absolute contributions to emissions reductions in order to remain in line with the 2015 Paris Agreement. To do so, we outline in the subsequent work a methodology aiming at computing climate debts at the national and regional scales. In other words, we aim at developing monetized indicators that encapsulate the amount of efforts to be made by each country within the next decades if we want to keep the global temperature increase below 2°C (or 1.5°C in the best case scenario) above pre-industrial levels, proposing a measure of the distance to a sustainable pathway for the economy.

Our methodology relies on a two-step approach. First, we compute "carbon budgets" libelled in physical units, namely $GtCO_2$. These budgets correspond to the cumulative amount of carbon dioxide (CO_2) emissions permitted until the end of times to keep within a certain temperature threshold. Since these computations are subject to normative implications, we detail various alternatives to build those numerical entities. We carefully pay attention to the question of differentiated historical responsibilities among countries. Then, our goal is to associate a monetary price to these carbon budgets. To do so, we develop the concept of "climate debt". By "climate debt" we mean the amount of money that will have to be invested or paid by countries for them not to exceed their carbon budget. It means that we rely on previously computed carbon budgets on the one hand and a provisional emissions path on the other so as to determine which quantity of carbon will have to be abated. This allows us to compute the numbers of years before depletion of the carbon budget by country. We then rely on assumptions on the cost of abatement technologies in order to give a monetary value to these residual carbon emissions past the depletion date.

In the end, climate debts and years before depletion put emphasis on the urgency to mitigate climate change since numbers at stake are quite big. What's more, we find that there is a significant heterogeneity among countries within the European Union. However, we believe that these quantitative elements should not be interpreted as the proof that mitigating the climate is not undoable or too expensive. Rather, it sheds light on the fact that it is within our reach, making our failure to address it even more condemnable.

2. See http://climatetracker.org/cop24-katowice-expect-polands-4th-un-climate-summit/

III.1. Carbon budget, historical carbon adjustment and burden share

1.1. Historical construction and standard definitions

The 2015 Paris Agreement achieved a global consensus about the boundaries that should constrain greenhouse gases (GHG) emissions to prevent global warming. Nearly all countries agreed to cooperate in order to keep the increase in global temperature under 2°C above pre-industrial levels and to do whatever is in their power to get this global temperature change as close as possible to 1.5°C. Thus, countries have already committed to reduce their carbon emissions while designing and submitting their ***Intended Nationally Determined Contributions**** (also known as INDCs).[3]

In the light of the latest geophysical analyses, this implies that only a limited quantity of carbon dioxide can be emitted. Indeed, in the last decades, it has become widely acknowledged that global warming is almost linearly related to cumulative emissions of carbon dioxide (Allen *et al.*, 2009; Matthews et *al.*, 2009; Raupach *et al.*, 2011) complicating the setting of stabilization targets to avoid potentially dangerous levels of global warming. Similar problems apply to the carbon cycle: observations currently provide only a weak constraint on the response to future emissions. Here we use ensemble simulations of simple climate-carbon-cycle models constrained by observations and projections from more comprehensive models to simulate the temperature response to a broad range of carbon dioxide emission pathways. We find that the peak warming caused by a given cumulative carbon dioxide emission is better constrained than the warming response to a stabilization scenario. Furthermore, the relationship between cumulative emissions and peak warming is remarkably insensitive to the emission pathway (timing of emissions or peak emission rate). This is tantamount to say that there is no path specificity to global warming: as a first order approximation, only the cumulated quantity matters, regardless of the emissions trajectory.

Not only did this near-linear relationship between global warming and cumulative carbon dioxide emissions improve our understanding of climate change but it also amounted to a huge leap forward in terms of environmental policies design. Indeed, this simple link allowed the production of more accurate forecasts of future global warming and climate change. It enabled for instance to

3. Terms in bold with an asterisk are detailed in Chapter 3 final glossary.

conceptualize the indicator called Transient Climate Response to Cumulative Carbon Emissions (TCRE), which aims at quantifying the global average temperature change per units of emitted carbon dioxide. On the other hand, the quasi-linear relationship between temperature increase and carbon emissions can also be used in reverse in order to define the cumulative quantity of carbon dioxide than can be emitted until we reach a given global temperature change target.

This idea thus led to the development of ***carbon budgets****, namely statistical indicators aiming at measuring how many tonnes of carbon dioxide can be released in the atmosphere before we cross given temperature change thresholds. According to the ***Intergovernmental Panel on Climate Change**** (thereafter the IPCC) Special Report on the impacts of global warming of 1.5°C above pre-industrial levels (SR1.5), the carbon budget is the "*estimated cumulative net global anthropogenic CO_2 emissions from preindustrial period to the time that anthropogenic CO_2 emissions reach net zero that would result, at some probability, in limiting global warming to a given level, accounting for the impact of other anthropogenic emissions*".[4] The IPCC SR1.5 also gives the most consensual and up to date evaluation of the global carbon budget.[5]

Table 17. **Global Carbon Budget**

Global warming since 1850-1900	Remaining carbon budget from 1.1.2018, $GtCO_2$			Uncertainties				
	33%	50%	67%	Additional Earth system feedbacks	Non-CO_2 scenarii variance	TCRE distribution uncertainty	Historical temp. uncertainty	Emissions uncertainty
+1.5 °C	1,080	770	570	+100	[-400:+200]	[+100:+200]	[-250:+250]	[-20:+20]
+2. °C	2,270	1,690	1,320					

Source: IPCC SR1.5 (2018).

Table 17 can be interpreted as follows: if we want to ensure a probability of 67% that global temperature change will remain below +2°C from preindustrial levels, we should not emit more than 1,320 billion tonnes (10^9 tonnes) of carbon dioxide ($GtCO_2$) from now until the end of times globally. This limited cumulative emissions of carbon dioxide that can be released in the atmosphere falls down to 570 $GtCO_2$ if we consider the 1.5°C threshold instead.

4. See *Summary for Policymakers*, IPCC SR1.5 p.26
5. Available here: www.ipcc.ch/report/sr15/

Of course, the computation of the carbon budget is always disputable as it relies on climate models which, in turn, depend on many assumptions and hypotheses that can be discussed. In particular, climate scientists keep improving climate models while bringing to light new physical properties of the Earth carbon cycle[6]. This is why the IPCC special report 1.5°C provides boundaries taking into account several uncertainties such as historical temperatures or the distribution of the TCRE in particular. More generally, the computation of the carbon budget can differ greatly between institutions not only because of the sensitivity of climate models but also due to the time frame considered, the scope of sectors under scrutiny (referring to the energy sector only or to all sectors) and the type of emissions accounted for (all greenhouse gases or carbon dioxide only).[7]

Nevertheless, although there is not a definitive consensus on how to compute global carbon budgets yet, the key issue lies elsewhere. More specifically, computing global carbon budgets remains less controversial than sharing these budgets between regions and countries.[8]

1.2. Normative implications of burden sharing

Deriving a global carbon budget is undoubtedly helpful when it comes to fueling the scientific debate on climate change. As far as national environmental public policies are concerned, it still needs to be broken down into smaller parts in order to enlighten decision makers and weigh in on public policy design. National budgets must be estimated to delineate countries' responsibilities and drive their emissions reductions. So far, the literature has underlined a continuum of burden sharing methods, whose two endpoints are the egalitarian approach on the one hand and full grandfathering on the other (Gignac and Matthews, 2015; Giraud *et al.*, 2017; Raupach *et al.*, 2014) on a spectrum of sharing principles that extends from continuation of the present distribution of emissions to an equal per-capita distribution of cumulative emissions. A blend of these endpoints emerges as the most viable option.

6. See for instance Comyn-Platt *et al.*, (2018) in "Carbon budgets for 1.5 and 2°C targets lowered by natural wetland and permafrost feedbacks".
7. For more details, see Sussams, (2018) in "Carbon budgets: where are we now?".
8. See Caney, (2013) in "Justice and the distribution of greenhouse gas emissions".

1.2.a The egalitarian approach

The first and most intuitive sharing method consists in allocating each and every human being the same right to emit carbon dioxide. Said differently, it means that the quota of CO_2 units per capita remains constant for a given reference year, regardless of considered country. It can be written as follows:

$$CB_c = CB_w \times \frac{pop_{c,t}}{pop_{w,t}}$$

with CB standing for "carbon budget", pop for "population", c (resp. w) for countries (resp. world) in year t. Thus, for a given year t, the more populated a country, the greater its carbon budget, no matter its level of economic development, degree of industrialization, cumulative past emissions, etc. This means that this approach is utterly blind to structural inequalities between countries[9] and puts at the forefront present equality between people as a sharing principle. To some extent, it is a way to erase past differences between countries and hence make people equally responsible from now on when it comes to fighting global warming and climate change. As such, it could be interpreted as a way to impulse cohesion so as to trigger a global effort in designing efficient environmental public policies.

The strength of such a method is its relative simplicity as well as the transparency of its underlying hypotheses. Nevertheless, numerous shortfalls must be highlighted. The first one deals with the choice of reference year. The carbon budget allocated to each region or country can greatly vary depending on this choice. For instance, choosing 1990 as a baseline would be more favorable to the European Union than 2005 or 2015, since the ratio of the European population over the global population keeps decreasing.

Furthermore, ignoring past and remaining structural heterogeneities between countries—such as differences in countries' access to renewable resources and in their weather and climate conditions—seems quite disputable. For instance, in countries where there are more cold days on average, it seems more likely that emissions per capita will be higher, all other things being equal. Allocating the same per capita carbon budget would implicitly mean that some people are constrained more than others since they are bound to do more efforts to keep their emissions within authorized boundaries. At some point, it goes against the idea that every individual is entitled the same rights and duties when it comes to their environmental impact.

9. At least, those that are not endogenous to population size.

1.2.b Grandfathering

The grandfathering method is the other endpoint of the continuum of burden sharing methods. While the egalitarian approach casts a blind eye to the past, the grandfathering approach seems on the contrary the most conservative sharing method to date. Indeed, it relies on the idea that the global carbon budget should be divided along the criterion of current carbon emissions. It means that the weight of each country in global emissions remains stable over time. In other words, countries that emit a lot will remain the major emitters while countries that release only a small quantity of carbon dioxide will keep being the smallest emitters, regardless of the absolute level of emissions considered.

This conservativeness can be interpreted to capture structural national elements that are only slowly modified or cannot be changed at all. This is for instance the case of the access to renewables or the exposure to particularly rough climate conditions, both linked to geographic location and physical features that cannot be changed at will.

It can be formalized with the following equation:

$$CB_c = CB_w \times \frac{ems_{c,t}}{ems_{w,t}}$$

with CB standing for "carbon budget", ems for "emissions", w for world, c indexing countries and t years. Once again, this method can be criticized due to its large dependency on the choice of the reference year. In this case, choosing 1990 as a reference year would favor the European Union more than 2005 or 2015 would do. Nonetheless the major problem of such a method lies on its normative implications rather than its disputable statistical robustness.

Indeed, it is worth highlighting that "*grandfathering is generally viewed as morally unacceptable, particularly in the developing world*" (Giraud *et al.*, 2017) since it is the exact opposite of the "polluter-pays" principle: emitting the greatest quantity of CO_2 ensures a country it will be allocated the greatest national carbon budget possible. In other words, the more you pollute, the less you are compelled to stop polluting: polluting gives you a right to pollute more than others in the future.

What's more, such a measure leaves aside the issue of historical responsibility, and can be interpreted as "environmental colonialism" (Agarwal and Narain, 1991) to the extent that it impedes developing and poor countries to industrialize the way developed countries have industrialized before them, hence threatening them to fall into a wide open poverty trap. Even more importantly, it prevents developed countries from acknowledging they are largely respon-

sible for the climate change and should therefore be the ones undertaking costly actions.

1.2.c Historical carbon adjustment

Considering historical accountability is thus at the heart of the carbon budget debates. It appears as the core concern and it is illustrated by the fact that the two endpoints of the methodological continuum seem to be polarized by the way they take into account past inequalities (*i.e.* not at all for the egalitarian approach and entirely for the grandfathering method). In order not to evade this issue, some authors such as H. Damon Matthews have suggested computing an additional measure of ***historical carbon adjustment****. In his 2016 paper entitled "*Quantifying historical carbon and climate debts among nations*", he relies on the following indicator:

$$HCA_c = \sum_{t=start}^{present} \left[ems_c(t) - ems_w(t) \times \frac{pop_c(t)}{pop_w(t)} \right]$$

with HCA standing for "historical carbon adjustment".[10] This methodology is based on an extrapolation of the egalitarian approach. More precisely, it is based on a preliminary computation of an annual quota of emissions that a country should not exceed, using the *start* date as the reference year. This quota consists in the sum of the individual emission rights over its population, which in turn are computed according to the egalitarian approach. Once this quota is defined, the historical carbon adjustment indicator aims at determining, for each year, whether countries have emitted more or less than their quotas and aggregates the deviations from the quotas over the time period extending from *start* to *present*.

Such a method enables to confront emissions released by a country to its theoretical carbon budget. It thus takes into account what can be called a "historical responsibility" of countries. Nonetheless, it still may be seen as an oversimplification of what is responsibility, all the more so as it is deeply rooted into the normative egalitarian framework. This means that we could compute historical carbon adjustments formalizing responsibility in a totally different way—for instance determining the quota of each country based on their past emissions.

10. In his 2016 paper, Matthews computes what he refers to as a "carbon debt" following the exact same definition. We believe calling it a "Historical Carbon Adjustment" enables us to be clearer in the presentation of our work, since we seek to avoid confusions between the concepts of "carbon debts" and "climate debts".

To that extent, this formalization of historical responsibility should be interpreted cautiously, even though it helps previous methods in getting closer to a more realistic and consensual way of computing carbon budgets.

1.3. The European Union Carbon Budget

In this chapter, we aim at computing the carbon budget that can be spent by the European Union from now until the end of times. This is a first iteration of an exercise bound to be improved in the next few years and in the light of political negotiations on burden sharing rules. As such, we mostly try to produce clear indicators whose underlying hypotheses do not confuse the reader rather than develop highly complex measures that are not easily interpretable. That is why we focus on the two previously mentioned methods, namely the egalitarian approach and the grandfathering approach taking 2015 as a reference year. More specifically, we proceed following a two-step repartition: *(i)* first, we compute the carbon budget of the European Union (28 members) starting from the global carbon budget for 2018 and *(ii)* then, we break down the European carbon budget into 28 national carbon budgets.

Given the European focus of the present report, we consider in this chapter the climate issue through the European angle. We attempt to estimate the European Union's regional responsibility, in aggregate, in the decarbonization process. To do so, we first use the egalitarian approach—with 2015 as reference year—in order to compute the regional carbon budget at the European aggregate level. Then, we allocate to each member country its proper national budget using full grandfathering—based on emissions ratios of 2015 too.

Nonetheless, in order to consider differentiated national historical responsibilities since 1990, we compute in a second moment a *historical carbon adjustment* per country over the 1990-2017 period,[11] following Matthews' method as detailed earlier. 1990 is an arbitrary starting point to responsibility. It seems that for complex reasons, it is one of the focal points in international negotiations.[12]

11. Since we only have emissions data until 2015, we assume that 2016 and 2017 CO_2 emissions levels are the same as 2015 emissions levels.
12. To put it briefly, we must underline that there is a huge and paramount debate in the carbon budget literature when it comes to the choice of the starting date of historical responsibility. In particular, for some searchers and decision makers it seems fairer to take into account past emissions starting in 1750-1800, before developed countries started their industrialization process. Others argue in favour of 1990 claiming that it corresponds to the beginning of the global awareness and subsequent commitments to fight against climate change. This debate is made even more complex considering its interactions with the general debate about what "pre-industrial levels" means.

Finally, we compute and analyze ***adjusted carbon budgets**** both at the regional and national scales. To the extent our baseline carbon budget computing method cashes in on both the egalitarian and the grandfathering methods, we thereafter call it the "hybrid" approach.

1.3.a Data

Our computations rely on three types of data: *(i)* the global carbon budget data, *(ii)* data on global and national emissions over the 1990-2015 period and *(iii)* data on national populations over the same period.

i. The Global Carbon Budget is retrieved from the IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels released in October 2018. For the sake of clarity, we focus on the 67th percentile of the probability distribution to remain under a given temperature change threshold, namely either 1.5°C or 2°C. We only consider the core estimation of the remaining carbon budget, which means that we disregard uncertainties measures as underlined by the IPCC in their special report.

ii. Emissions data are two-fold. On the one hand, when it comes to historic global emissions, we rely on the version 1.3 of the Historical Carbon Budget as computed by Le Quéré *et al.*, (2018),[13] which includes emissions from fossil fuels and industry but also from land use change in $GtCO_2$ per year between 1990 and 2015. On the other hand, we use data on final demand content emission, in order to implement a consumer approach to emissions. We thus rely on data on CO_2 emissions embodied in consumption that are calculated by the OECD based on Input Output tables and imports from each region of the world for each country to take in account CO_2 emissions needed to produce goods and services consumed in a given country. Embodied emissions are added to direct emissions to calculate the consumer approach emissions.[14]

iii. As far as population data are concerned, we exploit the 2017 revision of the United Nations World Population Prospects dataset, extracting data for the 28 member countries of the European Union between 1990 and 2015.[15]

13. http://www.globalcarbonproject.org/carbonbudget/17/data.htm
14. Data from 1995 to 2011 are used to correct national emissions. For emissions data before 1995 (resp. 2011), we use 1995 (resp. 2011) as a correction factor.
15. https://population.un.org/wpp/DataQuery/

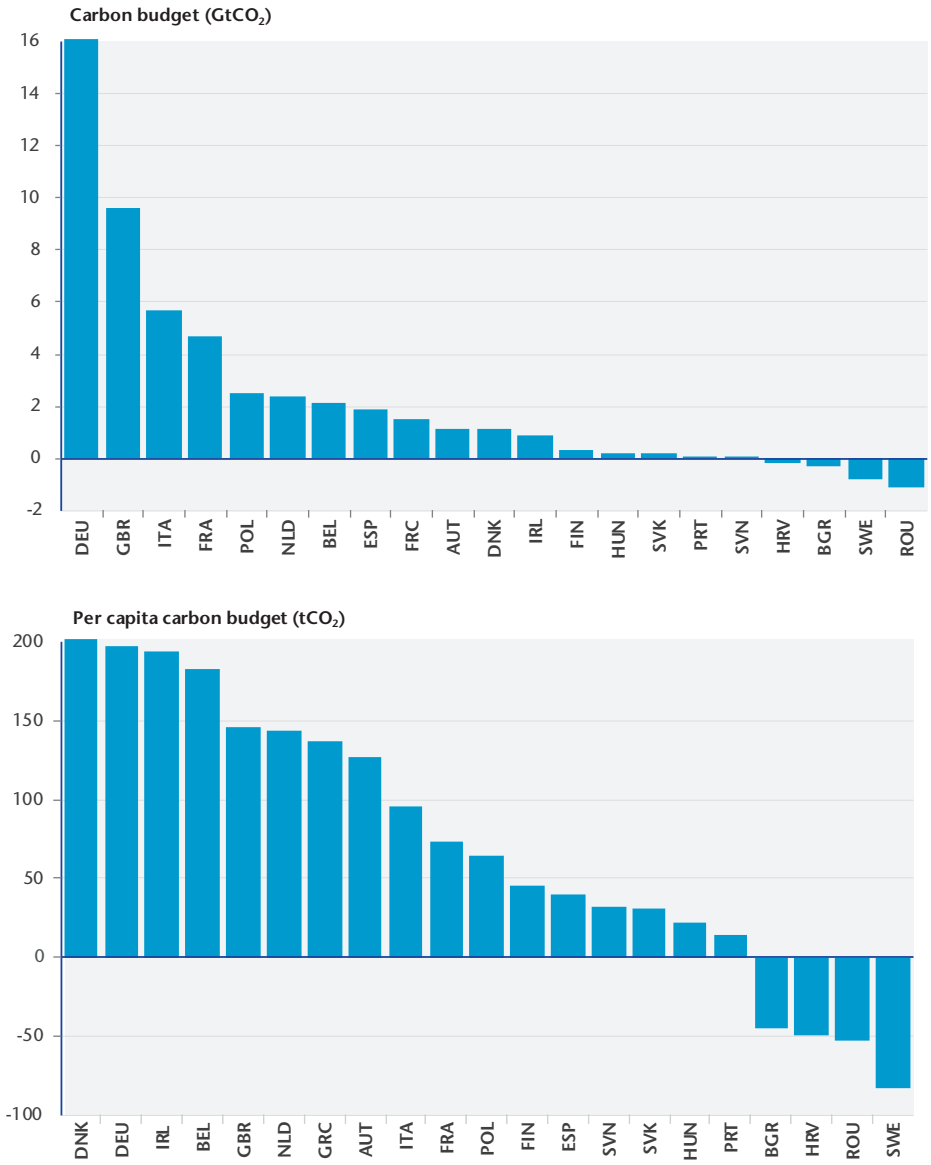
1.3.b Carbon budgets and historical carbon adjustment

Using the hybrid sharing method with 2015 as a reference year credits the European Union with a carbon budget of 91 $GtCO_2$ if we consider the +2°C scenario (Table 18). This amounts to approximately 30 more years if current emission levels remain unchanged. This budget falls down to 39 $GtCO_2$ in the case we scrutinize the +1.5°C scenario, that is to say a little bit more than 10 years. At the regional scale, the historical carbon adjustment since 1990 over the 28 member countries of the European Union amounts to 49.7 $GtCO_2$. This means that, updating previous results on the basis of historical carbon adjustments leads to a way smaller carbon budget for the European Union. More precisely, it falls down to 41 $GtCO_2$ for the +2°C scenario. Considering the +1.5°C scenario, these estimations lie at 11 $GtCO_2$.

Moreover, carbon budgets are quite dispersed among member countries. With the hybrid method for the +2°C scenario, the biggest carbon budget goes to Germany with 21 $GtCO_2$ while the smallest budget is for Malta with 0.04 $GtCO_2$. Considering the +1.5°C scenario does not change these two endpoints, granting Germany a budget of a little bit more than 9 $GtCO_2$ while the Maltese one is about 0.02 $GtCO_2$. Apart from Germany, the United Kingdom, France, Italy and Spain are the four countries with the more generous carbon allocations with budgets falling between 13 and 6.6 $GtCO_2$ for the +2°C scenario. This ranking remains unchanged while considering the 1.5°C scenario with budgets lying between 5.5 $GtCO_2$ for the United Kingdom and 2.8 $GtCO_2$ for Spain.

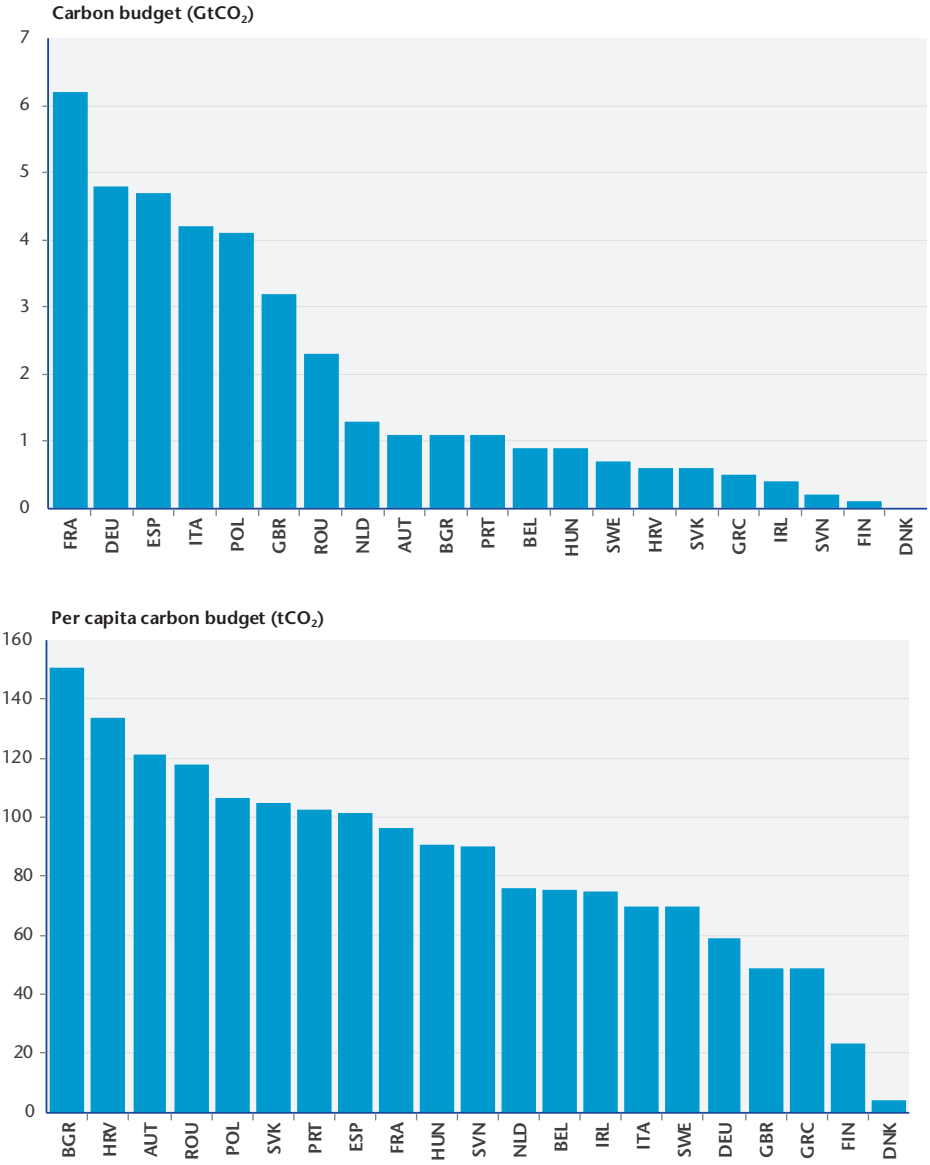
Nonetheless, taking into account adjusted carbon budgets changes quite a few things: in the framework of the 2°C scenario, computing hybrid budgets makes France the country with the most important carbon budget with 6.2 $GtCO_2$ while Germany goes down to the second position with an adjusted carbon budget of 4.8 $GtCO_2$ (as opposed to 21 $GtCO_2$ before adjustment). Spain, Italy and Poland follow. This is largely due to the fact that Spain and Poland have a small historical carbon adjustment while the United Kingdom's is the second biggest of the European Union, which makes it go out of the top 5. Denmark and Luxembourg are granted the smallest adjusted carbon budget with 0.02 $GtCO_2$. This order differs largely when considering the 1.5°C scenario, the first five countries being Romania, Spain, Sweden, Bulgaria and Portugal. More particularly, Germany's position shifts to the bottom with a negative carbon budget of 7 $GtCO_2$, just after the United Kingdom (-4 $GtCO_2$) and Italy (-1.5 $GtCO_2$).

Figure 43. **1990 Historical carbon adjustment**



Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *OECD emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); consumer approach.

Figure 44. **Adjusted hybrid carbon budgets (consumer approach)**



Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *OECD emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); adjusted carbon budgets take into account the Historical Carbon Adjustment (see Figure 43, 1990 Historical carbon adjustment for assumptions) and are calculated for +2°C 2/3 probability, hybrid share and consumer approach.

Table 18. **Hybrid carbon budgets, historical carbon adjustment and adjusted carbon budgets**

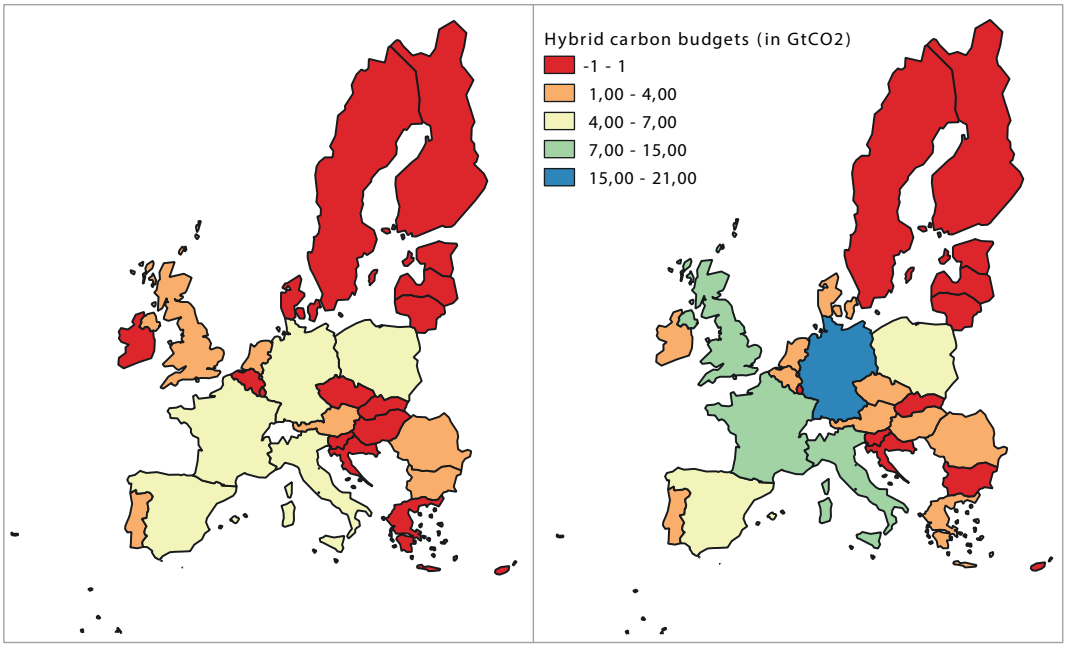
	Hybrid carbon budget (2015 reference year) (A)	Historical carbon adjustment (1990-2017) (B)	Hybrid adjusted carbon budget (2015 reference year) (C = A – B)	Per capita hybrid adjusted carbon budget (2015 reference year) C/POP
EU-28	90.7	49.7	41.0	96.5
AUT	2.16	1.11	1.05	121.5
BEL	2.92	2.07	0.85	75.7
BGR	0.76	-0.32	1.08	151.0
HRV	0.36	-0.21	0.57	133.5
CYP	0.21	0.11	0.10	84.6
CZE	2.15	1.56	0.59	55.6
DNK	1.17	1.15	0.02	3.8
EST	0.26	0.19	0.07	50.6
FIN	0.38	0.25	0.13	23.2
FRA	10.93	4.71	6.22	96.5
DEU	20.96	16.13	4.84	59.2
GRC	2.09	1.54	0.55	48.7
HUN	1.10	0.22	0.89	90.6
IRL	1.26	0.91	0.35	74.6
ITA	9.88	5.72	4.15	69.8
LVA	0.23	-0.28	0.51	255.6
LTU	0.23	-0.13	0.36	122.3
LUX	0.17	0.15	0.02	43.3
MLT	0.04	0.01	0.03	73.7
NLD	3.73	2.44	1.29	76.1
POL	6.54	2.46	4.09	106.8
PRT	1.21	0.14	1.07	102.6
ROU	1.28	-1.06	2.34	117.8
SVK	0.74	0.17	0.57	105.0
SVN	0.25	0.07	0.19	90.4
ESP	6.58	1.87	4.70	101.3
SWE	-0.13	-0.81	0.68	69.7
GBR	12.75	9.55	3.20	48.9

Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision). Calculated for +2°C 2/3 probability, hybrid share and consumer approach.

In those numbers a "population size" effect remains, even while sharing the European budget between member countries using full grandfathering. The level of emissions is correlated to the number of people living in a given country. In other words, two differently populated countries with the same levels of emissions per capita will have different aggregate levels of emissions, hence different carbon budgets. This is why it is also instructive to cast a glance at per capita results, which largely redistribute emissions rights within the European Union. More precisely, Bulgaria, Croatia, Austria, Romania and Poland then appear to have the greatest carbon budgets per capita. France ends up at the 9th position while Germany and the United Kingdom respectively hold the 17th and 18th positions.

The maps on Figures 45 aim at summarizing carbon budgets and adjusted carbon budgets for the 2°C scenario using the hybrid approach with embodied emissions data:

Figure 45. **Maps of carbon budgets**



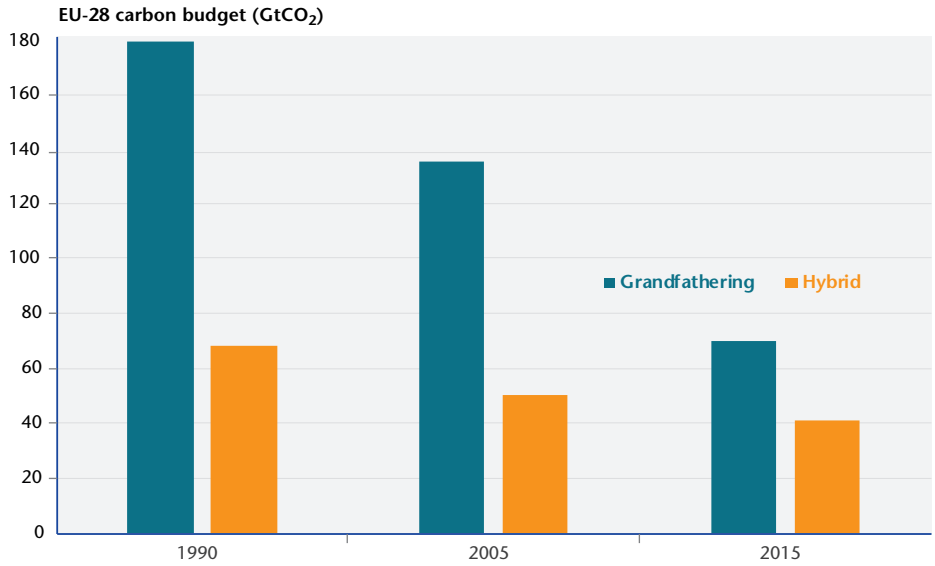
Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); on the left handside are displayed national adjusted carbon budgets for EU28 member countries; on the right handside are displayed national carbon budgets (before historical carbon adjustment) for the same countries. Calculated for +2°C 2/3 probability, hybrid share and consumer approach.

1.3.c Sensitivity analysis

The previous section detailed the result of our baseline scenario, namely hybrid carbon budgets with a consumer approach to emissions data. We first wonder whether these results are greatly sensitive to the sharing approach used. When it comes to the grandfathering method, computed carbon budgets appear to be bigger, with 119 $GtCO_2$ (resp. 52 $GtCO_2$) for the European Union for the +2°C scenario (resp. +1.5°C). Furthermore, at the regional scale the hybrid method and the egalitarian method lead to the same results, by construction of the former.

As underlined in the first section, sharing methods might be very sensitive to the choice of the reference year and this also goes hand in hand with normative implications. In particular, there seems to be great differences depending on the reference year used when we rely on the grandfathering sharing method: the 1990 computed budget is 2.5 times bigger than the 2015 budget. On the other hand, the egalitarian approach seems more robust and shows less variation due to the choice of the reference year. That being said, 2015 is the reference year that leads to the smallest differences between the two sharing methods at the regional scale.

Figure 46. **Grandfathering *versus* hybrid EU adjusted carbon budgets**



Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); adjusted carbon budgets take into account the Historical Carbon Adjustment (see Figure 43 for assumptions) and are calculated for +2°C 2/3 probability, hybrid share and consumer approach.

At the national scale, results are a little bit more sensitive to the implemented method in absolute terms. Nevertheless, in relative terms, the three methods lead to very robust results. The top 5 ranking does not vary hugely while considering the grandfathering allocation method, the egalitarian approach or the hybrid one. Nonetheless, it is worth underlining that adjusting budgets for the historical carbon emissions lead to substantial differences between these three approaches.

Table 19. **Ranks of countries under various assumptions**

	Grandfathering budget	Egalitarian budget	Hybrid budget	HCA-adjusted grandfathering budget	HCA-adjusted egalitarian budget	HCA-adjusted hybrid budget
1	DEU	DEU	DEU	DEU	FRA	FRA
2	GBR	GBR	GBR	FRA	ESP	DEU
3	FRA	FRA	FRA	ITA	ITA	ESP
4	ITA	ITA	ITA	GBR	ROU	ITA
5	ESP	ESP	ESP	ESP	POL	POL

Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); budgets are calculated for +2°C 2/3 probability, hybrid share and consumer approach.

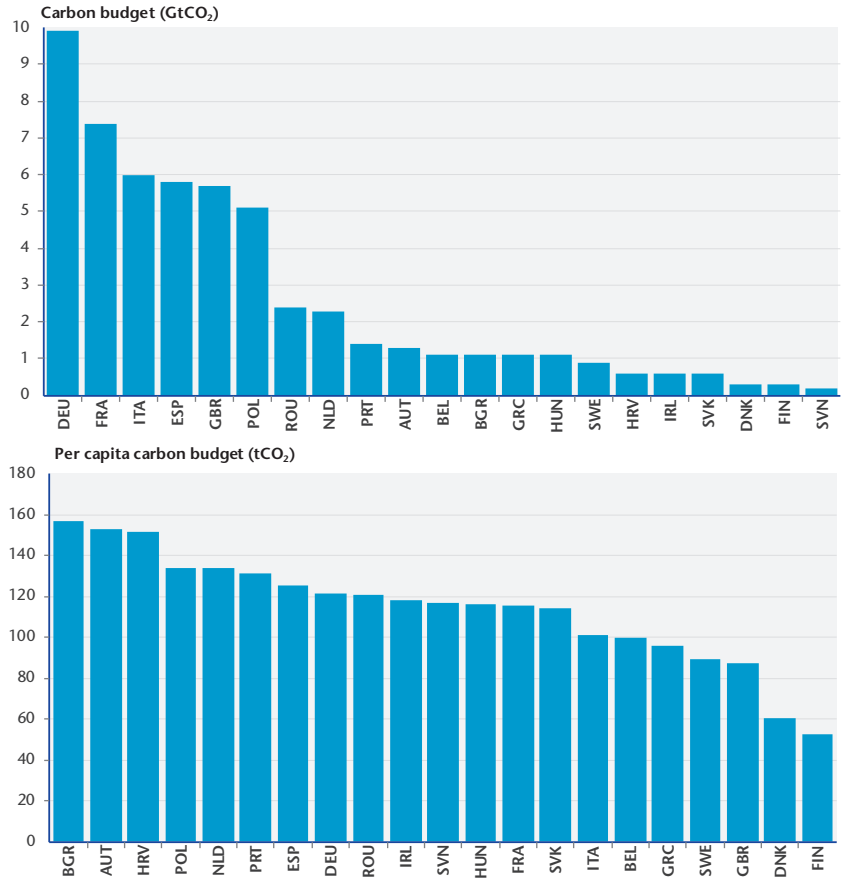
These discrepancies between methods might be largely due to the fact that they do not take into account countries' structural inequalities in the same way. A solution to tackle these heterogeneity issues would be to estimate econometrically the idiosyncratic part of each country explaining their levels of emissions. It would thus allow to use the egalitarian approach in a first moment and modify the results in a second moment applying the estimated idiosyncratic factor in order to redistribute budgets with respect to structural differences between countries.

Finally, computed results may also be sensitive to the type of emissions data considered.[16] We have sought to understand to what extent considering producer emissions data would modify our results. Hence, we use the United Nations Framework Convention on Climate Change (UNFCCC) total carbon

16. The consumer approach imputes the emissions to the consumer, accounting for direct carbon emissions and embodied carbon emissions in goods or services. The producer approach accounts for carbon emitted on a territory, using for instance fuel consumption for final demand and production processes. The producer approach overstates the responsibility of highly industrialized countries where production activities have been located. The consumer approach appears to be more satisfactory even though the calculation needed for the imputation can be complex and rely on assumptions, subject to criticism.

dioxide emissions (with land use, land use change and forestry) time series of the Annex I countries from 1990 to 2015. In relative terms, results are a bit different as compared to the consumer approach but Germany, France, Spain, Italy, Poland and the United Kingdom remain at the top of the ranking, just as in the consumer approach. However, the producer approach to emissions leads to bigger adjusted carbon budgets for European countries. Germany and the United Kingdom have a 10 $GtCO_2$ and 5.7 $GtCO_2$ budget (Figure 47) as compared to a 4.8 and 3.2 $GtCO_2$ with the consumer approach (Figure 44). France's budget remains quite identical in both cases with 7.4 $GtCO_2$ (producer) and 6.2 $GtCO_2$ (consumer).

Figure 47. **Adjusted hybrid carbon budgets (producer approach)**



Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *OECD emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); adjusted carbon budgets take into account the Historical Carbon Adjustment (see Figure 43 for assumptions) and are calculated for +2°C 2/3 probability, hybrid share and producer approach. Assessing the current path for emissions.

The estimation of the EU countries carbon budgets performed in the first part provides information on the total amount of CO_2 emissions that can be emitted before reaching a threshold (in this case, the probability to keep the temperature increase below +1.5°C and +2°C) but without indication on the pace at which it will be exhausted. In order to tackle this issue, one needs to associate it to an emissions reduction scenario.

We propose to combine several approaches to reconcile the short-term considerations on the emissions level with the long-term objective of reaching a Zero-Net Emissions (ZNE) state. The first part aims at providing a methodology for bridging the gap between the emissions data availability and the existence of contemporaneous estimated indicators. The second presents the long-term emissions pathways scenarios used in the process of calculating indicators on climate debts.

1.4. Estimating current emissions through nowcasting

Ascertaining the current level of greenhouse emissions is a key prerequisite to estimate the trajectory of future emissions. However, country-level emissions data is released with a significant lag (generally several years) by major statistical bodies, both at the national and multilateral levels. This calls for implementing new methods of emissions tracking (See Box 1). This stands in stark contrast with the prevailing timeliness of macroeconomic data, which is almost estimated and released in real time. Table 20 illustrates this lag for the main organizations reporting greenhouse gas emissions worldwide. European countries' climate targets call for aggressive emissions reductions, which—if implemented in practice—should lead to rapid change in the level of their emissions on a yearly basis. This strengthens the need for more up-to-date emissions data.

Table 20. **Latest year of emissions data currently available**

Agency	Year
UNFCCC	2016
International Energy Agency	2015
European Environmental Agency	2016
U.S. Environmental Protection Agency	2016

Source: iASES (formerly iAGS) 2019 computations.

Box 1. Nowcasting Emissions

We propose to compensate the publication gap in the data on emissions through the use of nowcasting. More specifically, we introduce a simple econometric methodology aiming at estimating current emissions level from available contemporary macroeconomic data—GDP in particular. We provide a brief outline of this approach in the rest of this section. For reference, a complete description is also provided in Appendix.

Our main design objective is to yield a parsimonious model providing the best possible emissions data from a small set of widely available macroeconomic data. This has driven our choice of a simple VAR approach.[17] We then took inspiration from the Kaya decomposition to choose the endogenous variables:

$$GHG_t = GDP_t \frac{E_t}{GDP_t} \frac{GHG_t}{E_t}$$

With GHG_t the current level of greenhouse gas emissions, GDP_t the current annual GDP, and E_t the total primary energy supply. Our main specification thus links GHG emissions to GDP and the share of non-fossil fuels in primary energy supply.[18] We supplement this core set of variables with an additional endogenous covariate, industry's share of value added, and exogenous variables driving energy consumption and by extension emissions: international oil prices, heating and cooling degree days.[19]

This yields the following straightforward specification:

$$Y_t = A\, Y_{t-1} + B\, X_t + \varepsilon_t$$

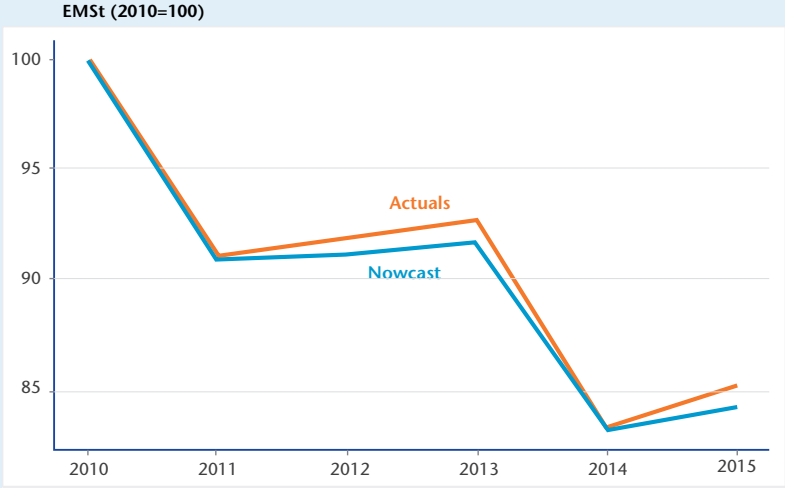
With Y_t the vector of the endogenous variables listed above, X_t the vector of the aforementioned exogenous variables and ε_t an error term. Parameters A and B are estimated separately for each country on data collected from 1974 until 2015. The oil shock of 1974, which led to a major change in the energy mix of European countries and their carbon intensity, motivates the exclusion of earlier data. Still, we control for country-specific shocks that affected the dynamic of emissions during the estimation period. Examples include the rapid expansion of nuclear power in France in the early 1980s, or the Great Recession of 2009. We also allow for the possibility of a structural break in the evolution of each country's emissions borne by decarbonization efforts. The occurrence and eventual timing of this structural break is estimated through an information criterion.[20]

Once the model estimated for each country, we can proceed with emissions nowcasting. The procedure is as follows: all of the variables included in our speci-

17. Vector AutoRegression is a tool to estimate a system of endogeneous variables including lags of those variables and exogeneous variables.
18. Alternatively, we also test the inclusion of the share of coal or natural gas in primary energy supply.
19. Heating and cooling days are days were heating or cooling systems are supposed to be used, based on the temperature reached that day and accounting for the difference between current temperature and a threshold. Threshold temperatures are different for each country.
20. The structural break year yielding the best fit on the data is elicited. See the Appendix for further details.

fication are observed in near-real time, save for emissions themselves. We therefore substitute each observed endogenous and exogenous variable for its current observation, and deduce the level of emissions implied by the model.[21] The use of observed data for the majority of our model's variables significantly improves the performance of our nowcasting algorithm when compared with a simple one-step ahead VAR projection. For illustration purposes, Figure 48 compares the performance of the nowcasting projection of French emissions between 2011 and 2015 with the actual measured data.[22] The root mean square error achieved in this case is below 1%, and remains below 2% for most European countries tested in our sample.

Figure 48. **Nowcast performance for French emissions (2011-2015)**



Source: iASES (formerly iAGS) 2019.

To strengthen the robustness of our nowcasting projection, we implement this procedure with several distinct specifications including different subsets of endogenous and exogenous variables selected among those listed previously. We then combine the results of these various model specifications into a single predicted value (Timmermann, 2006) simple combinations that ignore correlations between forecast errors often dominate more refined combination schemes aimed at estimating the theoretically optimal combination weights. In this chapter we analyze theoretically the factors that determine the advantages from combining forecasts (for example, the degree of correlation between forecast errors and the relative size of the individual models' forecast error variances).

21. See the Annex for an explicit derivation.
22. The model used in this example is the simple 3-variable VAR model including GDP, share on non-fossil energy and emissions, along with Brent oil price, heating and cooling degree days. It should be noted that to perform this nowcasting test on the period 2011-2015, the model's estimation period had to be restricted to 1974-2010.

The results of this nowcasting exercise for the six largest European emitters is presented in Table 5 of chapter 1.

1.5. Establishing the long-term path of emissions

The choice of a scenario is a comprehensive task in the sense that it needs to draw an emissions reduction pathway onto the next decades[23] based on our current knowledge on different parameters such as the set of available technologies, public policies implemented, demography, economic structure, GDP growth rate, etc.

An easy way would be to use a business-as-usual scenario (BAU), projecting the current trend of emissions reduction until the exhaustion of the carbon budget. This approach, despite having the advantage of being straightforward, appears not to be satisfying for several reasons. On one hand, it eludes the market penetration of already emissions mitigation or energy efficiency technologies and the long-term effects of existing public policies, on the other hands, it raises the question of the historical period on which the trend is projected.

One another approach is to simulate a scenario with a model that allows encompassing different dynamics on the supply and the energy use. Such a model allows producing scenarios depending on different dynamics in an integrated and consistent framework. For the sake of this exercise, we decided to choose the *Ener-Blue* scenario from the *Enerfuture* Emissions forecast issued by Enerdata (2018) and simulated with the POLES model (Keramidas *et al.*, 2017), see Box 2.

Box 2. The Energy model POLES

The POLES Model (Prospective Outlook on Long-Term Energy Systems) developed since the beginning of the 1990s by ENERDATA, the applied economics laboratory GAEL from the Grenoble University and the Joint Research Center from the European Commission is a world techno-economic energy supply-use model. It assesses equilibria for each period and for each of the 46 regions the energy flows in physical units as well as the price dynamics for each energy vectors. Technical progress is also included through an endogenous process for energy related technologies, on both the energy transformation side and the energy use sectors. 50 key-technologies are accounted and represented by learning-by-doing and learning-searching curves (Research & Development expenses). It also includes a

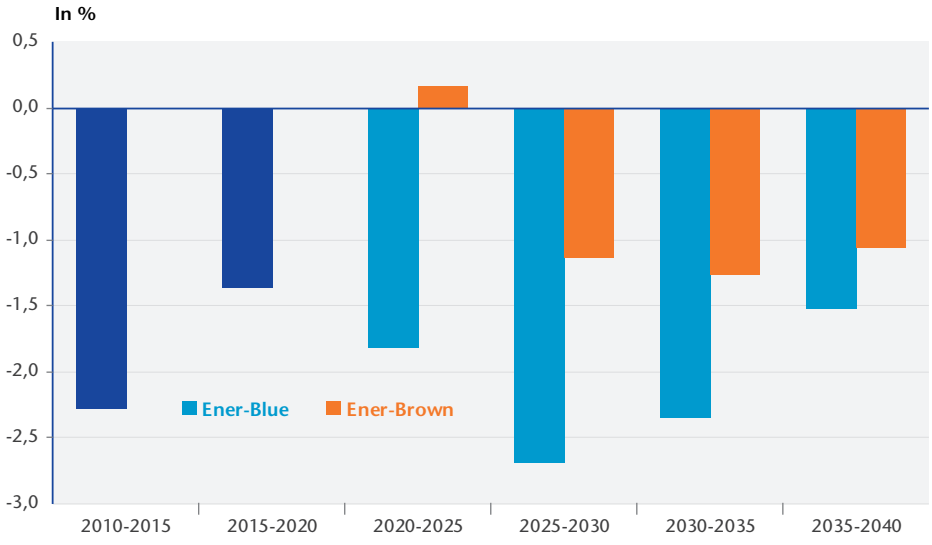
23. Ideally up to 2200, considering this period as the end of time.

resource constraint module for all the fossil-fuels in order to fully explicit the price formation as well as precising the strategy associated to their management.

This model allows sketching energy scenario up to 2050 and can provides results on the world GHG emissions in an integrated and consistent framework.

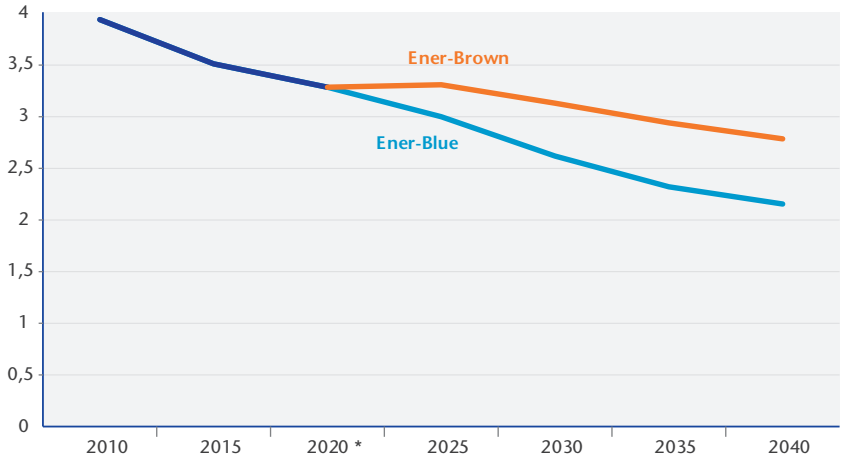
This scenario corresponds to an INDC-compatible trajectory up to 2040 (extrapolated up to 2200) and which leads to a global average rise in temperature between 3 and 4°C. Whereas GHG emissions are reaching a peak in 2020 and follows then a near-stabilization pathway around 42 Gt CO_2eq, fossil-fuels are still the main energy source with a primary energy mix share of 70% (with respect to a current 81% share). Despite a stabilized level of GHG emissions at the world level, OECD-countries experience a constant decrease of them at a 0.6% yearly rate. Concerning European Union countries, we observe a constant decrease of their emissions, in the wake of the observed dynamic from the past decade (Figure 49 and Figure 50). The range of the yearly average CO_2 emissions reduction per 5-years period remains in an interval from 1.4% to 2.6%, close to the observed trend for the period 2010-2015 where this rate was 2.3%. We also consider an alternative scenario called *Ener-Brown*, which leads to a +5°

Figure 49. **Compound annual decline rate of CO_2 emission**



Sources: European Environmental Agency (2010,2015), Enerdata (2025-2040), 2020 is extrapolated using a moving average mean on the last five known years (2016-2011).

Figure 50. **CO_2 Emissions from EU countries in the *Enerfuture* scenarios (Gt)**



Sources: European Environmental Agency (2010,2015), Enerdata (2025-2040), iASES (formerly iAGS) 2019 computations.

rise in temperature. In this scenario the INDC's pledges are not fulfilled; the use of fossil fuels is still rising, spurred by the unconventional fossil resources extraction like shales gas or coal tar and with energy efficiency improvement remaining modest.

1.6. Abating emissions with a backstop technology

We assume in our estimations that only a backstop technology can remove the remaining CO_2 in the atmosphere from the carbon budget depletion date and until reaching a zero net emissions state. This backstop technology does not replace a potential investment. It is only aiming at reducing emissions, in the sense that in does not provide any other benefit than removing CO_2. Such Carbon Dioxide Removal (CDR)[24] technologies are currently experimented in some places—Climeworks, Carbon Engineering being active companies in that field.[25] It is assumed to be more expensive than any other option and with a

24. We do not consider here the use of Solar Radiation Management (SRM) technologies or, more generally, of geo-engineering since such technologies imply irreversibility and uncertainties far beyond what is acceptable.
25. See "Sucking CO2 out of the atmosphere explained" on vox.org by Umair Ifran for a quick survey. Websites of Climeworks and Carbon Engineering provide commercial information. Some peer reviewed papers are published (Keith *et al.* (2018), Joule 2, 1573–1594).

high enough potential capacity to achieve the targeted reduction, as the limit is physical only. The ability to scale up the deployment of such technologies is controversial, as well as the cost per tonnes of CO_2 removed from the atmosphere. The ability to store CO_2 underground definitively and the potential capacity to do so is also disputed. Current cost estimations are mostly industry side estimations with only prototype or experimental projects to back up over optimistic announcements.

The set of assumptions around the existence of such a backstop technology is undoubtedly questionable, but from our viewpoint, it has the advantage of translating a physical metric (carbon budget in Gt) into a monetary one (expressed in $€_{18}$). The sensitivity tests surrounding the backstop price are attempts at reducing the uncertainty via the definition of a confidence interval around its estimated value [250€:500€]

1.7. The Climate debt

The areas under the emissions pathways serve as the basis for the valuation. As it is a flow with a complex time pattern, it is necessary to use a net present value to transform it into a stock. We use a standard discounted sum with a discount rate representing the social rate of time preference, and potentially, an effect of technical progress on this backstop and the uncertainty on future technological progress. The discount factor we use there has no implication on intergenerational equity, a point that was central to the Stern Review, and is therefore simpler to quantify.

With r the discount rate, $\overline{T}$ the number of years before the carbon budget is exhausted $CO_{2,T}$ the present value of emissions at the date $\overline{T}$, at which the budget is exhausted,—that is to say the total cost of meeting ZNE given the current policy path– climate debt can be expressed as:

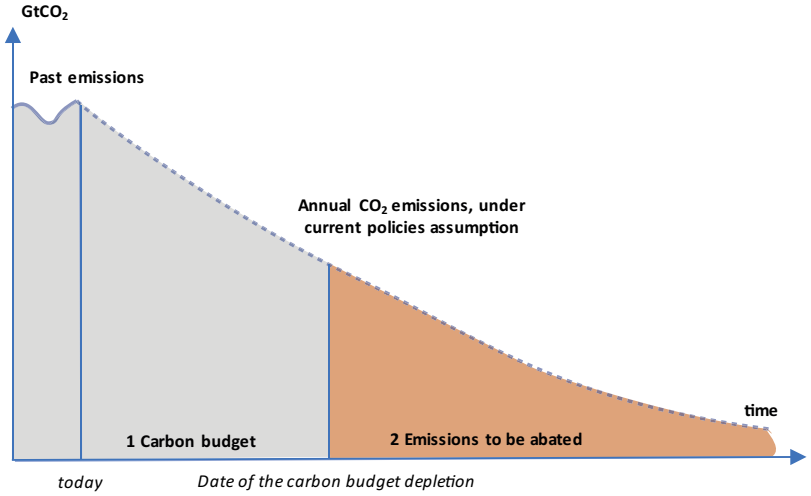
$$ClimDebt = \frac{1}{(1+r)^T} \times \frac{CO_{2,\overline{T}}.p^{BS}}{r}$$

$e^i(t)$ being the annual flow at date t of CO_2 emissions under the scenario i used as a path for current policies, the $CO_{2,\overline{T}}$ quantity is then calculated as:

$$CO_{2,\overline{T}} = \sum_{t=\overline{T}}^{\infty} \frac{e^i(t)}{(1+r)^t}$$

The Figure 51 illustrates the principle of the calculation:

Figure 51. **Discounting climate debt**



Source: iASES (formerly iAGS) 2019.

Observed emissions are projected with current policies scenario. Once the carbon budget is exhausted—area 1 in gray on Figure 51—, at some date in the future, the remaining annual flow of emissions has to be fully abated—area 2 in brown—. Discount rate *r* is applied to the cost of abatement every year (the cost of abatement times the emissions to abate) and summed to get the net present value today of those future costs.

There may be a special case if the date of the carbon budget depletion has already occurred. It is the case for one country in the +2°C, under the baseline assumptions and for many in the +1.5°C scenario. Burden sharing with less favorable bases than the ones of the baseline scenario (for instance adjusting for historical emissions since 1980 or 1970) would push more countries in the exhausted carbon budget zone. In that case, as argued below, countries still emitting past the depletion date are borrowing to other countries or to the Climate their current emissions. To repay those emissions they will have in the future to pay back and possibly, because it will cause the climate to overshoot the +2°C scenario, they will have to abate more than the overshooting of emissions.[26]

26. This could be represented as a « geo-physical » interest rate. If that rate is superior to the discount rate (probable) it is profitable not to overshoot. It would be better (same outcome for a lower cost) to postpone emissions reduction and overshoot on global temperature if the cost in term of supplementary emissions is low enough (unlikely). We are not able to compute this parameter without access to climate models.

III.2. Years before depletion of Carbon Budget and Climate Debts

Here, we present the results of this exploration of the concept of *climate debt*. It is important to distinguish what relies on physical units (the carbon budget, the year of the depletion of the carbon budget) and the differences between countries from what relies on a monetary evaluation. A monetary evaluation needs to be done to add hypotheses and shortcuts which are going to pile up on all the hypotheses done before. Piling up hypotheses does increase the fragility of the evaluation or, evenly, the range for the final quantification.[27] Nevertheless, a monetary valuation of the debt is necessary as it provides an alternative metric to the underlying problem—how far are we from the +2°C—in a unit that pins the potential trade-offs in a universally understandable way. A euro value of the distance to the +2°C target is more striking than a distance expressed in tonnes of CO_2. Moreover, modifying the metric is not only a question of the striking power of the unit in which it is expressed. It is also a question of the ability to weigh more some dimensions of the problem and thus to give less weight to some others. Using a discount rate for instance puts more weight on the present and the near future compared to a more distant horizon. This reduces the impact of hypotheses about the far future, which speculative nature is irreducible, and allows for, may be, an easier interpretation. Expressed in monetary units, distance to targets will also make comparisons between countries more meaningful, by taking into account various elements such as levels of development, country sizes or current levels of emissions.

2.1. Years to depletion

Starting with physical unit Table 22 displays the number of years left before depleting the entire carbon budget. This number encapsulates both the share of the global carbon budget that was allocated to a given country and the current policies emissions pathway. The lower the budget, the shorter the time before the carbon budget is depleted. The quicker the emissions reductions due to current policies, the higher the number of years before depletion. Hence, a country implementing an ambitious policy to reduce emissions in the near future can postpone significantly its depletion date.

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27. As Mark Twain (supposedly quoting Benjamin Disraeli) put it a long time ago, "there are three kinds of lies: lies, damned lies and statistics". Quantification of extrapolated scenarios may be the fourth kind. Doing such a quantification and being honest impose thus to be highly transparent about the methodology.

2.1.a Baseline and alternative scenarios (political, speculative and technical)

To assess the mere possibility of quantifying the distance to the climate target, we need to calculate that distance using various assumptions and judge for consistency. This is a way to identify the sensibility of the final number to chosen parameters and shed light on underdevelopments of the modelling needing further improvements. We define a baseline scenario. Alternative scenarios are modifications of this baseline. More precisely, each alternative scenario only differs from the baseline due to the modification of one very specific hypothesis (see Table 21).

The baseline is defined for the +2°C target and what we deem to be a middle point in the burden sharing question, that is to say the previously details "hybrid" sharing method. Different views on the way to share the burden will lead to different allocations of the global carbon budget. Those are moral or political hypotheses and we are not to decide which ones are the right ones.

Among the hypotheses needed, some are forecasts. For instance, the current policies pathway, further reductions of emissions past that date, the price of the backstop technology or future MACC are by definition speculative. No matter how subtle your understanding of the problem is, it remains impossible to guess future realizations of technologies, of the evolution of the environment, the feedbacks, positive or negative that can appear one day. Just like any other sustainability concern, the climate change issue cannot be analyzed without relying at some point on long term forecasts. Our choice has been here to define the simplest approach possible in order to warrant perfect transparency and to use consensual scenarios whenever possible (IPCC, ENERDATA).

Finally, technical hypotheses are also at stake. We display every time we can plausible ranges for those hypotheses, always keeping in mind transparency as a guiding rule. However, for those hypotheses, a sophistication of our analysis may provide a better estimate, in the sense that we could reduce the range of the estimation. This calls for more research and work so as to discard as many uncertainties as possible. In other words, alternative scenarios to the baseline have different interpretations (political, speculative, technical, see Table 21 for a qualification of each hypothesis).

Table 21. **Hypotheses of baseline and alternative scenarios**

	Baseline assumption	Alternative assumption	Comment
Producer vs Consumer approach	Consumer	Producer	Consumer approach accounts for embodied carbon and direct emissions by the final consumer. Producer approach accounts for emissions by final consumers and firms in a country. (moral).
Historical carbon adjustment	HCA	no HCA	Historical carbon adjustment corrects the carbon budget of emissions since a given date (1990 in our case). It is equivalent to consider a 1990 carbon budget and calculate the date of depletion including observed emissions since 1990 up to 2017. No HCA starts the carbon budget in 2018. (moral).
EU population vs emissions share	Emissions shares	Population	Carbon budget is shared between the world and EU following the egalitarian principle. Emissions shares are used to share the carbon budget between EU countries willing to take in account specific reasons (climate, industrial structure) mutualized between similar countries. The alternative is the full egalitarian principle. (moral).
+1.5°C target versus +2°C	+2°C	+1.5°C	The target is to limit climate change to no more than +2°C (or +1.5°C) increase of global surface land and sea temperature as compared to pre-industrial times. Emissions compatible with targets are reviewed and selected by the IPCC. (moral).
TCRE 50th vs 67th percentile	67th	50th	This number is the (estimated) probability to meet the target chosen for climate change (+1.5 or +2°C) given the uncertainties in our knowledge of the climate. (moral and technical).
Ener-brown vs Ener-Blue scenario	Ener-blue	Ener-brown	Ener-blue is a scenario for future carbon emissions (from 2017 to 2040) following INDCs. Ener-brown is a scenario with less emissions reduction leading to a +5°C increase of global temperature. (speculative).
Discount rate (annual)	4%	3%	The discount rate is used to discount flow of future costs and calculate a net present value (aka debt). The discount rate add a standard real discount factor of 2% and a 2% or 1% rate of decrease for the cost of future abatement technologies (divided by 2 every 35 years for 2%, 70 years for 1%) (speculative and technical).
Price of backstop (annual)	250€/tCO_2	500€/tCO_2	The initial (before discount) price of the backstop is crucial for the quantification of the climate debt. It has been chosen on the basis of expert knowledge. (speculative and technical).
Extrapolation of emissions after 2040	2020-2040 trend extrapolation	emissions of the year 2040	Extrapolation is used to extend scenarios beyond 2040. Trend extrapolation leads to zero emissions in most countries at some date. (speculative).

Source: iASES (formerly iAGS) 2019 computations

2.1.b The EU carbon budget is nearly exhausted

The first result of Table 22 is that for the 6 main European Union member countries, the +2°C budget is nearly exhausted. On average for EU countries, there are only 10 years left. It means that current stocks of capital—productive capital, residential buildings, tertiary buildings, means of transportation, etc…—are partly stranded under the +2°C constraint: the capital stock is far too polluting, it needs to be zero net emission in 10 years from now and its average lifespan is probably longer than 10 years, leaving a share of it unsuited to meet the climate target. It means that current policies are not sufficient to meet the +2°C target and that some of this already built capital stock will need to be seriously retrofitted or decommissioned before the end of its full depreciation. The extent to which it is stranded and the cost of resolving that are difficult to estimate. We attempt to do lead such an evaluation in the next section (Section 2.2).

Table 22. **Years remaining before the Carbon budget is exhausted, EU-6 largest countries**

	DEU	GBR	FRA	ITA	ESP	NLD	EU-6
Baseline (see note for definition)	5	7	16	10	16	8	10
Producer approach (vs Consumer)	15	20	32	22	27	14	22
No historical carbon adjustment (vs HCA)	40	41	31	32	26	29	35
EU population share (vs EU emissions share)	0	4	17	12	25	3	10
+1.5°C target (vs +2°C)	-6	-6	0	-2	2	-4	-3
TCRE 50th percentile (vs 67th)	14	17	25	19	25	16	19
Ener-brown scenario (vs Ener-Blue)	5	6	13	9	15	7	9
Constant post 2040 (vs trend extrapolation)	5	7	16	10	16	8	10

Note: scenarios are described in Table 21. A 0 means that the carbon budget is exhausted before the year 2018. EU6 is the aggregation of the 6 largest economies (2017 GDP).
Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *OECD emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision), *AMECO online* (11/2018) for 2017 GDP.

If the years before depletion were 0, it would mean that the concerned country is borrowing some carbon emissions (rights) to other countries (which have not reach their depletion date yet) or to the "Climate", because it will lead to overshooting in emissions and to meet finally the climate target, compensation in the future—in the form of more negative emissions—will be needed to meet the target in the long term.

This situation of an already exhausted scenario would undoubtedly constitute a situation of "*excessive climate deficit*", implying a warning and a strict monitoring from surveillance bodies. The use of the Stability and Growth Pact vocabulary is intentional. The spillover effect coming from not respecting climate by on European country on the other member states are better identified than the ones implied by public debt.

The baseline scenario shows that there are important differences between countries. The metric used to compare those differences is key as linearity and quantification can lead to very different relative appreciations. However, the number of years before depletion indicates that the emergency of taking seriously the climate targets varies among countries. Germany, with no surprise, is facing a very near climate cliff and is close to the implicit borrowing point. This cliff is the closest of all, even closer than the ageing population one, the underinvestment in infrastructure one or the public debt one.

That being said, even the least stranded countries are stranded. France and Spain have less than two decades to reach zero net emissions.

2.1.c Sensitivity analysis: a wide range of estimation

Sensitivity analyses suggest that the political or moral hypotheses may completely change the perspective, pointing at a much-needed agreement on how to share the burden. With no Historical Carbon adjustment, emissions from 1990 to 2017 are forgotten and the national budget is based on the 2018 global budget shared proportionally to population ratios. This gives a larger share to strong emitters and postpone the date of depletion by 25 years on average for EU6 countries. Using a producer approach increases the EU Carbon budget since the EU is a carbon net importer overall[28].

The +1.5°C target, which the IPCC recently advocated for since it is the only way to avoid a lot of costly and irreversible consequences of climate change,

28. According to OECD embodied CO_2 emissions, net imports of CO_2 (of exports of CO_2) for EU as a whole are equal to 20% of CO_2 emissions on the EU territory.

would put EU countries in an "*excessive climate deficit*" situation. Under the constraint of +1.5°C, all countries except Spain have exhausted their allocated carbon budget, some of them since a few years. Relaxing the constraint, by using the 50th percentile and risking a 50% probability to miss the +2°C target, is postponing the depletion date.

Under a less "optimistic" evaluation of the current policies pathway (namely the *Ener-Brown* scenario), the years left before depletion are lower although the order of magnitude is close. The same applies for the way extrapolation is conducted but with little change for most countries as the extrapolation date is after the depletion date.

What's more, sensitivity analyses show a large impact of political and moral considerations. The hierarchy between European member states, at least for the largest ones is fairly robust to different assumptions. Yet, we will see that the euro metric of climate debt may qualify this interpretation.

We have chosen not to display in the main text data for smaller countries. The reasons are that imputation of carbon emissions for small countries, even in the consumer approach is a sensitive topic and is currently done on an unsatisfactory basis. For instance, small countries that have a large tourist inflow may be imputed a rather large amount of fossil fuels due to transportation or tourists. Current data do not allow for a correct imputation of tourism, because of the lack of data on the origin of tourists. For large countries, this matters less, because it is mixed with other sources of emissions large enough to cover those difficulties. This even may be the case for countries whose commercial transport activities are important respective to the size of their economy and may explain the rather dire situation of the Netherlands.

Moreover, we need to consider subtler ways to share the burden. Basing the allocation of the carbon budget on factors such as the level of economic development (less developed countries may have more) or geographic endowments (north countries are colder in the winter, denser countries need less fossil transportation) can change a lot the budget for each country. Larger countries however are quite close in structure, which makes imputation issues less sensitive.

2.2. **Climate debts**

The climate debt for a given country is calculated by estimating the cost of a specific scenario. Once the carbon budget is exhausted, in order to fulfil its pledge, the country implements overnight and for the following years, abatement techniques that shrink its remaining emissions down to zero. The point is not the realism of such a scenario in technical terms. There is no denying that if

the emissions to abate are large, building overnight negative emissions capacities or retrofitting existing capitals would be impossible. The point here is to estimate the underlying cost of procrastination. This cost could be then claimed by other countries whose carbon budget is not exhausted yet. This claim could be materialized as a transfer. Carbon emitted past the depletion date could also be borrowed to the "Climate" by a commitment to remove CO_2 from the atmosphere in the distant future, conditionally on the fact that the country compensates fully the consequences of overshooting the target (in terms of more removal of CO_2 from the atmosphere, see note 26). This cost can also be interpreted as the cost that should have been paid in the past to meet the target but has not been paid and thus must be at the depletion date. Hence the thought experiment scenario we are using is an abstraction of complex realistic scenarios, giving a crude but coherent estimate of those scenarios.

Interestingly, each of these scenarios would have macroeconomic consequences, because of multiplier effects of the climate spending, crowding out effects of financing that investment (depending on the way it is financed) or distortion effects due to taxes needed to induce the transition. At this stage, we completely ignore these considerations, not caring for instance on whom is going to fall the cost and what would be the distributional issues. The point of such an abstraction is not to say that these issues are not important, especially as we, all along the previous iAGS and in the first chapter of this report, have asserted that those macroeconomic and distributional issues are of cardinal importance. The point is rather that, in order to understand the challenges, one needs to have a clear view of what lies ahead, and a good starting point is to assert the "core" cost of more real-world scenarios.

2.2.a Valuation of Climate debt depends on some assumptions

Once the carbon budget is allocated, the debt valuation is dependent on the quantity of CO_2 still emitted at the depletion date. A country committed on a successful decarbonization path will have a lower emissions flow than one still postponing the transition to zero net emissions. It will also be dependent of the date of depletion of the carbon budget. As the climate debt is the net present value of the investment needed to fulfill the pledges, the latter the depletion, the latter will be the investment and the more discounted will be the cost. Countries with time before depletion can adjust slowly. Our conviction is that adjusting slowly is going to be less costly and less stressful on the social and political levels. Hence the justification of the discount rate can be based on that interpretation of the time left before the cliff. This of course could be estimated in a subtler way.

The role of the abstraction is to give an order of magnitude and to escape the perils of valuating the incommensurable. The valuation of the climate debt also depends on a third important element, namely the price of the backstop. It is impossible to define with certainty such a price. Industry promises costs as low as 100€/tCO_2 abated, when estimates of cutting-edge abatement technologies points to costs per abated ton close to (still under) 1,000€. We have chosen in the baseline a value of 250€/tCO_2 incorporating some wishful thinking about technical progress and an alternative scenario of 500€/tCO_2. The wide range will have an immediate consequence: a wide range in the valuation of the climate debt. Because of that, our quantification is indicating the importance of the problem we are facing rather than aiming at being a guide for public finance. This is one reason among others why we consider that climate debt should not be added to public debt. The discount rate used in the calculation is also changing a lot the valuation. Indeed, a lower discount rate increases the value of the debt by giving more weight to the future or expecting less progress in the evolution of the abatement technologies.

Table 23. **Climate debts, EU-6 largest countries**

	DEU	GBR	FRA	ITA	ESP	NLD	EU6
Baseline (see note for definition)	66	53	37	51	41	62	53
Producer approach (vs Consumer)	29	20	11	18	17	49	22
No historical carbon adjustment (vs HCA)	4	8	17	12	22	20	12
EU population share (vs EU emissions share)	95	63	35	45	23	81	61
+1.5°C target (vs +2°C)	145	125	92	117	99	123	120
TCRE 50th percentile (vs 67th)	35	30	24	29	23	40	30
Ener-brown scenario (vs Ener Blue)	80	80	67	66	57	79	73
Backstop 500€/tCO_2 (vs 250€/tCO_2)	86	61	46	69	61	73	67
Discount rate 3% (vs 4%)	132	105	74	102	82	123	105
Constant post 2040 (vs trend extrapolation)	86	68	53	66	56	81	68

Note: scenarios are described in Table 21. EU-6 is the aggregation of the 6 largest economies (2017 GDP).
Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *OECD emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision), *AMECO online* (11/2018) for 2017 GDP.

In the baseline scenario, the EU Climate debt is close to 50% of GDP. This quantification is high and reveals that the climate issue is far from being a small one. The interpretation of that number must be done carefully. It is the net present value of costs to be paid in order to reach the +2°C target, without any consideration on how to do it. Smart policies, early enough, although it is a bit late for that today, could produce a less costly reduction of emissions. However, nothing in our current policies indicates that we are caring to do such smart and careful policies. Hence, the cliff scenario is more likely. The debt figure is a stock. One can understand it better as a flow. Using a 2 or 3% interest rate (which is a different concept than the discount rate used for the climate debt calculation), based on market value of risk-free interest rates, this stock can be converted to a 1 to 1.5% of GDP flow of investment in Climate change from now until the end of times. This is a large flow, meaning for instance a reduction in consumption by the same amount, but it is an amount that rich societies can afford without any difficulties.

That number comes with a wide range given the piling up of assumptions—some heroic and speculative—and interpretation of data sets—with some uncertainties and inconsistencies. The range for climate debt for the 6 largest EU economies is from a little more than 20% to nearly 200%: EU6 climate debt lies between [22%:193%] of GDP depending on the discount rate [3%:4%], the price of the ton of CO_2 abated with the backstop [250€:500€], a riskier targeting [50th:67th] and the range between Ener-brown and Ener-blue. This forces to a careful use of climate debt figures and asks for more work to better assess this important notion.

To the specific uncertainties of the valuation of climate debt, one has to add the elements pointed in the previous sections. The burden sharing can lead to very different carbon budgets and hence to very different climate debts. Table 23, using the same methodology than Table 22, displays what can change when you change the burden sharing principles. The extent of implicit transfers between countries, comparable in size and in structure is also important. For instance, the historical carbon adjustment modifies the climate debt gap between France and Germany by more than 40% of (France) GDP. Such differences are not really a transfer in the usual sense of the word, but it illustrates that relative differences of a macroeconomic magnitude can be driven by the principles in the burden sharing.

A decisive conclusion is that climate issue is important but is not a catch-22 situation. No one should find reasons to give up the project of mitigating climate change and to consider that the responsibilities towards future generations are beyond reach. Even the 1.5°C is still doable (Table 23). The costs are undoubt-

edly larger than for the +2°C target—more than twice, reaching 120% of GDP for the EU6—but they are still in the acceptable and possible bounds. Our methodology does not incorporate the costs of adaption; those costs are surely lower for the +1.5°C objective than for the +2°C one.

2.2.b Climate debts differences between countries are important

Table 23 displays important differences between countries. EU6 average is 53% for the baseline scenario, Germany climate debt is 66% and France one is 37%. Part of it comes from the historical adjustment (as discussed above). The rest is related to a more carbon intensive energy mix in some countries than in others. It is a strong divide between Germany and France. Recent transition of Germany towards renewable energy has not been enough to compensate for the exit from nuclear energy. Our point is not to promote one energy mix over another one. It is to acknowledge that our methodology amplifies existing state of the economies.[29]

Industrial structures—more industry in Germany, much less in France—play definitively a role, except in the baseline scenario where the consumer approach is taken. Without this approach, the relative climate debts of France and Germany are in the 1 to 3 range instead of less than 1 to 2. Again, methodological choices, based on moral or political considerations, can lead to a very different appreciation of the situation.

The speculative nature of the *Enerfuture* scenarios we have used for climate debt valuation and carbon budget calculations have also an influence on differences between countries. Failing to take in account fully the impact of renewable investment in Germany on future emissions may increase the estimated value of climate debt. We believe those scenarios to be middle ground and solid interpretation of current policies, but we will know for sure not until some time.

2.2.c How climate debt and public debt do relate?

We have mentioned above that climate debt should not be added to public debt because of the uncertain nature of the evaluation. Public debt is the result

29. Climate debt is a quantitative indicator which cannot deal with every question in the choices to mitigate climate change. For instance, nuclear energy is a low carbon energy, hence improving climate debt when deployed, but implies a set of moral choices related basically to safety not involved in the debt quantification. Environmental policies should not be designed only based on emissions reduction targets. As safety concerns go over borders, at least a European Safety Agency for Nuclear Energy would be a necessary requirement to different paths for energy mix.

of a contract between two parties with a well-defined flow of payments of interest and principal. One can follow the evolution of public debt as the accumulation or decumulation of such contracts. Climate debt is a different notion, being the net present value of a flow of investment needed under an extreme scenario, where you choose to respect commitments but have done nothing so far to respect them.

Therefore, climate debt depends on the discount rate used and the price of the backstop considered. There are no equivalent hypotheses for public debt. Calculating net present value of public debt, using the same discount rate would be a first step toward an uniformization of the definition. However, it would not be enough: the discount rate incorporates possibilities about the future price of the backstop, decreasing because of technical progress and learning by doing. The discount rate applied to flow of interest payment on public debt cannot be assimilated to this discount rate.

The macroeconomics of climate debt are different. Climate debt looks a lot like a negative shock to productivity. This stimulate spending in climate transition, may have multiplier effects or distortionary effects in the economy through taxes needed to trigger the transition. Distributional issues are raised by whom is going to pay for or own the negative productivity shock. Macroeconomics of public debt are way different. Public debt is a transfer between agents inside an economy. When public debt is held by foreigners, then it is a transfer between a country (or agents in a country) and the rest of the world. Sovereign rates are changing and may impact the whole spectrum of rates. The mechanisms are different.

For those reasons it is a bad idea to add public debt figure and our valuation of climate debts. Nevertheless, in order to diagnose the situation of an economy, we strongly suggest that climate debt is a complement to other macroeconomic imbalances. A country may seem in a sustainable and prudent situation – a low public deficit, a public debt stable at a low ratio to GDP – but may be facing a wall due to climate change unpreparedness. A scoreboard failing to inform on that would be inappropriate. Moreover, the EU committed to climate change targets and insuring that all countries take their shares in that commitment is necessary to avoid unwanted transfers.

III.3. Main conclusions

Climate debt and years before depletion concepts shed light on the urgency to mitigate climate change. As a rich and developed area, EU is now facing that cliff. We have exhausted our procrastination capital and the amount of debt is significant, in the range of 20% to 200% of GDP for the +2°C, our point estimate being close to 50% of GDP. For the more constraining +1.5°C, the number is much higher, the point estimate being close to 120% of GDP. However, the quantification of the climate debt should not fuel excuses to despair in front of the responsibility ahead. Mitigating the climate is not undoable or too expensive. It is within our reach, making our failure to address it even more condemnable.

The quantification of years before depletion and debt are sensitive to various assumptions and hypotheses. Some of those assumptions are in the field of *moral position and politics*. They deal with burden sharing methods. It is not our task, in this report, to decide on those rules. Nevertheless, we have shown that the quantifications are very different for each scenario. That means that, implicitly, important transfers are done when you do not address those issues politically.

Some assumptions are *technical issues*, some others are related to the use of *long-term forecasts*. It means that the quantification is partly *speculative* in nature and that little can be done to reduce that unpleasant characteristic. This uncertainty has to be understood when discussing the burden sharing issue on the political point of view.

As for technical issues, we have to admit that some more work and further research are needed to refine the quantifications and provide a better information for the instruction of the political and moral debate about the burden sharing (see Box 3). Considering the importance of the problem stated by our tentative quantifications, this task should not fall only on us but should be the concern of administrative bodies, member states governments, national representations and civil society.

They are three policy conclusions to our tentative estimation:

1. It is imperative to act to address mitigation of climate change. The procrastination capital is nearly exhausted for the +2°C scenario. It is completely exhausted for the +1.5°C one and EU is running a massive climate deficit.

2. Surveillance mechanisms, policy recommendations should focus much more on climate and more generally on sustainability issues. Public debt is

for sure one element of general sustainability. But it is far from being the only one. It may not be the most important one. A change in EU governance is needed to shift from the narrow vision to a broader one. Investment in quantifications and tools to appreciate sustainability has to be urgently delivered.

3. A consensus on the way to share the burden is necessary. Climate change mitigation is a deeply structural change so some time is left to decide on the extent of responsibility of each country. However, as we have shown, already some countries, may be the EU may be the EU as a whole, could be close or past to the exhaustion of their allocated budgets. Solving this issue is necessary before the *fait accompli* is the new rule.

Box 3. How to better estimate the climate debt

The evaluation presented here is based on a large number of assumptions, sometimes heroic. Such shortcuts are however necessary to show that the concept is useful, that the order of magnitude is relevant to policy conclusion and that there are some lessons to be drawn from international comparisons. We acknowledge and shoulder the limitations. To produce a better estimation of the climate debt, one needs to go further on several points.

1. Improve the MACC and use an integrated modelling to understand the links between technologies. This would also allow to represent scenarios for the energy mix and energy vectors more realistic and more holistic. Soberness could be incorporated in the framework, whereas an estimation of the welfare loss (and not only of the technical cost) of that solution would have to be included.
2. Improve the current policies scenario and the long term of emission reduction. We have used and extrapolated scenarios up to 2040. Such an extrapolation is fragile and has produced for some countries current policies paths with little or no emission reduction. This is clearly overstating the climate debt in some countries whereas being overoptimistic in others.
3. Backstop technologies are crucial to our estimation because the inventory of non-CDR technologies is limited. Cost and capacity of backstop technologies is difficult to estimate and as time and deployment of CDR technologies go on, we may able to have more reliable figures in the future.
4. For backstop technologies as for MACC in general, the effect of technical progress on future cost is important. Incorporating more flexible hypothesis there may lower the estimation of the Climate debt. However, uncertainty should be incorporated in the analysis.
5. The line of reasoning we have adopted is that each country is responsible for a certain target of emission reductions (the carbon budget, adjusted by historical emissions). However, without disregarding this responsibility, it may be

possible for a country to buy emission reductions elsewhere, especially if the cost of this abatement is lower than the national one. That could be an important element in the medium run as some developing countries have still important carbon budget. Developed countries could access in the next decades to cheaper ways to meet their commitment through ambitious trade schemes. The idea is not to define a possible scheme to trade emission rights, but to incorporate in the analysis the positive impact it could have by reducing the climate debt of some countries.

6. The possibility to borrow to the Climate, by overshooting the carbon budget in the medium term and then compensating that overshooting by more negative emissions may be a rational way to deal with the constraint. However, climate science does not give today a real cost to do so. One can imagine it would lead to impose an overall lower cumulated emission and that would come with nonlinear effects, limiting the extend of that dangerous game with climate change consequences. Nevertheless, this could be incorporated in the analysis, especially for already exhausted carbon budgets.

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GLOSSARY

**** Adjusted carbon budget***: a carbon budget minus the historical carbon adjustment. It aims at producing a carbon budget which would take into account the national differentiated historical responsibilities in global warming and climate change.

**** Carbon budget***: the cumulative amount of carbon dioxide (CO_2) emissions permitted until the end of times to keep within a certain temperature threshold.

**** Historical carbon adjustment***: national deviation—in tCO_2—from the carbon budget allocated to a specific country thanks to the egalitarian approach over a given period of time.

**** Intergovernmental Panel on Climate Change***: created in 1988, it is an international group of scientists and experts mandated by the United Nations in order to document climate change not only from a geophysical point of view but also in terms of economic and political impacts.

**** Intended National Determined Contributions***: emissions reduction targets submitted by the Annex I countries of the UNFCCC in the wake of the 2015 United Nations Climate Change Conference. These targets concern mainly emissions levels by 2030 as compared to those of 2005.

Appendix. DATA AND SUPPLEMENTARY MATERIAL

Table A1. Egalitarian carbon budgets, HCA and adjusted carbon budget

$GtCO_2$	Egalitarian carbon budget (2015 reference year)	Historical carbon adjustment (1990-2017)	Egalitarian adjusted carbon budget (2015 reference year)
EU28	91	49.7	41.0
AUT	1.6	1.1	0.4
BEL	2.0	2.1	0.0
BGR	1.3	-0.3	1.6
HRV	0.8	-0.2	1.0
CYP	0.2	0.1	0.1
CZE	1.9	1.6	0.3
DNK	1.0	1.1	-0.1
EST	0.2	0.2	0.0
FIN	1.0	0.3	0.7
FRA	11.5	4.7	6.8
DEU	14.6	16.1	-1.5
GRC	2.0	1.5	0.5
HUN	1.7	0.2	1.5
IRL	0.8	0.9	-0.1
ITA	10.6	5.7	4.9
LVA	0.4	-0.3	0.6
LTU	0.5	-0.1	0.7
LUX	0.1	0.1	0.0
MLT	0.1	0.0	0.1
NLD	3.0	2.4	0.6
POL	6.8	2.5	4.4
PRT	1.9	0.1	1.7
ROU	3.6	-1.1	4.6
SVK	1.0	0.2	0.8
SVN	0.4	0.1	0.3
ESP	8.3	1.9	6.4
SWE	1.7	-0.8	2.6
GBR	11.7	9.6	2.1

Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision). Calculated for +2°C 2/3 probability, egalitarian share and consumer approach.

Table A2. Grandfathering carbon budgets, HCA and adjusted carbon budget

$GtCO_2$	Grandfathering carbon budget (2015 reference year)	Historical carbon adjustment (1990-2017)	Grandfathering adjusted carbon budget (2015 reference year)
EU28	118.8	49.7	69.1
AUT	2.8	1.1	1.7
BEL	3.8	2.1	1.8
BGR	1.0	-0.3	1.3
HRV	0.5	-0.2	0.7
CYP	0.3	0.1	0.2
CZE	2.8	1.6	1.3
DNK	1.5	1.1	0.4
EST	0.3	0.2	0.1
FIN	0.5	0.3	0.2
FRA	14.4	4.7	9.7
DEU	27.6	16.1	11.5
GRC	2.8	1.5	1.2
HUN	1.5	0.2	1.2
IRL	1.7	0.9	0.8
ITA	13.0	5.7	7.3
LVA	0.3	-0.3	0.6
LTU	0.3	-0.1	0.4
LUX	0.2	0.1	0.1
MLT	0.1	0.0	0.0
NLD	4.9	2.4	2.5
POL	8.6	2.5	6.2
PRT	1.6	0.1	1.5
ROU	1.7	-1.1	2.7
SVK	1.0	0.2	0.8
SVN	0.3	0.1	0.3
ESP	8.7	1.9	6.8
SWE	-0.2	-0.8	0.6
GBR	16.8	9.6	7.2

Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision). Calculated for +2°C 2/3 probability, grandfathering share and consumer approach.

Table A3. Per capita hybrid carbon budgets, HCA and adjusted carbon budget

$GtCO_2$	Per capita hybrid carbon budget (2015 reference year)	Per capita historical carbon adjustment (1990-2017)	Per capita hybrid adjusted carbon budget (2015 reference year)
EU28	169.6	98.0	96.5
AUT	248.9	127.4	121.5
BEL	258.6	183.0	75.7
BGR	106.3	-44.7	151.0
HRV	84.1	-49.4	133.5
CYP	180.7	96.1	84.6
CZE	203.1	147.5	55.6
DNK	205.3	201.5	3.8
EST	196.0	145.4	50.6
FIN	69.0	45.8	23.2
FRA	169.6	73.0	96.5
DEU	256.5	197.4	59.2
GRC	186.3	137.6	48.7
HUN	112.7	22.1	90.6
IRL	269.0	194.3	74.6
ITA	166.0	96.2	69.8
LVA	116.7	-138.9	255.6
LTU	79.0	-43.3	122.3
LUX	299.4	256.1	43.3
MLT	104.3	30.6	73.7
NLD	220.1	144.0	76.1
POL	171.0	64.2	106.8
PRT	116.3	13.7	102.6
ROU	64.6	-53.2	117.8
SVK	135.9	30.8	105.0
SVN	122.0	31.5	90.4
ESP	141.7	40.4	101.3
SWE	-13.7	-83.4	69.7
GBR	195.0	146.1	48.9

Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision). Calculated for +2°C 2/3 probability, hybrid share and consumer approach.

Table A4. Per capita egalitarian carbon budgets, HCA and adjusted carbon budget

$GtCO_2$	Per capita egalitarian carbon budget (2015 reference year)	Historical carbon adjustment (1990-2017)	Per capita egalitarian adjusted carbon budget (2015 reference year)
EU28	178.8	98.0	80.8
AUT	178.8	127.4	51.4
BEL	178.8	183.0	-4.2
BGR	178.8	-44.7	223.5
HRV	178.8	-49.4	228.2
CYP	178.8	96.1	82.7
CZE	178.8	147.5	31.3
DNK	178.8	201.5	-22.7
EST	178.8	145.4	33.4
FIN	178.8	45.8	133.0
FRA	178.8	73.0	105.8
DEU	178.8	197.4	-18.6
GRC	178.8	137.6	41.2
HUN	178.8	22.1	156.7
IRL	178.8	194.3	-15.5
ITA	178.8	96.2	82.6
LVA	178.8	-138.9	317.7
LTU	178.8	-43.3	222.0
LUX	178.8	256.1	-77.3
MLT	178.8	30.6	148.2
NLD	178.8	144.0	34.8
POL	178.8	64.2	114.6
PRT	178.8	13.7	165.1
ROU	178.8	-53.2	232.0
SVK	178.8	30.8	148.0
SVN	178.8	31.5	147.2
ESP	178.8	40.4	138.4
SWE	178.8	-83.4	262.2
GBR	178.8	146.1	32.7

Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision). Calculated for +2°C 2/3 probability, egalitarian share and consumer approach.

Table A5. Per capita grandfathering carbon budgets, HCA and adjusted carbon budget

$GtCO_2$	Per capita grandfathering carbon budget (2015 reference year)	Historical carbon adjustment (1990-2017)	Per capita grandfathering adjusted carbon budget (2015 reference year)
EU28	234.1	98.0	136.2
AUT	327.8	127.4	200.4
BEL	340.6	183.0	157.6
BGR	139.9	-44.7	184.7
HRV	110.8	-49.4	160.1
CYP	238.0	96.1	141.9
CZE	267.5	147.5	120.0
DNK	270.3	201.5	68.8
EST	258.2	145.4	112.8
FIN	90.9	45.8	45.1
FRA	223.3	73.0	150.3
DEU	337.8	197.4	140.5
GRC	245.4	137.6	107.8
HUN	148.4	22.1	126.3
IRL	354.2	194.3	159.9
ITA	218.6	96.2	122.4
LVA	153.7	-138.9	292.6
LTU	104.1	-43.3	147.3
LUX	394.2	256.1	138.2
MLT	137.3	30.6	106.8
NLD	289.8	144.0	145.9
POL	225.2	64.2	161.0
PRT	153.1	13.7	139.4
ROU	85.1	-53.2	138.3
SVK	178.9	30.8	148.1
SVN	160.6	31.5	129.1
ESP	186.6	40.4	146.2
SWE	-18.0	-83.4	65.4
GBR	256.8	146.1	110.7

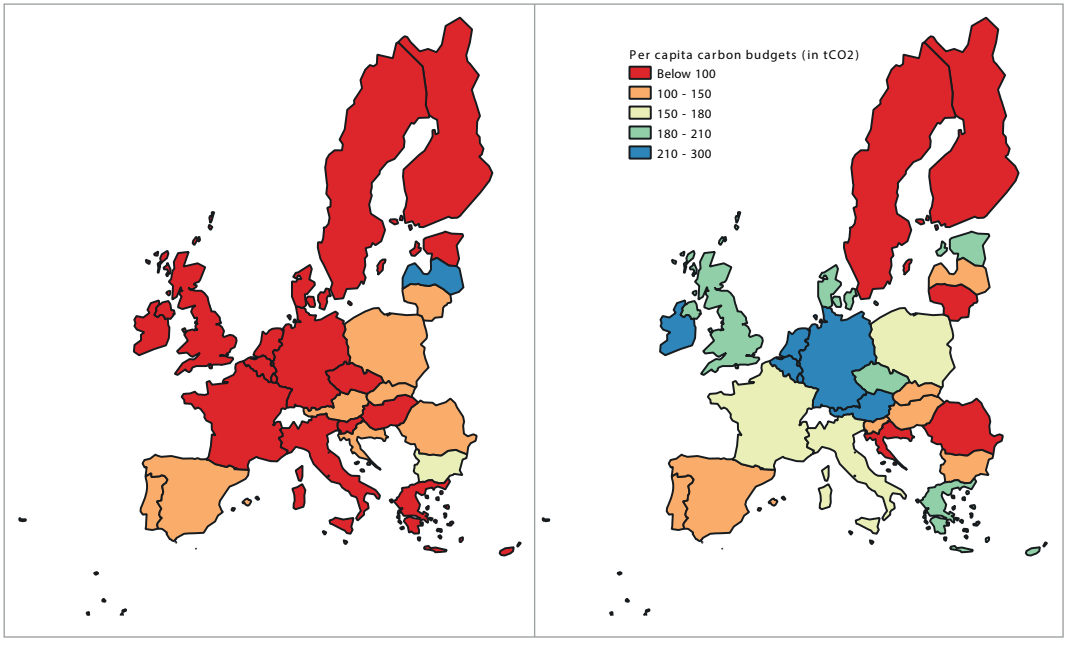
Source: iASES (formerly iAGS) 2019 computations, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision). Calculated per capita based on 2015 population data for +2°C 2/3 probability, grandfathering share and consumer approach.

Table A6. Ranks of national per capita carbon budgets under various assumptions

	Grandfathering per capita budget	Egalitarian per capita budget	Hybrid per capita budget	HCA-adjusted grandfathering per capita budget	HCA-adjusted egalitarian per capita budget	HCA-adjusted hybrid per capita budget
1	LUX	—	LUX	LVA	LVA	LVA
2	IRL	—	IRL	AUT	SWE	BGR
3	BEL	—	BEL	BGR	ROU	HV
4	DEU	—	DEU	POL	HRV	LTU
5	AUT	—	AUT	HRV	BGR	AUT

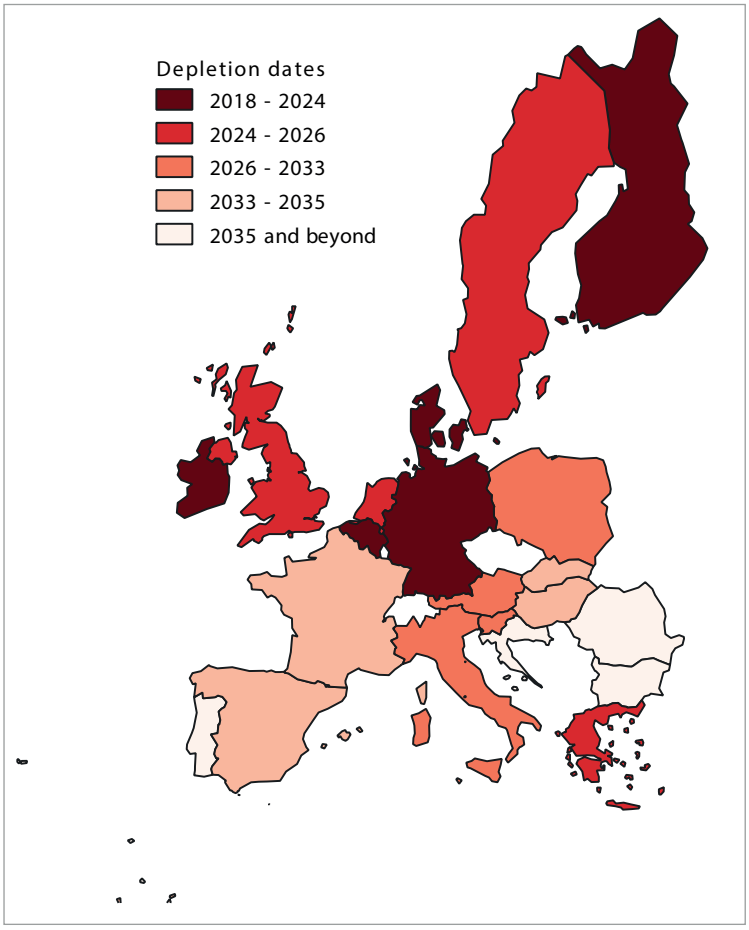
Source: iAGS, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); budgets are calculated per capita based on 2015 population data for +2°C 2/3 probability and consumer approach.

Graphique A1. Per capita carbon budgets before (right) and after (left) historical carbon adjustment



Source: iAGS, based on IPCC SR1.5, *UNFCCC emissions data*, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3) and *UN World Population Prospects* (2017 revision); on the left handside are displayed national per capita adjusted carbon budgets for EU28 member countries; on the right handside are displayed national per capita carbon budgets (before historical carbon adjustment) for the same countries. Calculated for +2°C 2/3 probability, hybrid share and consumer approach.

Graphique A2. Maps for the years before depletion



Source: iAGS, based on IPCC SR1.5, UNFCCC emissions data, Le Quéré *et al.* (2018) *Historical Carbon Budget* (version 1.3), *UN World Population Prospects* (2017 revision), *AMECO online* (11/2018) for 2017 GDP. Calculated for +2°C 2/3 probability, hybrid share and consumer approach.

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Abbreviations Country names

Euro area **EA**

Austria	**AUT**
Belgium	**BEL**
Bulgaria	**BGR**
Croatia	**HRV**
Cyprus	**CYP**
Czech Republic	**CZE**
Denmark	**DNK**
Estonia	**EST**
Finland	**FIN**
France	**FRA**
Germany	**DEU**
Greece	**GRC**
Hungary	**HUN**
Ireland	**IRL**
Italy	**ITA**
Latvia	**LVA**
Lithuania	**LTU**
Luxembourg	**LUX**
Malta	**MLT**
Netherlands	**NLD**
Poland	**POL**
Portugal	**PRT**
Romania	**ROU**
Slovakia	**SVK**
Slovenia	**SVN**
Spain	**ESP**
Sweden	**SWE**
United Kingdom	**GBR**

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