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FOREWORD

OLIVIER BLANCHARD AND JEAN TIROLE

Scope

For the next year or so, the key challenge will be to deal with Covid-19 and its legacy. The exit from the pandemic, the high unemployment and the potential bankruptcies, the economic recovery, the handling of public and private debt: these issues are what will make the headlines and will be the main topics of political attention.

As important as this short-term challenge is, structural problems pre-dating Covid-19 are still present and have been made even more acute by the pandemic. So, when we were asked in January 2020 by President Macron to organize and head a commission addressing these structural challenges and were granted free rein in choosing the commission's members and full independence in stating our conclusions, we accepted this mission with enthusiasm.

In agreement with the President, we have chosen to focus on three long-term structural challenges: the climate change, the economic inequalities, and the demographic challenge. Technological change is a central aspect of these three themes, being both part of the problem and part of the solution.[1]

[1] In all three cases, we tried to look beyond the Covid-19 crisis, and focused on what we saw as the longer-term issues. Were the Covid-19 to last longer, it would clearly have implications for each of the three challenges we discuss in the report. It would affect the budgetary margins to fight global warming. It would reinforce pre-Covid-19 inequalities. It might even change population dynamics and affect the retirement system. While we could have added something to that effect in the introductory chapter, we thought it was too early to speculate.

Team

We formed a commission of 24 economic experts, plus the 2 of us acting as rapporteurs.[1] One of the members, Professor Emmanuel Farhi (Harvard University), sadly passed away on July 23, 2020, a couple of hours after participating in one of our plenary sessions. This report is dedicated to the memory of this extraordinary researcher and human being.

We chose members first and foremost based on their economic expertise. They are very diverse in their intellectual and political choices and they expressed themselves freely. We decided to select a team of economists rather than a larger group of social scientists and practitioners. The economics of the post-Covid-19 world are an essential brick in the overall thought-building. But, while we paid careful attention to the views of experts in other fields and of civil society, our report is obviously only one of the pieces needed for policy makers to decide. It must be complemented by other views, from experts in other fields, practitioners, citizens, interest groups, and independent associations.

We also deliberately went for a commission with an international membership: one third French, one third American, and one third non-French European. There are pros and cons to this approach. On the benefit side, the geographic diversity avoided localism, the Franco-French discussions that often obscure that there are other ways of doing public policy; it also enabled us to draw on international evidence to benchmark the French situation and propose policies. Finally, many of the challenges have a European, if not a world dimension. The cost was a more limited knowledge of the granularity of French institutions and constraints, which, as we freely admit, makes our propositions for reforms at times not quite ready for use.

The report consists of an introductory chapter and three main chapters, each on one of the three themes. The seven writers of the three underlying chapters spent many months on the project and were compensated according to standard research contract practices. The seventeen other members as well as the two rapporteurs contributed pro bono.

Commission's modus operandi

Three teams were put in charge of drafting the chapters corresponding to the three themes. They presented their views at three different stages of their work in July, September, and November/December 2020. Overall, we had 12 plenary video conferences, in which the authors received suggestions and comments from other members. Numerous spontaneous bilateral interactions and e-mails added to the overall discussion and collective wisdom, and head authors also benefitted from research support from France Stratégie. While these month-

[1] The list of members appears at the opening of the report, and a more detailed presentation of the members is given at the very end.

long interactions shaped the content of the three chapters – divided into sections –, the latter remain the responsibility of the individual authors.

The introductory chapter presents what we, the two rapporteurs, see as the main conclusions of the three thematic chapters. A commission with 24 members and 2 rapporteurs is bound to reflect a variety of views. Nonetheless, there was broad agreement on the diagnoses, on the relevant arguments and on the main recommendations. Where problems are complex and evidence lacking, though, there is understandably some disagreement about specific recommendations and indeed even how some of the problems are framed. Many policies involve trade-offs, and one can reasonably be on one side or the other. We have indicated points or issues where there was significant disagreement within the commission; more broadly, members are not bound by statements in the introductory chapter. Like the underlying chapters, it is the responsibility of its two authors, even though it was discussed at length with the head authors and all the commission's members.

Accordingly, readers are urged to read the three underlying chapters and not to rely on just the introductory chapter. First because it inevitably embodies our own views. And mainly because it cannot reproduce the richness of the facts and arguments developed in the three chapters and their appendices.[1]

The commission's propositions

Our policy propositions fall in two groups: recommendations, and more tentative propositions. Some recommendations include measures which have been repeatedly discussed but have not been implemented. The issue there is why it did not happen: bad design, lack of consideration of distributional effects, or misperceptions? One of our conclusions is that, to succeed, some unpopular measures, such as a sufficiently high price for carbon or an increase in the retirement age, if they are proposed, must be part of a holistic approach, a larger set of measures, which deal with distribution effects, perceptions, and trust.

Some propositions are more tentative because they are new, or their effects are not well understood, or their implementation risks are substantial. Some of these are still sufficiently raw that they should be looked at by researchers. Others are closer to implementation and could be explored further and subjected to experimentation.

The chapters on climate change and inequality, while going into some design and implementation specifics, focus by and large on general principles. The chapter on demography goes more into the weeds. The reason is simple: there is already a retirement reform on the table, and the existing proposals have already been looked at by policy makers, social partners, and citizens. We had to be specific about how our conclusions coincided or differed from those of the reform under examination.

[1] The Appendices are gathered in a second volume, also available online.

Thanks

Our first thanks go to head authors and commission members. For the quality of their contributions; it was a privilege for us to collaborate with and learn from them. For their commitment, first prior to the installation of the commission (only 2 people we approached said no, feeling already overcommitted). And for their diligence, their constructive mood, and their cheerfulness at a moment that the pandemic made rather dark. It is remarkable that top economists, who were already overcommitted and with many alternative options for their time, accepted this time-consuming public-service task. That two-thirds of them are foreigners makes it even more remarkable. It warms the heart. *Un grand merci !*

France Stratégie brought superb research support to the endeavor; special thanks go to its Commissaire général, Gilles de Margerie, and to its Commissaire général adjoint, Cédric Audenis. Not only did they manage to mobilize France Stratégie teams in support, but they themselves continuously brought savvy advice and insights on the French economic challenges. Specific France Stratégie and OECD researchers who helped us are thanked in each individual part.

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EXECUTIVE SUMMARY

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Overall Picture

Common themes

- The commission chose to focus on three challenges: global warming, inequality, and aging.
- All three challenges raise fundamental distribution issues both across and within generations.
- All three challenges are time bombs. Their immediate effects are much weaker than their long-term ones, prompting public decision-makers to procrastinate.
- All three challenges are complex, and decisions must be taken under substantial uncertainty.

For each of these three challenges, solutions exist. So why has there been so little progress?

- *Badly thought-out reforms?* To design a reform, one needs to understand the nature of the challenges, the potential effects of alternative policies. This requires contributions from many experts, from different fields.
- *Badly explained, unpopular, reforms?* Without popular support, reforms are likely to fail, as shown by the recent experience in France. One must thus pay special attention to winners and losers. This requires a global approach to reforms, in effect a combination of reforms, implemented simultaneously.
- *Badly implemented reforms?* The devil is in the details. Judicious reforms can turn into failures if their implementation is not well-thought-out carefully.

Those considerations led our commission to define our mandate as follows: Give our best economic advice on both the nature of the challenges and the set of potential solutions; think hard about how to make these policies popular or at least acceptable; suggest how they may be put into practice.

On Climate Change

In short

- The climate urgency calls for swift and large-scale action.
- Success will depend on technological breakthroughs.
- The fight will be expensive.
- A holistic approach is needed.
- Carbon pricing is necessary but far from sufficient.

Representations and reality

- There is a disconnect between the general belief that global warming is happening and is due to humans, and the reluctance to accept the changes and the costs that come with the need to fight it.
- A lack of transparency about the costs of various measures has led people to focus on the costs that are visible, such as the carbon tax, rather than on those which may be much larger but are harder to see and assess, such as those caused by some inefficient bans and subsidies.

Our recommandations

- *A full endorsement of "carbon pricing done well"*
  - Although it is unpopular, carbon pricing is an essential piece of any coherent plan. It leads households and firms to adopt a more ecological behavior; it gives incentives to researchers to develop green technologies, and to firms to adopt them; it allows for better policy choices.
  - Although carbon pricing exists already, its effect is weakened by its low level, by the many exemptions, and by the large subsidies to fossil fuels. The price of carbon must be set in accordance with our climate ambitions, exemptions limited, and fossil fuel subsidies eliminated.
  - Two other conditions are essential. The distributional implications must be taken into account and dealt with. And, to prevent production from moving abroad to evade the tax, a carbon tax must come with a border tax adjustment.

- *R&D subsidies, standards, and bans*
  - Green R&D is on the rise, but its funding must be increased.
  - But more is needed, and targeted R&D subsidies, standards, bans and adoption incentives are justified, especially where carbon pricing does not do the job. However, these interventions are more discretionary than carbon pricing and therefore more prone to lobbying, regulatory capture, and red tape.
  - For a proper governance, we propose the creation of two independent agencies, if possible at the European level: one to fund high risk/high reward R&D projects ("EU-ARPA-E"); another to inform citizens and public officials of the cost of alternative ways of achieving the same environmental impact.

- *A role for France and Europe*
  - France by itself will have a very minor direct impact on climate mitigation.
  - But, especially if designed at the European level, its indirect impact can be substantial: leading by example and showing that "things can be done", putting pressure on free-riding countries through border tax adjustments, promoting technological and policy innovation that will benefit poor countries, and playing an intellectual leadership role in the building of effective international agreements.

On Inequality

In short

- Inequality has many dimensions. A major one is the degree of access to good jobs and satisfying working lives.
- More equal access means more equal education and more equal financial resources.
- The traditional approach has been to prepare workers for jobs as well as for changing jobs. Professional training is indeed essential and can be substantially improved.
- There is no reason however to take the evolving distribution of jobs as given, and not try to improve it. This suggests promoting a better internal organization of firms, labor market reforms – such as genuine financial (dis)incentives for employers – fostering good jobs, taking measures to affect the direction of technological change, and developing trade rules to prevent social dumping.

Perceptions and facts

- France's statistics on income, wealth, and regional inequality do not look bad in international comparisons. Contrary to many other countries, they have not become worse in the recent past. France redistributes heavily, especially toward very low incomes.

- A large majority of the French however perceive inequality as a serious or very serious problem.
- Standard statistics miss essential dimensions of inequality, such as the ability to acquire a good education or to hold a good job.
- People do not believe that there are equal educational and job opportunities. They are skeptical about social mobility. This indeed accords with the facts.
- People worry that good jobs will disappear; they blame trade, more so than technological progress, which in fact plays a dominant role.
- This led the commission to put some emphasis on “good jobs”.

Our recommendations

To reduce inequality, one must work at three margins and thus consider three types of measures. Those that take place before production (more equal chances, education, financial resources), those that take place after production (redistribution, protection), and finally those that affect the nature of production (creating more good jobs and more access to good jobs). The traditional focus has been mostly on redistribution. It needs to shift more to the other two margins.

- *Equal opportunity*. France has a serious equal opportunity problem. We make several recommendations to reduce educational inequality, most of them not original, but still very relevant. The inheritance tax also does not play the role it could in creating more equal opportunity. More than its rates, at fault are its design and its loopholes. To make its goal clearer and increase support, inheritance tax revenues could be explicitly allocated to financial redistribution that fosters equal opportunity.
- *Fairer taxation*. The weight of taxation is already high in France and there are limits to redistribution. Still, we give several examples where taxation can be made fairer, for example through the use of artificial intelligence, better information exchange (third-party reporting, international cooperation), and international agreements.
- *Prepare workers better for jobs*. France should follow international best practice regarding continuous education: clean certification, design of training through interactions with private-sector employers.
- *Stimulate the creation of good jobs, bend technological R&D and redefine trade rules*. The organization of firms, and the nature of technological progress, trade rules, should not be taken as given. This remark leads to the most provocative part of the chapter. While this is largely unexplored territory, it suggests several ways in which the state may intervene.

On Demography

In short

- Aging, and aging in good health are good news, indeed major societal achievements. Yet, they require adjustments in the way life is organized, the main one being maintaining the right balance between work and retirement.
- To keep the retirement system in balance, a longer life expectancy requires either a decrease in benefits, or an increase in contributions, or else a higher retirement age.
- Public pension expenditures are high in France, due to a very low activity rate of 55-64-year-olds and an early effective age of retirement compared to other countries.
- The pension system should be unified, become more transparent and fairer. It should allow for individual flexibility in the choice of retirement age versus the level of retirement benefits. It should recognize the large differences in life history and life expectancy across workers.
- The pension system should be flexible enough to maintain financial balance, now and in the future, while respecting societal preferences.
- Pension reform should be accompanied by health and other measures that increase both the supply and the demand for senior workers.

Perceptions and facts

- Employers and employees often believe that decreases in productivity should motivate early retirement, even though there is no evidence for this except in the case of chronic diseases.
- For many workers, the current reform is perceived as technocratic and lacking transparency.

Our recommendations

- *A transparent system*. Workers would accumulate points on an individual account over their entire work life until claiming a pension at the earliest eligibility age (EEA) or later. Each point would give a right to the same pension income.
- *A redistributive system.* Low income workers and workers with checkered work history would receive “bonus points” when retiring, to ensure a decent pension. Unlike in the current system, the pension would grow with accumulated points even in the low-points range, to preserve incentives.
- *A system allowing for individual flexibility.* Workers who keep working beyond the EEA and do not claim benefits until later, would keep receiving points for both additional

years worked and for the decrease in the expected number of years they will receive a pension.

- *A system taking into account painful working conditions*. Workers in arduous jobs would be able to retire earlier than the EEA. However, to use decentralized information, to incentivize firms to engage in the prevention of chronic illnesses, and to avoid a cross-subsidization among firms or industries, social partners at the industry or firm level would define what constitutes a hard working condition and employers would bear the extra cost associated with retirement before the EEA.
- *A sustainable and transparent determination of the computation of pension benefits*. All pensioners would receive the same number of euros per point. This number (the "service value") would be computed to balance the system. Assuming that the pension contribution rate (which is currently very high at 27.5%) remained constant, the service value of a point would grow at the rate of wage inflation minus the variation in the system dependency ratio (the ratio of pensioners over active workers).
- *A system dependency ratio reflecting societal preferences*. A rule that maintained a 2:1 ratio of work vs. retirement years (any 3-year gain in life expectancy would translate in 2 more years of work and 1 more year of retirement) would keep the system roughly in balance. But society may prefer a rule that leads to a smaller increase in the retirement age, and, by implication, a lower replacement rate.
- *An independent governance structure.* To deal with the trade-off between adjusting the retirement age or the replacement rate, we propose the creation of an independent board, taking decisions reflecting societal preferences, together with the creation of a reserve fund to deal with transient, demographic or economic, shocks and to serve as an indicator of the financial soundness of the pension system.
- *The need to go beyond retirement reform.* An essential part of an overall reform should be to make it more attractive for older workers to work; by engaging in more prevention against chronic diseases; by improving the quality of continuous training; by making work more flexible for older workers (possibility of part-time work, employer accommodation practices to help older workers with health problems to stay in work). Foreign experiences show that these accompanying reforms can make a large difference.

Improving the labor market integration of immigrants is the other demographic issue the commission took on. This group's low labor force participation is a challenge on its own, but it is also relevant to balancing the retirement system. The report offers several measures which could be taken to improve the situation.

INTRODUCTORY CHAPTER
FRANCE IS FACING THREE MAJOR CHALLENGES

Olivier Blanchard and Jean Tirole

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ON THE REPORT

The challenges

We decided to focus on three challenges, global warming, inequality, and aging, which we saw as the top challenges facing us. We realize that we could have extended the list substantially. Some important topics – the long lasting health and economic effects of Covid-19, the need to prepare for other pandemics, the redefinition of fiscal and monetary policy in an era of very low interest rates, competition policy and privacy in the digital age, financial regulation, the implications of social media for politics and by implication for economic policy… – are outright absent. Some others – education, reform of the state, labor laws, health… – appear piecemeal in the three main chapters. Even the treatment of the three selected topics is far from exhaustive: for instance, we focus on climate change, but leave aside biodiversity and air pollution. For aging, we emphasize pension reform and devote too little discussion to other implications of an aging population.

All three challenges raise fundamental intra- and intergenerational issues: what life shall we leave to our kids? What planet? What kind of jobs? What balance should there be between the interests of the young/workers and those of the old/retirees? Will we be able to address existing inequalities and the new ones created by Covid-19, which will hit particularly hard younger generations, especially the lower educated?

All three challenges arise, in their own way, from the complex nature of economic growth, and its main driver, technological progress. Technological progress has contributed to enormous increases in the standard of living, in France and elsewhere. But it is also at the root of the challenges we face today. The industrial revolution contributed to the emergence of global warming, and innovations in carbon-based electricity and transportation technologies have fueled carbon emissions. Technological progress, including the advent of applications of artificial intelligence, contributes to the growth in inequality and to the technological obsolescence of skills for older workers. Medical

technological progress has increased life expectancy, a good thing of course, but one which puts pressure on retirement systems.

At the same time, technological progress will have to be an integral part of the solutions. Global warming will not be solved just by emitting less carbon under current technologies; it will require a substantial R&D effort along with the important technical progress that comes from experience with new technologies, commonly known as learning by doing. The fight against inequality will also benefit from technology: innovative teaching methods and ubiquitous access to good education through online courses; the development of new technologies that complement rather than substitute for human skills; better tools to tax mobile capital. Prevention and treatment of chronic illnesses and better continuous education will reduce disability and facilitate the work of older workers, and thereby make our pension system more sustainable. The challenge is how to design policies to stimulate and harness this progress, so as to achieve more balanced and more sustainable growth.

All three challenges have slow fuses. The costs build slowly over time, and this makes it easier for policy makers to procrastinate. Political biases (only the current generation votes, including on matters that deeply affect future ones) and behavioral biases (overconfidence and the belief that problems will work themselves out on their own) also tilt the balance towards avoiding costs today even if there are obvious benefits in the future; they tilt decisions against the future generations. The life-threatening impact of climate change was heralded almost three decades ago, with little actual reaction from governments except in their political discourse. Inequality, poor education and professional training, the lack of preparedness for pandemics or artificial intelligence, the sustainability or social acceptability of the pension system are a few other examples of societal time-bombs. Where there have been substantial efforts, they have often lacked a “big picture” or inadequately addressed the underlying problems.

All three challenges raise complex technical and economic issues. It is difficult to predict the social acceptability of alternative climate policies, which green R&D to subsidize, or the pace of technological progress. Will storage technologies become sufficiently cheap that we can rely on wind and photovoltaic energy, or do we need to keep nuclear energy as backup? How much can we rely on education to level the playing field and lead to wider access to good jobs? How much can we bend technology so that it helps complement rather than substitute for workers?

This uncertainty raises a major policy challenge, combining the need to be flexible with the need to give clear signals about future policy. For example, citizens, firms, green-energy start-ups, and municipalities need to anticipate future climate policies when engaging in long-term choices (housing, electricity generation, R&D, modes of transportation…); similarly, some citizens are understandably concerned that a “green cheque” may not have lasting power while a carbon tax might. Climate-related, jobs and pension-related decisions

are long-term decisions and raise the issue of expectations of future public policies. Economic actors need forward guidance and, failing certainty, have some visibility on how policy decisions that will crucially impact them will be taken in 10 or 20 years.

The right balance is not easy to achieve. Policy predictability requires clear guidelines: how will environmental regulations and the carbon price be determined tomorrow? How will my pension check be computed? And how long shall I be expected to work? At the same time, adjustments to a changing world require flexibility. The longer lifetime and the macro shocks affecting contributions to the retirement system will need to be accounted for. The speed of environmental degradation, the public policy reaction to climate change, the pace of technological discoveries, are all uncertain, creating a need for policy adjustments.

Resolving these apparently conflicting goals of useful guidance and future flexibility requires thinking about institutions which can achieve the proper balance. For that, one must insulate adjustment decisions from political pressure. Adjustments must reflect what is learned, not political expediency. It can be done. For example, the independence of Central Banks has allowed them to successfully create a commitment to tame inflation, but at the same time to adapt to unusual circumstances during the financial and Covid-19 crises by bringing in the necessary flexibility. With this example in mind, the creation of a "central carbon bank" is one of the measures envisioned in Chapter One to best combine predictability and flexibility in the issuance of permits. We suggest that the pension system be run by transparent adjustment rules, but adjustments to unforeseen evolutions be managed by an independent body, with the potential use of a reserve fund as an adjustment stabilizer.

How the commission saw its role

What we have discussed are questions which can only be answered, if at all, by experts (not just economists, but social scientists more broadly and others). They can summarize the state of knowledge, what is known as well as what is unknown, what policies have worked elsewhere, and what policies should be explored.

But they cannot stop there. Reforms that most experts believe are needed have often run into strong opposition and have been abandoned or bastardized. Nearly all economists believe that a coherent strategy to fight global warming must include the use of a carbon price. Yet, the attempt in 2018 by the French government to introduce a carbon tax was at the origin of the revolt of the *Gilets jaunes* (Yellow Vests), and, in 2020, the Convention citoyenne pour le climat decided not to include it in its list of recommendations. Nearly all economists believe that part of the response to the increase in life expectancy must be some increase in the retirement age. Yet, this aspect of the retirement reform presented by the French government in 2020 ran into strong opposition.

Some of the opposition may come from a lack of trust in experts, or from misperceptions of facts or policy trade-offs. The task of experts is then to present their conclusions with the proper degree of humility – which they do not always do – and to correct the misperceptions as best they can – not an easy task either. Transparency can increase trust. Creating such transparency is another cross-cutting theme of the report. The pension reform aimed at introducing more transparency into the system but failed to do so; its features can be improved to raise the citizens' confidence in the system. The carbon tax suffered not only from a feeling of unfairness, but also from a lack of informational level-playing field among alternative approaches to fighting global warming, many rather opaque in their incidence and some, such as the carbon tax, patently visible. But the opposition is more likely to come from groups that feel that, even if the reform is desirable, they will be among the losers. This is clearly the case for the *Gilets jaunes*. Experts cannot brush these concerns away. They have a responsibility to take those perceptions into account.

Thus, if reforms are to pass and be accepted, those who argue for them must understand and deal with these perceptions. Reforms must be perceived as fair. Limiting exemptions and loopholes are no-brainers, at least in principle. The perception of fairness can also be promoted through compensation. No policy can compensate all losers, as information regarding who loses is never fine enough;[1] neither should losers always be compensated, as the status quo, itself a policy choice, is not cast in stone. If a carbon price is put in place, coal producers will lose; coal workers deserve some compensation, but not coal companies which had decades to adjust. Earmarking, i.e. allocating specific revenues to specific expenditures, can also be useful. It is typically frowned upon by economists: Their argument is there is a single state budget, and it is important that the best use of this budget not be hampered by an ownership of some industries or citizens on parcels of public funds. This is a healthy rule, whose violation has often led to waste, for example when highway revenues were dedicated to the construction of new highways when there was no longer a need for them. While aware of the hazards associated with departing from this rule, the Commission however took a less orthodox line, and argued that in specific instances new revenues associated with a policy might be redistributed to losers from the policy or to other actions that are directly related to the policy in question. The direct link from revenues to public policies allowed by earmarking makes the compensation more visible and the losers more

[1] See Conseil des prélèvements obligatoires (2019). *La fiscalité environnementale au défi de l'urgence climatique*, which discusses the difficulty in identifying losers, and (with respect to compensation) recommends (1) making the carbon component an autonomous and visible tax instrument by distinguishing it from, or even dissociating it from, energy taxation; (2) introducing compensation mechanisms for the most affected households, particularly low-income households, in order to promote acceptance of carbon taxation; and (3) ensuring transparency in the use of carbon tax revenues.

confident that the compensation policy will last; similarly, citizens may be more willing to accept a tax if they know that the tax is allocated to a cause they support. This idea can be found in the climate change and inequality chapters, and of course in the demography chapter, as pension-related social security contributions are already earmarked to the payment of pension benefits.

Finally, successful reforms need not only expertise and popular support, but careful implementation. Implementation is as important as the original policy idea itself. Good ideas lose value when implemented poorly. Indeed, they are like medecines and antibiotics. Without diagnostics and an instruction manual, they can do as much damage as good. Beyond just being incompletely realized, well-intended policies can be abused and end up being counterproductive. Policymakers, however well-meaning, do not have time to think about actual implementation. They delegate and do not monitor what becomes of their reform/policy, hence the need for detailed diagnostic tests and instruction manuals.

The efficiency of the French state and the quality of public services, the "elephant in the room", was beyond our mandate but is very relevant here. Public policies will have an impact only if we stop measuring their potency by the amount of money spent on them instead of evaluating their actual impact. An example is supplied by our educational system, which receives much emphasis in the inequality chapter; despite a substantial increase in teaching positions over the last decade, the ranking of French pupils in PISA (Programme for International Student Assessment) and other assessments keeps falling. The chapter emphasizes the need for systematic impact measurement and sunset clauses; the necessity of providing the private sector with proper incentives; the need for streamlining policies and making agencies more agile and more integrated with each other, for creating one-stop windows so as to avoid wasting citizens' and corporations' energy on administrative procedures (an example among many: France has over 60 different windows for R&D subsidies) and to increase the low take-up rate of some policies; the necessity of resisting the French passion for exemptions and loopholes; the benefits of decentralization and experimentation, provided local actors are accountable for their policies. Moving away from the expenditure side of public finances, a similar imperative applies to the revenue side: France should tax better, not more. Compulsory levies (*prélèvements obligatoires*) take 46% of GDP[1] (Gross Domestic Product) and public expenditures represent 56%, the highest levels in the developed world. The inheritance tax, with its high rates but its loopholes and low yield, is an example in point and is discussed in the part on inequality. While in the end the size of the state is a societal choice, it is not hard to agree that taxes should be smart, and that France is not always a role model in that dimension.

[1] 46.2% in 2017 according to the OECD; the average for the OECD is 34.1%. Comparisons of course are difficult as the services covered by the state are not the same.

To conclude, this is how our commission saw its role: bringing expertise, assessing what is known and what is unknown about each of the three challenges; proposing holistic reforms, which take into account potential winners and losers; giving directions about how best to implement them. Our report is optimistic: we believe that solutions to all three challenges exist, and we hope that our commission will help their design.

SECTION 1

CLIMATE CHANGE

Underlying Chapter One written by Christian Gollier and Mar Reguant

Climate change poses an existential threat. It will generate tremendous economic costs, jeopardize ecosystems and biodiversity, bring about social unrest, provoke wide scale migration, and create a resentment from poor and middle-income countries that might trigger wars or other forms of conflict.

We have little time left to act. Despite the sense of urgency, there is still a sharp contrast between the officials' voluntarist political discourse and long-term pledges, and their actual behavior. Almost thirty years after the Rio summit, emissions continue to grow; and public and private R&D on green technologies represents only 4% of total world R&D, chicken feed in view of the stakes. The sizeable and costly transformation of our economies that is required to achieve the Paris agreement (Conference of the Parties/COP 21) targets or the more recent "zero-net-emissions by 2050 or 2060" pledges of some major polluting countries still needs to happen.[1] The longer we wait, the more costly and disorganized the transition will be. In France, the National Low-Carbon Strategy (SNBC), France's roadmap

[1] Changing our agriculture and consumption, phasing out fossil fuel energies for our mobility (cars, trucks, airplanes), industries and living spaces, retrofitting poorly insulated buildings and using smart meters with time varying prices to rationalize our energy consumption for a given comfort level, redefining urban planning and land use with a green mindset, preparing for the electrification of the economy, and spending much more on green R&D.

for combating climate change, defines a greenhouse gas emissions reduction trajectory, broken down into sectoral carbon budgets until 2033. These budgets are not binding: they are indicative, and are re-evaluated on the basis of realized overruns.

Fortunately, there is good news too: Despite the relatively low amount of money spent on R&D, some technologies, such as solar, wind power and electricity storage,[1] LED lighting, electric vehicles or alternative proteins have been progressing faster than expected. Furthermore, many companies realize that their fossil-fuel-based assets may end up stranded, and the innovativeness of the private sector has been unleashed. Some key technologies will come up when more money is devoted to green technologies and the private sector's incentives to turn green are reinforced by, for example, clear carbon price signals around the globe.

Another good news is that the environmental awareness has progressed in the polity; over 90% of the French population believe that global warming is man-made and that we can do something about it. The challenge for this commission and for similar endeavors is therefore to find ways that will put an end to the disconnect between speeches and behavior, to make costly actions politically acceptable while making sure that the cost of these actions remains as low as necessary.

We believe that, despite the grim situation, solutions exist, that combine multiple approaches. Provided that they are implemented rapidly, they will allow us to address climate change at an economic and societal cost that is small compared with the alternative. But, and this is another message of this report, we must be selective. When it comes to proposals for green policies, there is an embarrassment of riches. Our report takes a stance as to what we believe will be impactful, stresses good ideas and screens out bad ones.

In a nutshell, we argue that:

- Carbon pricing is good economics. We describe what France and the EU are doing in the matter and how it can be made much better, with a fair number of details and analysis.
- R&D support is good economics. Low carbon prices not only encourage current emissions, but also are detrimental to the R&D effort. But, even if carbon prices are generalized and given more substance, green R&D is still likely to be smaller than needed. Much more money must be spent on green R&D than is now the case. This money must be spent right if we want it to have an impact; we explain how to do so.

[1] Electricity storage, the very desirable complement to these intermittent productions, includes batteries, but also pumped hydro, compressed air, and green hydrogen produced either by electrolysis or by natural gas reforming plus carbon capture and storage (blue hydrogen).

- Done well, other policies, such as standards, bans and targeted subsidies, can be good economics. But they have often been incoherent in the past and their implementation is delicate. Again, there are ways to do them better, which we review.
- Domestic and international compensation is key to the acceptability of efficient policies.
- When viewed in isolation, France's emissions will not materially alter the course of climate change. Yet France and the European Union can show the way ahead. They can provide leadership / momentum on global agreements and on the need to fund climate change policies in developing countries. The rationale for keeping the rest of the world in sight when thinking about French and European policy is that every ton of CO_2 emissions cuts that take place in China, India, Russia, Pakistan, the United States, and elsewhere, deliver the same benefits to France as a similar cut in emissions in our country.

1. Facts and Perceptions

Despite the general support for policies to fight global warming, a number of perceptions hamper the design of policies that deliver the most reductions in emissions per cost to society. These perceptions, driven by experience with actual policies, disregard for budget constraints, and distrust for market mechanisms must be addressed when designing public policies.

1.1. An unpopular carbon tax

The first observation is the unpopularity of carbon taxation as illustrated by the *Gilets jaunes'* demonstrations (Yellow Vests) against the carbon tax and the absence of mention of carbon pricing in the Convention citoyenne pour le climat (CCC)'s final recommendations. People feel that (a) a carbon tax is "punitive" (so are many alternative policies, as we will see), (b) it is regressive (which is correct: the fraction of income spent on the tax is higher for low-income households), and (c) this would be so even if the French received an unconditional lump-sum refund from the receipts of the carbon tax (which is incorrect). The latter perception may be due to a distrust about the long-term credibility of the compensation: The compensation, once promised, can be whittled down or eliminated over time. If so, institutions must be designed, that will minimize the risk.

1.2. The relative popularity of opaque policies

In contrast, people favor, or at least do not ostensibly oppose policies whose cost is invisible to them. Yet, these policies in nature are as "punitive" as much or even more than a carbon tax.

Let's start with a second way to put a price on carbon emissions and thus make economic actors accountable for their pollution: the cap-and-trade system. Since 2005, Europe has levied a form of carbon tax through the subjection of electricity, aluminum, cement and other companies that represent around 40% of the EU's greenhouse gas emissions, to the European Union's Emissions Trading System (EU-ETS, also called "cap-and-trade" system). In an ETS, the number of allowances, also called "permits", is fixed (the lower the number, the higher the environmental ambition). The emitters must match their emissions with allowances. The market for allowances determines a price through the matching of supply – the number of allowances – and demand – the emissions whose abatement cost exceeds the price of an allowance.

There are 46 cap-and-trade systems for CO_2 emissions on the five continents, from California to China and the European one. No doubt, many still lack ambition and admit too many allowances relative to stated environmental ambitions. Because they force polluters to own an amount of allowances in accordance with their emissions, they are formally a tax on (dirty) production rather than on final consumption. However, because the producers by and large pass the allowance price through to consumers[1], the latter pay for the increase in the production cost. For certain, the price in the EU-ETS – €25 for the emission of one ton of CO_2 in 2020, €50 in May 2021 – has lied below the €55 of the carbon tax that brought the *Gilets jaunes* to the streets; but the fact that this levy on consumers occurs at the production stage has left it largely unnoticed by the citizens.

The next example makes the same observation, with a vengeance. Subsidies to green energies (wind, solar) are popular. In practice, the cost of renewable energy purchase obligations at some pre-specified price ("feed-in tariff") imposed by the regulator on our power supplier is embodied in our electricity bill. Customers' bills include a "contribution to the public electricity service", covering both the additional cost of electricity production in Corsica and overseas and the public subsidies to renewable energies. Again, however, while the levy is formally on producers, it is passed through to consumers, who hardly see it.[2]

Such policies (whether they are justified or not, we focus here on perceptions) would probably be less popular if two facts were rooted in our minds.

First, someone's subsidy is always somebody else's tax, as illustrated by feed-in tariffs (the price at which electricity companies must purchase renewable energy produced externally); in that example it is a tax on electricity consumers. Furthermore, subsidies need not have a nice distributional impact either: In the United States, the subsidies for

[1] The extent of the pass-through to consumers depends on how competitive the industry is (full pass-through obtains if the industry is competitive).

[2] In 2021, the cost of the feed-in tariffs for renewables energies in France will be €6.4 billion, which is also the revenue from the carbon tax.

rooftop photovoltaic (PV) power station, including net metering, burden lower income groups.[1] In France, the regressivity of the renewables policy is equivalent to that of the carbon tax, without the possibility of using a carbon dividend to compensate the poor.

Second, the environmental performance of the policies could have been better. The cost for electricity users of economizing one ton of CO_2 reached €1,000 and beyond for early generations of renewables ten years ago, 20 times the €55 per ton of CO_2 removed that brought our country to the streets in 2019 and about 50 to 100 times the EU-ETS price during that period. Put differently, at the time, France, Germany and other countries may have chosen to buy 1 ton of climate protection when it would have been possible to have 50 tons of CO_2 removed for the same amount of money (of course, this reasoning ignores the fact that mandated renewable purchases contributed to the fall of wind and solar costs: tax incentives and various green mandates helped the private sector to push wind and solar down the innovation/learning curves.[2] To take another angle at it, the same learning could have been achieved with solar capacities installed in Southern Spain rather than in Germany, with a greater environmental impact for the money spent).

Similarly, there has been little backlash against the high subsidies for insulation and boiler installation in France. Well-meaning, this policy has attracted some unscrupulous types driven by the opportunity for short-term profits, led to dissipative commercial efforts (e.g., the phones calls for the "€1 insulation"), and interestingly done little to reduce global warming, as they provide suppliers with a generous supply of energy savings certificates ("white certificates") that are unrelated to actual savings and can be used to satisfy energy savings obligations faced by energy utilities.[3]

Two other cases in point are green standards and laws banning some technologies (e.g. phasing out thermal-engine cars) by a certain date. Both impose extra costs, either on consumers directly or on manufacturers, who pass them through to consumers;[4]

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[1] More broadly, Borenstein and Davis (2016) found that 60% of the income tax credits for weatherizing their homes, installing solar panels, buying hybrid and electric vehicles, and other clean energy investments were received by the income top quintile. See Borenstein S. and Davis L. W. (2016), « The distributional effects of US clean energy tax credits », *Tax Policy and the Economy*, Vol. 30 (1), NBER.

[2] As we later discuss, there is a complex debate about the counterfactual: How much did purchases contribute to renewables' cost reduction? This debate pits those who argue that microprocessors have followed Moore's law despite the absence of subsidy and those who say that pump priming was necessary because technological spillovers prevented early losses from being recovered later on through a competitive advantage. We return to learning by doing later on.

[3] See Glachant, M., Kahn, V., and F. Lévêque (2020), "Quand les économies d'énergie deviennent fictives", *Les Échos*, December 21. See also Crampes, C. and T.O. Léautier (2021), "White Certificates and Competition", *Concurrences*, No. 2021-01, February.

[4] Sometimes the cost of bans is directly incurred by consumers (as opposed to indirectly through a cost pass-through by the manufacturer). The cost of a ban on airline travel when there exists a train alternative taking

furthermore, they can be ill-designed and fail to reach their objective;[1] finally, they can be regressive as well (fuel-efficiency standards cost more as a fraction of income to low-income households).[2] Yet few have ever demonstrated against a ban (with delayed effect) or a standard.

To be clear, our claim here is not that these opaque policies are necessarily inefficient, but rather that perceptions are often more driven by appearances than by reality: the visibility of the levy to the payers (consumers or the taxpayers) often shapes attitudes much more than the actual amount of money levied upon them to avoid the emission of one ton of CO_2. To function well, a democracy must provide its citizens with sufficient information about the relevant trade-offs. The political costs of going against public opinion are real, but allowing these costs to exert undue influence in policy will lead to unnecessarily large climate damages for France and the rest of the world or unnecessary expenses of private or public money to deliver limited progress.

1.3. Motivated beliefs

Social scientists have documented that people hold certain beliefs in part because they attach value to them, resulting in a trade-off between accuracy and desirability. Such beliefs accordingly have been shown to be resistant to many forms of scientific evidence. Motivated beliefs are understandable in that they make for a nicer life (think about savoring a holiday in advance or repressing thoughts about a protracted lockdown or the possibility of death or illness of our loved ones). Relevant for our context, all of us want to believe in a prosperous future.

Spending vast amounts of money in the next thirty years on fighting climate change is not an exciting project. Promising “blood, sweat and tears” is a non-starter in climate politics (maybe because citizens still underestimate the size and ubiquity of the transformation that is required), and it is no wonder that following the Paris COP 21 no chief of state returning home announced that their compatriots would roll up their sleeves. Occasionally, the

less than some number of hours include the value of time lost by users. The cost of a ban on home heating systems using fossil fuel energy includes the cost of building alternative equipment (say a heat pump).

[1] In the United States, cars and trucks became less fuel efficient last year, because the regulation treats cars differently than light trucks/SUVs and preferences have been moving toward SUVs/light trucks (SUVs and trucks accounted for almost 76% in 2020, while they were only 49% of sales in 2012). The regulatory design flaws can be fixed: see Greenstone, M., Sunstein, C. and S. Ori (2020), “Fuel Economy 2.0”, *Harvard Environmental Law Review* 44, No. 1, May, pp. 1-42. Similar remarks can be made with the French system of a bonus-malus on cars. By failing to reward non-owners, it encouraged the latter to buy small cars, made cheaper by a bonus! These observations point at the importance of a proper policy design, not at an overall undesirability of fuel-efficiency standards.

[2] They also have had unintended effects: fuel economy standards have not yielded the promised reductions in emissions because people have switched to SUVs from cars.

soothing concept of "green growth" is even invoked to argue that we can have our cake and eat it too; but if this were true, why haven't we done it in the last 30 years?

The same observation applies to the "green-jobs" argument, also meant to soothe public opinion. Officials and the industry often flaunt the merits of green policies in terms of job creation. In the absence of careful investigation, the argument does not really hold water. Its validity hinges on the answers to the following questions: Are more jobs created with the money spent on green actions than on alternative uses such as healthcare or education that compete for scarce public resources?[1] Can displaced workers fill geographically and educationally the new jobs (a coal miner may not easily become a wind generator technician)? Did we consider the equilibrium effects in the respective labor markets affected with subsidies (to take a topical example, a sharp and rapid increase in the subsidies for the retrofitting of buildings would translate into higher prices for retrofitting rather than in more jobs, if there were no anticipation in the job training and certification process, thus a waste of public funds), or those associated with the funding of the policies (the taxes that enable the subsidies may make some other industries less competitive and thereby destroy jobs)?

The reluctance to say that the planet is worth enough to justify a cost has serious consequences. The problem with this political discourse is that it comforts citizens in their views that painless solutions are available. This Chapter One notes that almost 90% of French citizens feel that the middle-class should not have to pay anything to fight climate change. This may have two interpretations. The first is that "the rich will pay", an opinion which is also relevant to the other chapters in the report. The rich can indeed pay more but their potential contribution is nowhere close to what is needed to fight global warming or reduce inequality.[2] The second is that people feel that there is indeed no need for anybody to pay. Both interpretations are probably relevant and equally problematic.

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[1] Some studies attempt to come up with an answer. Chapter 3 of the *2020 IMF World Economic Outlook* and the International Energy Agency in their *Special Report on Sustainable Recovery* (June 2020) look at the impact of making the economy greener on jobs. There might be a small positive effects on the number of jobs.

[2] Consider some back of the envelope calculations. The top 10% receive a 30% share of income. If France increased its tax rate (broadly construed, to include social security contributions, special levies such as CSG) to tax 10% more of their income, this would yield 3% of GDP more. A similar computation can be performed for the 1%, who receive 10% of income. These numbers are highly optimistic, as many top earners (entrepreneurs, engineers, specialist physicians, academic, finance and law top earners, wealth owners, etc.) are internationally mobile. Even if they stayed, they might also engage in tax avoidance. On the other side – demand for contributions –, the climate effort by itself is estimated at 1% to 2% of GDP in the chapter. Some argue for higher numbers: 4.5% in Germain, J.M. and T. Lellouch (2020), "The social cost of global warming and sustainability indicators: Lessons from an application to France", *Economics and Statistics* 517-518-519, pp. 81-102. There is a lot of uncertainty about such numbers, but it is clear that the effort is significant. Take the pension system: Benefit payments represent 13.6% of GDP. The current demographic dependency ratio is 33%, forecast to increase to 45%, a percentage increase of 36%. Suppose that we do not change the age of retirement, so that the system dependency ratio also increases by the same percentage, and also that the pension benefits over wages remains the same. This would lead to an increase in benefit payments to 18.5%

2. A Holistic Approach

Faced with the urgency of addressing the existential threat of climate change and the political challenges of crafting policies to do so effectively and expeditiously, Chapter One suggests a five-leg, holistic approach: leg 1: carbon pricing; leg 2: an intense R&D effort; leg 3: other actions: leg 4: compensation: and leg 5: international juicing. While commission members agreed on the five legs, some thought more emphasis should be put on legs 3 and 5. Some however were more skeptical. We shall indicate where disagreements arose.

2.1. Leg 1 – Carbon pricing

The conclusion of the commission as well as most experts outside it (see the chapter) is that one cannot do without a sizeable carbon price, despite its unpopularity. Carbon pricing applies the polluter-pay principle contained in the *Charte de l'environnement* attached to the French constitution. Pricing has been shown to substantially alter behavior both for other pollutants as well as for carbon emissions. For example, the United Kingdom has substantially reduced its CO_2 emissions from the electricity sector almost overnight by imposing a mild carbon tax that led to the phasing out of coal production: its coal production fell from 40% to 5% of its electricity generation between 2013 and 2018 (2% in the first half of 2020). The main[1] reason for this drastic change is that the United Kingdom adopted a carbon price floor (around €21 per ton of CO_2) in 2013 on top of the EU-ETS price (which remained under €10 between 2013 and 2018); it is estimated that a carbon price around €35 to €40 per ton suffices to induce a switch from coal to gas, which pollutes half as much. The impact of the Swedish carbon tax, introduced in 1991 and equal to €114 in 2021, has been meaningful as well.[2]

We may dream of a society in which such evolutions would take place spontaneously without need for material incentives (another illustration of motivated beliefs), but history teaches us otherwise: time and again, we have seen that hitting economic decision-makers

of GDP, a 4.9% of GDP increase, again far beyond what the "rich can pay". Substantial reductions in inequality, for example a more generous *prime d'activité*, also lead to very large numbers. And that only focuses on our three challenges. If ambitious policies regarding education and healthcare were undertaken for example, more income would still have to be found. The numbers just do not match.

[1] The carbon price was not the sole instrument. The United Kingdom also pushed wind into the system through government sponsored auctions, which created excess capacity, lower prices, and made coal uneconomical.

[2] The Swedish carbon tax applies to both consumers and businesses. When it was launched in 1991, the tax was €24 for consumers and €6 for companies. For fear of offshoring or unfair import competition, a lower tax rate was applied to industry (namely to sectors outside the EU Emissions Trading Scheme, the EU ETS: to avoid double taxation, sectors covered by the scheme are fully exempted from the carbon tax). From 2018 onwards, however, the carbon tax for sectors outside the EU-ETS is the same as the carbon tax applied to consumers, currently €114.

where it really hurts, namely in their wallets, changes their behavior and unleashes innovations that can solve challenging problems.

A carbon price has at least four virtues:

- It encourages those who can eliminate their pollution at a relatively low cost to do so.
- It boosts green innovation. By monetizing the intellectual property associated with green R&D, it allows start-ups to receive finance from private investors and to reach the necessary scale.
- It requires measuring emissions (which is not always straightforward), but no other information. It therefore reduces bureaucratic red tape and discretion relative to other methods of reducing pollution.
- Finally, it is simple, in that it empowers consumers to act for the climate as the price they pay for a product captures the cost of all emissions along the value chain (they otherwise need detailed information if they want to make an informed choice: see section 3).

The approach for setting a carbon price is detailed in the chapter: scientists and governments have set a "carbon budget", the amount that we can still emit to stay within the bounds allowed by the COP 21 objectives. The Intergovernmental Panel on Climate Change (IPCC) calculates that to keep global warming below 1.5°C, no more than roughly 700 billion tons of CO_2 (up to an uncertainty range) should be emitted looking ahead. In the absence of uncertainty, this carbon budget can be easily achieved by mirroring the carbon budget for Europe[1] in the volume of allowances in the EU-ETS system. The carbon price then results from market clearing: those who find it too costly to reduce their pollution can purchase an allowance from those who hold unused allowances.[2] This "quantity setting" approach will ensure that the objectives are met: There is no more pollution than planned to meet the COP 21 target.

[1] There is no formal carbon budget for Europe, which has selected a specific emission pathway (-55% by 2030 and zero-net-emission by 2050). We stick to this political decision in this report. Notice however that this pathway may not be compatible with intertemporal optimization under a carbon budget for Europe, as it is likely to lead to too little effort in the short-term, i.e., a too low a shadow price of carbon in the next 10 years. See Gollier, C. et al. (2020), "The cost-efficiency carbon pricing puzzle," *TSE Working Paper*, n° 18-952, Toulouse School of Economics.

[2] In practice there are a couple of reasons why some players may hold unused allowances: Firms invest in allowances years in advance of their actual use to hedge against their allowance-price risk (allowances are issued long in advance – 30 years in the case of SO_2 in the United States – and are bankable); they may also have received free allowances as part of a grandfathering scheme (high polluters – firms or countries – receive some allowances as partial compensation). If their production becomes greener than they had anticipated, they resell those tradable allowances. Similarly, market-makers (financial actors who obviously do not have a need for allowance) may hold allowances temporarily.

In practice, though, there is substantial uncertainty, about the speed of global warming, about the advent and cost of green technologies, and, last but not least, about the political willingness to handle climate change. The uncertainty implies that the carbon budget will need to be revised over time as news accrue, with consequences for carbon prices. This unfortunately creates uncertainty for firms, households, and inventors: it is hard for them to fathom how the current carbon budget will translate into future carbon prices and therefore to plan their investments. A power producer builds a plant for 30 or 50 years, a consumer buys an electric car that will last 15 years, inventors' innovations will materialize 10 years down the road, and urban planners and builders take decisions whose effects are even more long-lasting. The financial stakes attached to such decisions hinge not so much on today's carbon price, but rather on the carbon prices that will prevail in the future.

This Chapter One calls for "forward guidance".

- One way to inform private investment decisions about future carbon prices is to set a floor and a cap for the price of carbon emissions, enabling some price stabilization. When, due to an abundance of allowances relative to the demand for them, the price hits the floor, the quantity of allowances offered is reduced (authorities purchase allowances at the floor price), leading to a faster decrease in CO_2 emissions.[1] When the price reaches the ceiling, extra allowances are sold at the price cap, the quantity of allowances offered is increased, leading to a slower decrease in CO_2 emissions. In particular, Chapter One recommends a price floor that starts around €60/tCO_2 in 2021 and grows at a rate of 4% or 5% per year (so around €190-€250/tCO_2 in 2050).
- Another approach discussed in the chapter is the creation of an independent carbon board (labelled "Carbon Central Bank") in charge of adjustments, so as to take such adjustments out of the political lobbying and electioneering process and thereby confer credibility on the policy in the same way independent central banks have kept inflation under control.
- Yet another approach to securing commitment to a strong environmental effort while allowing for some flexibility is to create some skin in the game for governments to abide by their commitment. This can be achieved through the issuance by the governments of securities that would compensate allowance holders if the future price of carbon fell relative to the preannounced path.[2] That would make it costly for governments to increase the number of allowances in the future; presumably, they would do so only in

[1] The UK system works differently: it adds a top-up tax to the market determined price.

[2] In the jargon of finance, such securities are called "put options". For details, see Laffont, J.J. and J. Tirole (1996), "Pollution permits and compliance strategies," *Journal of Public Economics*, 62, No. 1-2, October, pp. 85-125.

case of unexpectedly good news about technological progress, in which case the increase in allowances would not necessarily reflect a reduction in the climate ambition.

To reach its full potential, carbon pricing must be universal. For fairness as well as for efficiency, the carbon tax that we propose must apply to all polluters without exception, unlike the current French carbon tax. This ubiquity requirement also requires avoiding "leakage", the migration of economic activities abroad to enjoy lower costs in countries that practice environmental dumping. We later discuss border tax adjustments that are meant to prevent this leakage.

Even if it is transparent, credible, and universal, carbon pricing is not a panacea. A carbon price is necessary, but not sufficient to achieve the goals of the Paris accord. Furthermore, while its scope can be enlarged compared with its current perimeter, some environmentally friendly projects are not easily amenable to this approach. We will come back to this in leg 3.

2.2. Leg 2 – An intense R&D effort

The ecological catastrophe will not be avoided without a substantial stepping up to the R&D challenge either. There is too little green R&D investment, but the causes are not to be found in a shortage of loanable funds: in the current low-interest-rates environment, there is a lot of money looking for investment opportunities. Rather, it is the insufficient profitability of green R&D that limits current investments. Innovation is critical because it improves the trade-off between damages from the climate and damages to the economy. This current dilemma weighs heavily in particular for Sub-Saharan Africa, Pakistan, India, and even China. If these countries found it more attractive to choose low-carbon technologies, they would deliver benefits to France by reducing global emissions far more than what France can generate itself.

The general R&D subsidies that are meant to compensate innovators in all industries for the partial appropriation of the fruits of their R&D efforts (that is, for the existence of technological spillovers to competing firms) will not suffice, for multiple reasons.

First, even if carbon prices are generalized and given more substance, political constraints are likely to keep them smaller than needed. With low carbon prices, it costs technology users too little to pollute and so they will not be willing to pay much royalties for access to green technologies. The very low carbon prices of the past and the absence of mention of carbon pricing in a number of official documents have created expectations of at best moderate carbon prices in the future and thereby disincentivized green R&D.

Second, and independently of too low carbon pricing, some of the most important green R&D programs involve unlocking the breakthrough technologies that will in the long run enable us to achieve zero or negative emissions. While the pharmaceutical industry shows

that the private sector may take long horizons in their R&D decisions, it is still the case that the public sector plays a fundamental role in supplying the required fundamental research.[1]

Considering this, R&D can be stepped up in two ways. The first is to set achievable technological goals for the private sector. Experience – not least with the recent Covid-19 vaccine – has shown that, when pushed, the private sector may do wonders: multiple vaccines were developed at yet-unseen speed and for some with yet-untested approaches.[2] The second is to create an "EU-ARPA-E", a European equivalent to the American green technology funding institution; this agency will finance high-risk, high-payoff research by the private and public sectors in Europe to unlock the key challenges for green technologies. The governance of this agency must be exemplary. More on this below.

Before concluding this section, the recent report by RTE and the IEA on the conditions necessary for exclusively-renewable electricity production reminds us that the outcomes of R&D efforts are by nature uncertain, even though they condition the feasibility of certain scenarios aimed at achieving carbon neutrality. This uncertainty should obviously not be a pretext for procrastination, but it must be integrated by public authorities in their strategy and in the sequencing of their actions. We must show humility and avoid putting all our eggs in the same basket.

2.3. Leg 3 – Complementary actions

We mentioned that in some domains the carbon price instrument is less perfect than we would wish. The first issue, already mentioned, is that the carbon price may, for political reasons, be lower than needed.

A second issue is measurability of emissions. Not necessarily because of the large number of economic actors: fossil-fuel products used in mobility and heating can be made subject to the overall EU-ETS system; taxes can thereby be collected early in the value chain and not from each household, firm or administration, as is currently the case for electric power and the cement and steel industries. Methane emissions from cattle breeding could be

[1] One can further make the case that because technologies build on the shoulders of previous generations and green energies have a longer horizon than fossil fuel ones, even if the latter are made cleaner through innovations such as carbon capture and storage, overall spillovers are larger for clean energy research, motivating higher subsidies than for alternative R&D tracks.

[2] Analyses of the impact of the Covid-19 vaccine procurement process are still awaited. Public procurement was also meant to preempt other countries on the supplies and not only for speeding up the advancement of technology (indeed the lack of international cooperation, except for the COVAX coalition, suggests that preemption was a major goal, even though no-one will ever say so). Also, we have little information about the counterfactual; the market for a vaccine was huge and we would expect a sizeable R&D effort even in the absence of public procurement.

taxed at the level of the slaughterhouse. Forestry contributions to global warming (admittedly less important in the EU, which has relatively less forest) or carbon storage from specific agricultural practices by contrast are harder to measure than a power plant's carbon emissions or the volume of gasoline produced by a refinery.

A third issue is that some infrastructures (say, for electric vehicles or applications of hydrogen) must be standardized so that competing producers can serve the market.[1] The polluter-payer principle ensures that economic actors are made accountable for their emissions, but no price guarantees that rival green companies will converge on a single standard, another market failure. The state may help with this standardization; it should be as neutral as possible as regards the choice of technologies, but it cannot be entirely neutral.

A fourth issue is that as a rule, incentives provided by carbon pricing work better for companies (power plants, cement, aluminum, or airline companies say) than for households. For the latter, a carbon price still works well to guide *current* consumption: applied to air travel, beef consumption,[2] gasoline and fossil-fuel-generated electricity, it leads consumers to substitute the train for the airplane, eat less beef, increase car-sharing and telecommuting, and use less air-conditioning. Carbon pricing may function less well when consumers invest for the long run. Three reasons for this:

- First, households are poorly informed about the future costs and benefits of their green actions. A case in point is energy retrofitting, especially in France where, unlike in Germany, consumers do not receive efficient advice[3] and subsidies are not based on realized energy savings. For carbon pricing to have the intended incentive effects, households must be properly advised regarding their private cost-benefit analysis.

- Second, those who decide are not always those who will pay the bill. Despite the energy performance certificates, tenants and landlords do not always agree on energy savings. In theory, landlords have the right incentives to invest in the energy renovation of their buildings and apartments if successive tenants are well informed about the quality of these investments (to which the energy performance certificate contributes), if they pay

[1] E.g., the recharging infrastructure for electric vehicles: charging connectors, vehicle charger vs. external charger and AC vs. DC connection, voltage…

[2] Their measurement is imperfect. An imperfect proxy for methane emissions might be the weight of the animal.

[3] And they should be wary of advice from the industry. Thermal insulation has had disappointing impact (see the next footnote). Households face both moral hazard (insulation suppliers can cut on the quality of material and work) and adverse selection (performance insulation benefits depend on many parameters; consumers further face a lemons market as they cannot evaluate the competence and honesty of professionals). See Ambec, S. and C. Crampes (2020), "Energy efficiency in buildings: From theory to practice," WP Toulouse School of Economics, February.

their electricity bills, and if the rent can be adjusted to reflect the lower energy consumption by the tenants. If these three conditions are not met, landlords will not make enough effort to improve energy performance. In practice, a few studies confirm that thermal renovation efforts are more sustained when landlords reside in the dwelling. Asymmetry of information problems can also slow down owners' eagerness to renovate if they are concerned about the impact of renovation investments on the value of their renovated property on the housing market in the event of a sale. Finally, there are coordination issues in condominium structures.

- Third, empirical evidence shows that households may underinvest in the quality of durable goods, either because of liquidity constraints or because of a present bias. This may well apply to energy efficiency choices, although a variety of government-sponsored zero-interest loans are often available to illiquid households.

These arguments call for complements to carbon pricing, such as bans and more generally standards. Examples of bans under consideration or already promulgated include the banning of single-use plastic bags and the prohibition on further sales or registration of new vehicles powered with specific fuels by a certain date or the definition of low-emissions zone not accessible by fossil-fuel cars. An international illustration of a standard in the environmental realm is the successful 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, which set targets for countries and burden sharing.

Such policies are easier to put in place when combined with leg 2, innovation. A case in point is the change in lighting, which came from a combination of regulation (banning of the incandescent light bulbs in the late 2000’s and early 2010’s) and research and development on alternatives (LED, from the theory in the early twentieth century to the breakthrough on blue LED in the 1990s). Similarly, banning new sales or restricting the use of the combustion engine cars in “low-emissions zones” will be made simpler once the cost of electric cars has fallen and their range improved, which is in sight. Bans and standards may also trigger innovation and learning by doing by presenting the industry with a challenge.

Chapter One favors such complementary measures but warns against treading into such interventions without ballpark numbers about their efficacy. To take a foreign example, it is known that rooftop photovoltaic panels (PV) are much more costly than state-of-the-art large scale grid-based PV in Southern California, Arizona, Texas, etc. Why should the US government subsidize rooftop PV with direct subsidies and net metering subsidies? If we are trying to meet a decarbonization goal, it is better to subsidize grid-based PV, or take the money and put it into R&D for hydrogen or long-term storage. Retrofitting, a very

popular policy, is another case in point; the evidence shows that the price per ton of CO_2 removed can be very high except for the really poorly insulated buildings.[1]

Ideally, the impact of such policies should be assessed whenever possible.[2] This is needed to ensure that the implicit carbon price justifying the policy not be totally out of line with the carbon price levied elsewhere. Put less technically, a standard, a ban or a subsidy that leads to spending €1,000 of consumer or taxpayer money to economize one ton of CO_2 is not a green policy: under a carbon price of €50, say, the same amount of money would have removed 20 tons instead of a single one. Subject to this caveat that bans, standards and subsidies must be cost-reasonable and the overall policy coherent (they must be "tested" by calculating a ballpark estimate of the implicit cost per ton removed), we think that these instruments can indeed be part of an optimal package. And they are a bigger part of the package, the smaller the actual carbon price.

In this context, the Convention citoyenne pour le climat (CCC) makes a number of good recommendations, some of which are listed in Chapter One. They tend to be biased however toward subsidies and bans. As we argued, a subsidy is always a tax as it needs to be financed, and bans can be costly in an invisible way. The climate urgency motivates both a sacrifice, and picking our fights so as to make the most from this sacrifice. To keep the impact on the people's purchasing power reasonable, Chapter One recommends performing a cost-benefit analysis and applies such a preliminary analysis to some CCC recommendations. The same need for evaluation applies also to renewable portfolio standards, a frequent policy around the world mandating a minimum fraction of electricity generated through wind and solar.[3] We recommend that this process be systematized, so that the debate be informed by the relevant data (in the United States, the Office of Management and Budget (OMB) and the Environmental Protection Agency (EPA) test regulations like this using a schedule of estimates of the social cost of carbon). More on this shortly.

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[1] See, e.g., Fowlie, M., Greenstone, M. and C. Wolfram (2018), "Do energy efficiency investments deliver? Evidence from the Weatherization Assistance Program", *Quarterly Journal of Economics* 133, No. 3, pp. 1597-1644. They find on a US sample of low-income households that projected savings are roughly 2.5 times the actual savings. Blaise and Glachant (2019) on French data ("Quel est l'impact des travaux de rénovation énergétique des logements sur la consommation d'énergie ? Une évaluation *ex post* sur données de panel," *La Revue de l'Énergie*, 646, September-October, pp. 46-60) find an even worse ratio, at almost 8 times the actual savings.

[2] Also, one should not undertake such policies in sectors where a high-enough carbon price prevails already, as they would duplicate carbon pricing.

[3] The methodology for estimating properly the impact must be as state-of-the-art as possible. See e.g., Greenstone, M. and I. Nath (2020), "Do renewable portfolio standards deliver cost-effective carbon abatement?" *BFI Working Paper*, No. 2019-62, Becker Friedman Institute, November. They find that the US renewable portfolio standards have had a substantial impact on CO_2 emissions, and that the cost per ton of CO_2 abatement ranges from $58-$298 and is generally above $100.

25% of global greenhouse gas emissions come from agriculture and 16% of global emissions come from methane, a potent greenhouse gas. Incentives must be designed to halt deforestation and land degradation, and the promotion of land carbon sinks. To this purpose, we must improve remote sensing technologies so we can actually measure the actual impact of private efforts. Sustainable, diversified agriculture, precision cultivation and vertical farming are examples of policies that help reduce our emissions. Agriculture, which is a major source of pollution,[1] needs more focus by policymakers.

Ambitious city planning and public transportation schemes are also called for. Cities, land use and transportation systems (including park-and-ride facilities) must be designed or re-designed; the greening of cities strategy may also bring "co-benefits" such as better health and a reduced exposure to heat waves. These environmental policies will require complementary policies. They will raise further the land rent enjoyed by owners of city-center property, especially as localities vote against densification (which is unpopular with owners, who want to preserve and increase their rent). The increase in property prices brought about by green policies (ban of polluting cars, suppression of parking spaces…) must be captured by the community, possibly through some capital gain tax; in France such collective appropriation of the gains associated with public investment failed to take place for TGVs or urban renewal programs.

Housing policy, beyond the standard economic issues (actual incidence of housing subsidies, reallocation of social housing to those who need it most, liquidity of the rental market, etc.) has an obvious link with the fight against global warming. We have already mentioned energy renovation and the usefulness of supporting households (especially low-income ones) in their renovations through effective advice, subsidies conditional on verified energy performance, and an increase in the skills of craftsmen in the sector. These policies make it possible to reduce the energy consumption of buildings and to encourage the use of existing buildings rather than the construction of new ones. The densification of cities, despite the resistance of owners anxious to increase their land rents, is a necessary instrument, both to fight urban sprawl and its corollaries (heavy use of automobile commuting, artificialization of soils) and to reduce intergenerational inequality. Making the owners of brownfield sites accountable – forcing them to renovate the brownfields, to convert them to green spaces them or to sell them – can also contribute to the fight against global warming. Finally, the decrease in demand for office space due to Covid-19 and teleworking provides an opportunity to convert some offices into apartments, an opportunity that should be systematically exploited by empowering the market mechanism.

[1] Emissions of ammonia, a serious threat to health, from the agricultural sector continue to rise, posing a challenge for EU member states in meeting EU air pollution limits. More generally, a serious change in agriculture practices is necessary, but hard to impose for political reasons.

Learning by doing and public procurement

Taking as an illustration the sharp decrease in the costs of wind and solar power over the last 40 years, governments often use mandates – the requirement imposed on electricity companies to procure at least some percentage of their electricity from renewables – and other incentives for the adoption of existing green technologies in order to bring down the cost of alternative energy. The argument is that, independently of any R&D (which is promoted by R&D subsidies rather than incentives to adopt current technology), manufacturers learn by doing. They correct engineering mistakes over time, and the production cost decreases with experience. Mandates, which for example force public utilities to have a minimum fraction of renewables in their portfolios, do not focus on future generations of the technology, but rather try to unleash incremental improvements on existing technologies.

While there is no question about the existence of a virtuous circle of R&D, learning and economies of scale, researchers have found it difficult to put numbers on the relative influence of each in achieving cost reductions, even on existing technologies[1] and a fortiori looking ahead at new ones. Given this limited evidence, it is unsurprising that different assessments co-existed within the commission.

For some members of the commission, a strong push on mandates and other adoption incentives to bring the cost of existing technologies and nascent ones was imperative: "bans and standards are essential and would benefit from careful evaluation." There are two strong arguments in favor of this position. The first is the urgency, so many tools must be harnessed to make rapid progress. The second is that some of these technologies, in particular solar energy, will strongly benefit poor countries, where much of the increase in emissions, if uncontrolled, will take place.

Others members viewed "bans and standards as useful but only if evaluated carefully." They emphasized two hazards associated with mandates and other adoption incentives. The first is obvious from the previous discussion: Estimating future learning curves is difficult, and no-one wants to create an open bar that might divert public money from green actions with a much stronger impact on climate. The second issue is one of commitment: At some point the cost reductions level off, or more generally[2] mandates and subsidies are

[1] The reason for this is simple. The effects of R&D (public and private), scale economies, and learning by doing are simultaneous and inherently interdependent. For example, government R&D, subsidies, and mandates get wind turbines or photovoltaic (PV) modules into the market. Developers, equipment manufacturers, and construction companies learn how to deploy the technology, learn from their mistake, make some profit and use some of it to support their own internal R&D to make a bigger and better wind turbine or more efficient PV modules and trackers. At some point consolidated markets become more concentrated and demand increases, so remaining producers benefit from returns to scale.

[2] For instance, if wind and solar are competitive with fossil fuel technologies, it is time to stop the subsidies.

no longer needed; and yet the government often finds it hard to phase them out. It is therefore important to announce at the onset a list of criteria for the unwinding of support measures when costs come down and deployment increases. Members of the commission agreed on the nature of these arguments but differed on the weights which would be put on them.

Promoting a transparent and efficacious decision process

We conclude this discussion of complementary measures with two closely-related policy recommendations. In view of the extreme urgency to act, cost-benefit analysis should not add an excuse for procrastination – the need for a time-consuming, complex expert assessment prior to acting – to another – the pushback from lobbies.

- *Acceptance of ballpark estimates*. Cost-benefit analysis relies on assumptions concerning uncertain variables. Some of the estimates of the cost per ton of CO_2 removed are subject to considerable uncertainty. Assessing the cost of a ban on conventional internal combustion engine cars by some year requires information about the likely learning curve for batteries, the availability of rare earth elements, the efficiency of governments in imposing standards on charging stations, or the evolution of the composition of electricity generation. Much more difficult still is the evaluation of risky research alleys and uncertain learning curves. But the existence of substantial uncertainty should not be an excuse for doing nothing.

- *Proactivity of evaluations*. Cost-benefit analysis, to be useful, requires expertise and is time consuming (engineering and econometric studies, randomized control experiments…). The climate urgency makes it important, though, that the rigorous analysis required for cost-benefit analysis does not slow down public decision-making.

This suggests creating a monitoring unit that uses the best available tools to produce transparent and independent estimates – themselves updated over time as data accrue, knowledge evolves, and scientific debate provides feedback. These estimates would be used in decision-making without delaying action. Representatives and public decision-makers would have rapid access to data shedding light on the impact of their decisions, for the sake of both transparency and efficiency. Transparent calculations of the marginal cost of removing a ton of CO_2 from the atmosphere should be required for all government subsidy or mandate programs.

To be concrete, one can envisage, for example, the creation of a permanent commission, whose structure would be similar to that of the expert group on the minimum wage (SMIC) and would benefit from the technical support of an independent body; the alternative would consist in giving a much greater weight to socio-economic assessment in already existing

structures.[1] Economists, scientists and other high-level experts would regularly update their estimates of current and future carbon prices and costs per ton of CO_2 not emitted. The results obtained would guide public decision-making, from the design of calls for tenders (see below) to the evaluation of the impact of fiscal and tax policies ("green budgeting"). This commission would thus pave the way for the indispensable creation of a similar structure at the European level; in this respect, it will be necessary to ensure that the "European Climate Change Council", whose creation is planned in the European Parliament's draft European "climate law" and is intended to be composed of experienced scientists, has an important socio-economic evaluation component. In summary, while good estimates are difficult to produce, they would nevertheless make it possible to identify, for a given expenditure, promising leads in terms of environmental benefits.

2.4. Leg 4 – Compensation

Climate policies sometimes ignore the fact that they create losers. The carbon tax that inflamed the *Gilets jaunes* (Yellow Vests) was economically justified,[2] but it was initially not accompanied with measures that would have offset at least partly its impact on poorer households and rural and suburban drivers with few public transportation opportunities. For the sake of clarity:

- Not everyone can be compensated, since we argued that there must be a cost to climate change mitigation. In our intergenerational arbitrage between current costs and future damages to our planet, we must do the least harm; but the fight against climate change will not come for free. Besides, by "loser" we do not mean all economic agents who are hurt by the green transition. Workers should be compensated, not

[1] In France, there are already several bodies with jurisdiction over climate policy, including the High Council for the Climate (HCC, an independent authority), the General Council for the Environment and Sustainable Development (CGEDD), the Economic Council for Sustainable Development (CEDD), as well as several cross-functional bodies such as the General Secretariat for Investment (SGPI, responsible for implementing the Investment for the Future PIA Programs) and France Stratégie. We have no specific recommendations regarding the reorganization of these bodies. On the other hand, these structures, including the High Council for the Climate, generally do not have the means to carry out the economic assessments that would maximize the ecological impact for a given expenditure. It seems important to us, therefore, that the strong culture of socio-economic evaluation of the Criqui Commission, an existing structure under the aegis of France Stratégie, permeates the French state.

[2] It can be argued, though, that buying gas at a station already carries an implicit effective CO_2 taxation rate that is above the EU-ETS value. There is no question that including a carbon price in the price of gasoline is justified; the price should be the "shadow price" of carbon, which correspond to the time-contingent price that will allow us to meet the COP 21 emissions objective and far exceeds the EU-ETS price. In practice, the gasoline price includes not only the price of oil and the cost of refining and distributing it, but also a variety of levies, that reflect general-revenue-raising considerations (captured by the general VAT), congestion pricing, the emission of particles, and of course CO_2 emissions.

shareholders, especially those of corporations that had opportunities to change their technologies and end up with stranded assets; indeed, a policy of compensation for stranded assets would disincentivize firms to adopt green technologies.

- Neither will compensation ever be fair to the entirety of the targeted populations: some in those populations will enjoy windfall gains (e.g., they do not use a car and receive a "green cheque" to "compensate" for the imposition of a carbon tax on gasoline) while others will still feel some net cost. Every situation is idiosyncratic, and the state has neither the information nor the personnel to enter each and every special case; and so, we must accept less than perfect solutions and not use the imperfection as an excuse not to act (an analogy can be useful here: antismoking policies – which in many countries are regressive – would never have been enacted if one had insisted on perfect compensation).

Incentives require that compensation be backward, not forward looking; that is, it should compensate for a cost inflicted upon the losers, but not be a recurrent compensation. For example, a recurrent compensation to workers who live in a rural area very distant from their workplace would not induce them to find a nearer job or move closer to their workplace if they have an opportunity to do so (not everyone has). But solutions do exist. Even a single identical lump-sum transfer, the "green cheque", for every adult resulting from a carbon tax proceeds would benefit poorer households on average. And the redistribution can even be made more targeted and more progressive. Simply, the compensation should be as targeted as possible on actual losers – avoiding windfall effects – and keep a proper forward-looking incentive pattern.

This being said, there were disagreements within the commission: some members suggested that some of the proceeds of carbon taxation should go instead to green actions rather than redistribution. This has the benefit of showing that the state puts its money where its mouth is and that it is convinced that the carbon tax really serves to fight climate change, rather than just being another source of public funds or of redistribution. But using part of the proceeds to, say, fund green projects does not do as much to address the discontent of losers.

While all countries must spend money to reduce their carbon footprint, they differ in both how costly it will be and how they will be impacted by climate change. Therefore, compensation is also crucial at the international level. Stopping coal, which emits much more CO_2 than even rival fossil-fuel energies, is a low-hanging-fruit. Yet, it has happened on an insufficient scale, be it at the European level or elsewhere in the world. Poland and Germany for example are big coal producers. One understands the human cost generated by the closure of their coal plants; displaced workers deserve strong support; but delaying closure only delays those costs and in the meantime leads to very high emissions. There is no other way to proceed than compensating losers, as has always been done historically

in the form of free allowances: mid-western US states received "bribes" in the form of free emission allowances when a cap-and-trade system enabled US SO_2 and NOx emissions (which cause acid rains) to be reduced by half starting in the 1990's; eastern European countries received free allowances in exchange of their participation in the 1997 Kyoto protocol. This is the spirit of the EU "Just Transition Fund".

2.5. Leg 5 – International juicing

The EU-28 by itself is only a very small piece of the climate change puzzle. It represents 9% of global emissions, France less than 1%. Future emissions furthermore will come mainly from emerging countries, further reducing the European share. So, there is little that Europe can do on a stand-alone basis. Nonetheless, Europe has a part to play, as inducing a reduction of global emissions elsewhere will deliver benefits to Europe that can be sizeable:

- First, by "leading by example". To be certain, this strategy was not that effective during the implementation phase of the Kyoto protocol.[1] Nonetheless, a voluntarist policy can have a demonstration effect – things can be done – as well as a shaming effect on countries who do not get on board.
- Second, by using a stick, the Carbon Border Adjustment Mechanism (CBAM), to ensure a level carbon price playing field between domestic firms and importers (more on this shortly) and to encourage recalcitrant countries to jump on board. If done right, the border tax eliminates the competitive advantage enjoyed by firms located in countries with lax environmental regulations. Besides leveling the playing field, it also puts pressure on these lenient countries, as their competitive advantage on the export market vanishes (indeed, they are better off collecting the carbon tax on exports themselves). Chapter One also argues that border tax adjustments are more efficient than conditioning bilateral or multilateral trade agreements on compliance with COP 21 nationally determined contributions and commitments on climate action set by each country, neither of which are binding as a matter of international law.
- Third, by engaging in public green R&D and making the resulting technologies available to poor countries, and by helping the demonstration of viability of existing technologies. Furthermore, the European Union (EU) can work through the multilateral development banks, the International Monetary Fund (IMF) and the development finance institutions

[1] An unequal distribution of efforts between countries (offering countries like the United States a good excuse to deviate from the agreement) combined with the absence of a sanction tool (such as a carbon adjustment mechanism at the borders in case of non-compliance with the agreement) explains why Europe remained alone in carbon pricing (through the EU-ETS). Not surprisingly, its climate activism lost in intensity: The EU refused to stabilize the price of carbon when it fell below €10 per tonne due to the financial and sovereign crises and the development of renewable energies in Germany and elsewhere in Europe. That said, the EU-ETS recently introduced a market stability reserve system to prevent this experience from happening again.

to help emerging market and developing countries, which will represent a big share of the growth in output and emissions in the near future, to adopt low-carbon technologies. Finally, innovation is not only technological. The EU could, for example, offer 5% of carbon revenues to developing countries to set-up CO2 verification and markets. The benefits from an Indian cap-and-trade would be large and would represent a relatively low-cost contribution to climate mitigation for the EU. There is not enough policy innovation in the world, and this could produce emissions reductions that benefit Europe.

- Finally, Europe must play a leadership role in promoting credible and effective international agreements.

3. Further Thoughts and Leads for Future Reflections

3.1. Governmental actions

The strengthening of the ETS system and the no-exception rule

A carbon price should apply to all actors whenever possible, for six reasons.

- *Containing cost*. First, it is inefficient to tax some emissions and not others. A carbon price of €50 applied to some sector but not another, will lead some to spend €45 to abate, while others will not spend €5 to avoid emitting a ton of carbon because they are exempt from any payment if they pollute. This holds true at the international level as well. Drastically reducing emissions of the French production of electricity would be very costly as electricity generation is already mostly decarbonized in France (incidentally, that shows that an ambition of reducing emissions in the same proportion in each sector would be absurd); in contrast, low hanging fruits can be found in the 39% of world fossil-fuel emissions that still result from coal production, most of it in countries with no or very low carbon prices.

  A single carbon price also helps address the large variation in the cost of decarbonization across usages. The latter is relatively low for electricity and light duty vehicles, higher for (older) buildings, and currently very high for sectors like airplanes, ocean transport, etc. Some of the progress will occur through switching away from fossil fuels, and some will occur through R&D instead (itself incentivized by carbon pricing). We will need alternative fuels, perhaps carbon capture and storage, negative emissions (e.g. air capture of CO_2), which are much more expensive presently.

- *Respecting fairness*. Second, exemptions are unfair. *Yellow Vests* noted that, unlike them, truckers, fishermen, farmers, airlines, and taxis were not paying the full carbon

tax. We realize that the no-exemption policy will add to the number of groups who might resist carbon taxation (farmers, taxi drivers, lorry drivers, real estate managers, homeowners, etc.). But a no-exemption policy has much more legitimacy than a patchwork one. Furthermore, compensation combined with a pedagogy explaining why alternatives are opaque and that subsidies are in the end taxes, might further enhance the legitimacy.

Accordingly, we recommend the inclusion of industries such as housing and transportation into the EU-ETS. However, this inclusion should not lead to a loss of ambition. As we have noticed, the EU-ETS price is currently far too low (it was still at €25 in 2020, before rising to around €50 in early 2021, close to the level of the carbon tax in France). Two solutions under these conditions: the best approach is to negotiate a higher ambition for the EU-ETS, which would allow the closure of coal mines among other desirable effects. Until the political constraints at the European level are lifted, we advocate to still include these sectors in the EU-ETS and to add an additional national tax that fills the gap;[1] this surcharge would evolve according to the EU-ETS price. After all, this is what the British did in 2013 to eliminate coal (the EU-ETS price was around €10 at the time).

- *Making the process lobby-proof*. Third, like fiscal loopholes, exemptions expose the tax system to heavy lobbying. Once the state has opened the Pandora's box of exemptions, every lobby tries to have its name added to the list.

- *Curbing offshoring*. Fourth, and as already mentioned, the no-exemption principle[2] has another important corollary: Imports for whose emissions the producer is not held accountable should not have an undue competitive advantage over home production that is subject to carbon pricing; put differently, carbon pricing by itself should not lead to the offshoring of domestic production. The level playing field can be restored through a Carbon Border Adjustment Mechanism at the borders of Europe, that charges imports for the price corresponding to their carbon content, applying the same price for carbon emissions as for European firms. Straightforward in theory, but more complex in practice; for, estimating the actual carbon content of imports is not that easy, especially along a value chain located abroad. Indeed, if only intermediate goods such as cement and steel are subject to the border tax, the level playing field is not obtained for final goods such as cars. The border tax adjustment must be comprehensive, which requires information on the value chains. For that reason, economists are only mildly

[1] This inclusion in the EU-ETS combined with the tax adjustment will not solve the problem of under-taxation of carbon in other countries, nor will the status quo. Hence the importance of reaching an agreement at the European level.

[2] France consumes more CO_2 than it produces. Indeed, the CO_2 footprint of imports is twice as big as that of exports.

enthusiastic about the border tax. But we feel that it is necessary, if only to force free-riding countries to the bargaining table and generate reductions abroad that benefit France and the EU. Note also that it will be hard for Europe to justify abroad a border tax adjustment if it does not get its act together internally and allows for exemptions.

- *Phasing out fossil fuel subsidies*. Fifth, another implication of a single carbon price is the shutting down of fossil fuel subsidies that are so ubiquitous around the world. Such subsidies are equal to the difference between the total cost for society of the fuel (production and delivery cost + induced cost of local air pollution and global warming – the carbon shadow price – + general-revenue-raising considerations, measured by ordinary VAT) and the price paid by the fossil fuel user. It is estimated that fossil fuel subsidies amount to a staggering 6.5% of world GDP, with China, the US and Russia by far the largest subsidizers.[1] While straight underpricing of fossil fuel (of diesel in France and Germany) is a very common subsidy, there exist many other forms of less-obvious fossil fuel subsidies, from the absence of collateral pledging by US oil and gas companies (which leads them to not plug the shafts when they become unprofitable, generating high methane emissions), to subsidies to low-cost airlines or to subsidies linked to export finance (by the Banque publique d'investissement in the case of France) for oil and gas exploration, pipelines, or LNG terminals. Although much smaller than those of China, the US and Russia, European fossil fuel subsidies should be phased out and the European Energy Taxation Directive still lags behind in terms of its ambitions. *Fossil fuels subsidies often amount to a negative price on carbon*.[2]

- *Rewarding negative emissions*. Sixth, negative emissions will be necessary to achieve the net zero pledges (for example, there is currently a lot of interest in a wide range of natural and other carbon removal technologies). In theory, such negative emissions, when certified, should be rewarded by "credits"[3] whose value corresponds to the carbon price, again to ensure that the same incentive applies to alternative ways of mitigating

[1] See Coady, D., Parry, I., Nghia-Piotr Le, and B. Shang (2019), "Global fossil fuel subsidies remain large: An update based on country-level estimates," *IMF Working Papers* 2019/89, May. There is some uncertainty around the exact number, for methodological reasons explained in the paper, but there is no question that it is sizeable.

[2] This is so if the total cost of the fuel short of the impact on global warming (production and delivery cost + induced cost of local air pollution + general-revenue-raising considerations) exceeds the price paid by the fossil fuel user.

[3] Of course, only actors who also pay for carbon emissions would be eligible for those credits (otherwise, they might emit, recapture, and claim credits, as has happened with trifluoroethane or hfc 23 under the Kyoto Clean Development Mechanism).

climate change. Needless to say, details matter, and one must ensure that the policy achieves the stated goals.[1]

Electricity production

The production of electricity must be altered in level as in structure. Much more electricity will need to be produced to match the increased demand associated with electric vehicles, green buildings (heat pumps for example) or the production of green hydrogen (which uses CO_2-free energy to power electrolysis that splits water into hydrogen and oxygen) for mobility and higher-temperature industrial processes. This will create challenges for both electricity generation and distribution and transmission. In structure, most electricity will have to be produced from carbon-free sources. This is already largely the case in France, but not in the rest of Europe. The transition requires some thinking. We already mentioned the rapid phasing out of coal, which will not create a big surge in the price consumers pay for their electricity.

Renewables will need to be widely deployed, but they may still be expensive overall due to electrical system balance and transmission problems. First, these are intermittent sources of energy, and, in the absence of cheap battery or other sources of storage, they require being supplemented by other means of production; if the latter are carbon-intensive, renewables are less green than they appear. Second, in Europe the best wind resources are in the North, especially offshore, while the best solar resources are in the South. Bringing renewable electricity to where consumption takes place poses a challenge for high-voltage transmission grids, for both economic and "not in my backyard" reasons. This has for example been an issue in Germany, where wind farms are in the North and much consumption is in the South, with limited high-voltage transmission capacity in-between; the shortage of transmission capacity has occasionally led to the substitution of wind energy from the North by fossil-fuel electricity produced in the South, a problem that will become much more acute in the future as renewable energy expands substantially. As for solar, which like wind has witnessed a spectacular technological improvement in the last ten years, locating photovoltaic panels in Andalusia or North Africa makes much more sense than doing so in the North of France and a fortiori further north.

Besides the unpopularity of high-voltage transmission lines, there is a second obstacle to an efficient localization of renewables. Developing such lines across Europe requires cooperation among a number of grid owners and dispatchers with divergent interests (the same problem arises in the United States). A long-awaited solution would be to create a

[1] For example, one should not repeat the mistakes made when setting up the Clean Development Mechanism. The latter failed the verifiability criterion; it furthermore led the credits being earned solely in the European region, and the resulting increase in the number of allowances put downward pressure on carbon prices in the EU-ETS system.

single European transmission and dispatching system that would enable a single European electricity market and thus facilitate the deployment of renewables.[1] We support such an endeavor to achieve a truly pan-European power market. Finally, it should be noted that the capacity of the high-voltage grid can be increased without building new lines, for example by installing sensors that allow more power to pass through a line without fearing a break in the line.

Chapter One concludes that in the transition phase:

- Regardless of opinions about this mode of production, keeping in (safe) operation existing nuclear plants, which provide three-fourths of the electricity production in France, is a necessity if we want to bring our contribution to the fight against climate change; nuclear is carbon free, dispatchable, and has high availability. Large refurbishment operations can, at a reasonable cost, extend the life of these power plants up to 60 years (some even argue 80 years).

- The commission did take a stance neither on the desirability of (UK-style) construction of new power plants, nor on the specific nuclear technology if one decided in favor of such construction (third and fourth generations, including small modular reactors). Doing so would have required more expertise and time than the commission could devote to study issues related to cost and reliability, sequencing of the green transition, extension of life span of existing plants. In any case, the construction of new nuclear plants should not be excluded on a priori grounds given the huge increase in demand for decarbonized electricity in the years to come. When it comes to investment and R&D, and given the technological and societal uncertainties, it is important not to put all our eggs in the same basket.

- During the transition, the use of gas may be a lesser evil. Indeed, gas generates half as much CO_2 emissions as coal, although this difference is reduced in the event of methane leaks (methane leaks due to gas production and extraction must be closely monitored). In addition, its cost is relatively low, keeping the price of electricity at a reasonable level. It should be noted, however, that a more intensive use of existing gas-fired power plants should be preferred to the construction of new gas-fired power plants, as new investments with long lifetimes could have a lock-in effect on the energy mix; however, gas is still too polluting and the transition should be made as quickly as possible. A different way of expressing this is that the construction of new power plants

[1] Failing this, we should support the European Commission's Trans-European Networks for Energy (TEN-E) regulation, which tries to identify projects of common interest.

can only be considered if there are very significant technological advances in carbon capture and storage.[1]

Boosting innovation

Innovation comes primarily from the private sector. But the impetus is often given by the state. First, through R&D subsidies and various policies encouraging innovative start-ups and subsidizing the demonstration of some key technologies. Second, by conducting smart industrial policy; not an industrial policy that is created to promote certain industries or to prop up losing industries, but one that tries to unlock technological challenges. While governments too often attempt to pick winners without having the required information, favor lobbies or just follow their favorite whim, they can alternatively attempt to unlock technologies through a well-thought governance design. A case in point is the US defense initiative DARPA, which played a key role in the development of now widely used key technologies, such as the GPS or the Internet. DARPA distributed money to the private sector, universities, and government labs with much discretion (due to insulation from politics and lobbying), an eye on outcomes and a strict oversight of the projects. Similarly, the US National Institute of Health has had a large impact on advanced medical and pharmaceutical research, but they have considerable financial resources (more than $30 billion per year).

A green R&D agency could be set up, preferably at the level of Europe, which offers a larger scale and a wider array of competences than a single member state. European Alliances for batteries (since 2017) and for clean hydrogen (since 2020) have already started to foster cross-European public-private collaboration. A European version, E-ARPA-E, of the Advanced Research Projects Agency–Energy (“ARPA-E”, as this spin-off of DARPA is known in the United States) would fund high-risk, high-reward research, “way out there” (“early stage”) projects. To avoid wasting public funds and to ensure a real impact, this independent agency would adopt a proper governance. Examples of desirable features include:

- A true high-level manager would be appointed, with substantial operational flexibility to oversee the allocation of funds and insulation from interest group politics. ARPA-E started in 2009 with tight supervision from Nobel laureate and US Secretary of Energy

[1] We do not see here any argument for policy intervention if the carbon price is high enough: the recommended carbon pricing mechanism should solve the problem efficiently provided it is put in place. A ban on coal (which will meet the same resistance as a carbon price) will be necessary if the carbon price remains too low. But this again raises the issue of predictability of the carbon price. New investment in gas is risky given that it will have to be phased out relatively rapidly; with the knowledge of future carbon prices, the private sector can evaluate this risk; in the absence of such knowledge, investment choices are complex.

Steven Chu and the first two directors were very distinguished science professors at UC Berkeley and University of Maryland.

- Grants would be subject to a rigorous peer-review process, in which independent, highly-qualified experts would assess the technological feasibility and the even-distant market prospects of the project, and would compare not only the projects, but also the scientific standings of the teams (a very important feature for the project delivering).
- E-ARPA-E would bet on highly promising teams and promising but high risk projects. It would be agnostic as whether the private sector or universities are best placed for solving a particular problem.
- The agency would not pick the solution in advance; it would set goals (e.g. battery capacity and longevity) rather than the way to achieve the goals. Again, the recent vaccine experience is useful: it was not clear a year ago what was the best scientific and cost-effective route.
- The agency would evaluate interventions after they have taken place, and publish the results; it would include a "sunset clause" which ensures support can be withdrawn if the project is not working or is no longer needed (a feature that is often missing when the public sector undertakes industrial policy: whether under the pressure of recipients who want to keep receiving funds or because they want to prove they were right in the first place, officials too often keep throwing money at projects that show little chance of succeeding). Relatedly, because a good R&D portfolio has some failures, failures need to be tolerated and recognized, but lessons must be learned.
- A requirement of co-funding by the private sector might be of further help (as is the case for the US ARPA-E), both at the project screening stage and to help facilitation the termination of non-performing projects.

Is this feasible? It may be useful to compare EU-ARPA-E with existing French and European institutions with similar objectives.

A European role-model for this, albeit in the academic-research sector and with too small a scale,[1] is the European Research Council (ERC), itself modelled after the very successful National Science Foundation and National Institute of Health in the US. It selects a small number of high risk-high promise projects, is protected from political intervention, and conducts a clean, peer-reviewed allocation of grants. The two key researchers, Ugur Sahin and Adrian Hill, behind two of the three current Covid vaccines, that of BioNTech-Pfizer and that of Oxford-AstraZeneca, are both ERC laureates whose grants were for then-exotic

[1] The ERC's budget is in the €2 billion ballpark for the associated 27 member states, while the EU-28 GDP is about €15,000 billion.

forms of vaccination that they were able to transform quickly when Covid-19 appeared.[1] Needless to say, the European agency in charge of green projects would face a different environment and have different goals and processes, but the ERC example shows that European cooperation and a clean governance can be achieved in the R&D domain.

Another European undertaking, the European Space Agency (ESA), has been successful during quite a long time despite two features that have made the agency difficult to run.[2] First, it has always applied an unwritten "fair-return" rule that contributing countries must receive a volume of orders for projects supported by the agency in proportion to their contributions. This fair-return rule adds a significant factor of complexity and slowdown in the decision-making process, as well as the occasional suboptimality in the selection process. Second, ESA defines the technical specifications to be met for the projects it finances, while DARPA and other American agencies have moved to a logic that defines performance objectives and leaves it to the contractor to find solutions. The European system has been less conducive to breakthrough innovations such as reusable launch systems, or the industrialization of the production of certain equipment.

As we already noted, European member states have embarked in joint research support. A newcomer to this landscape is the European Innovation Council (EIC), which will distribute €10 billion over 7 years; at the pilot stage in the framework program ending in 2020, the EIC is inspired by the way the European Research Council (ERC) operates: a fraction of its budget will even be used to take over where the ERC's "proof-of-concept" program ends, to bring innovations closer to industrial or societal use. The EIC also has thematic priorities in the tradition of DARPA. Unfortunately, unlike the ERC's, the EIC's strategic council is only advisory. The European Commission has kept the upper hand on the concrete decisions. Because of this "detail", Europe cannot claim to have created its own "DARPA" (in fact, DARPA has a lot of independence).

A final comparison: in France, the General Secretariat for Investment is piloting the "Programme d'investissements d'avenir (PIA)". The PIA finances innovative investments[3] over the entire innovation life cycle, often with co-financing from the private sector. Its independence and its approach (on the whole rather bottom-up) also make it tick several boxes listed above. On the other hand, EU-ARPA-E would perhaps put more emphasis on defining a target than the path to reach it. Governance would also be more oriented towards

[1] In the case of Covid-19, the promise of government procurement played a role – the companies knew that they would have massive demand for their innovations from governments. There was little uncertainty about demand.

[2] France Stratégie (2020c), *Les politiques industrielles en France. Évolutions et comparaisons internationales*, report for Assemblée nationale, November.

[3] PIA programs have evolved from cross-cutting approaches (innovation competitions) to a more sector-based approach (batteries, artificial intelligence, etc.).

scientists, who are very present in the consultations in the PIA but much less in the decision-making bodies.

While the role of scientists in decision making and target setting could be strengthened in the management of the PIA, it should be noted that these differences are particularly important when it comes to selecting a very small number of disruptive projects and putting large sums of money on them, as the US agencies in the high-tech, environmental and medical fields have been able to do, unlike us. Committing such sums with a high risk of failure is not in the European administrative culture for understandable reasons, but it is indispensable to make such risky bets to achieve world leadership in at least a few areas. There are of course two corollaries: it is imperative to attract very high level scientists as managers, and to do so, it is necessary to know how to put the necessary means in place if necessary. Moreover, both for budgetary reasons and for having access to a broader talent pool, it is desirable to situate the agency at the European level (without imposing "fair return" constraints, or sprinkling posts according to nationality quotas).

Diplomatic channel

We already mentioned the need for a border tax adjustment. Many are concerned with the risk that, under the cloak of green policymaking, lobbies obtain protection against foreign competition. Aligning the import duties with the current price of carbon in effect in Europe limits the scope for such manipulation; but the tax base – the estimated emissions induced by the imports – is more discretionary. This border tax adjustment should be as rule-based as feasible, possibly as part of an accepted World Trade Organization (WTO) process.

In view of the constraints inherent in the United Nations process (obtaining the signatures of 196 countries gives each a veto right and necessarily leads to "least common denominator" decisions), a number of economists proposed in the past a joint action by a small number of high emitters (such as the United States, China, Europe, Russia, India, Brazil and Japan). These countries would agree on a core of common actions, and put diplomatic pressure (and economic pressure through the border tax) on other countries to join the club. With the 2016 American election and more broadly the rise of populist governments often unwilling to tackle climate change, the idea lost momentum. The election of Joe Biden might create an opportunity for Europe to rethink such an approach, together with China, the largest emitter, and one that has become over the years more and more climate conscious. The commission did not reach an agreement as to the appropriate forum:

- Some argued in favor of a "coalition of the willing"; the voluntary nature of such a "climate club" would facilitate progress on an agreement. The club's variable geometry would make it flexible.

- For others, creating a new institution does not come without cost. We already have the G7 and the G20 (which covers 80% of world emissions), of which the European Union is a major player, and the climate club might introduce more bureaucracy and disconnect between the various institutions. Climate change discussions will shortly take place within the G7 (plus say China) or a spinoff of the Group of 7, which might be a better forum than the G20, which includes a number of countries that may oppose policies that diminish the reliance on fossil fuels.

Our commission however had little expertise in diplomatic issues, and left the debate there. The contribution of political scientists would shed important light on this issue.

Environmental covenants in public contracts

It is often suggested that the award of public contracts include green criteria as important factors of choice among contenders. For example, following a CCC recommendation, a French bill would alter the Public Procurement Code to make the integration of environmental clauses in all public procurement contracts mandatory, rather than optional. A priori, this idea is compatible with the concept of "economically most advantageous bid" inscribed in the European public procurement directives: this concept could be understood as including an evaluation of the environmental damage caused by production processes; the relevant data in this case are emissions and their implicit subsidy (the difference between the social cost of carbon emissions and the actual price of carbon).

But the (well-meaning) calls for environmental covenants in public procurement most often are not related to high-risk, high-return R&D. Indeed, following a CCC recommendation, a French bill aims to move from the possibility to the obligation to insert environmental clauses in all public procurement (Code des marchés publics). The devil is in the details and we would advise to exercise caution here, as it would be preferable to tackle incentives directly. Not because the concept of "economically most advantageous offer" is enshrined in the directives on European public procurement: this concept could conceivably be understood as including an assessment of environmental damages generated by the production process; the relevant data here are the emissions and the underpricing of these emissions (the difference between the shadow and the actual price of carbon).

Consider the well-taken concern about the greenhouse gas emissions created by the transportation of non-local production of inputs or food. A paradox arises when a government refuses to subject the airplanes' emissions to the ETS system or the truckers' gasoline to the carbon tax, and at the same time allows or even asks procurement officers to include environmental concerns in the tender of public contracts. Environmental criteria in procurement are (imperfect) substitutes for the taxation of emissions by the government. This passing-the-buck implies a switch from a well-defined and consistent carbon price to a series of discretionary and likely incoherent policies.

We here reiterate a warning made in Chapter One: green policies will be expensive, there is no need to inflate this cost by selecting ineffective policies. Without careful assessment, the specification of the weight on environmental actions might involve an implicit amount of public funds of €5 or of €1,000 per avoided ton of CO_2. The public accounting offices (regional and national *Cours des comptes* in France) are currently not equipped to compute these implicit costs and to verify the claims of bidders made in public tenders. Furthermore, the ability to tilt procurement exposes officials to lobbying and electioneering. A local official eager to be re-elected may over-emphasize the benefits of local production or voluntarily ignore some relevant dimensions (say, the heating of local greenhouses to grow vegetables) while including others (say, transportation), so as to protect local producers against competition, at a high cost for public finances or the consumers and a low or even negative impact on the environment.[1]

3.2. Non-governmental actions

Regulations are never perfect for a variety of reasons, and we all should do our bit to help. First, we should try to alter ongoing social norms. This is no easy task, but norms-based interventions can be effective, especially when coupled with material incentives. Tobacco smoking in public spaces is a case in point: attitudes changed drastically in France when fines and legal enforcement suggested that such individualistic behavior was not widely accepted in the population and constituted antisocial behaviour. For instance, combining maluses on high-emission cars with a ban on advertising their “glamorous” features or outright awareness campaigns would mimic what was done for tobacco.

Second, citizen and corporate initiatives (socially responsible investment and consumption for example) can contribute to a better outcome. Whether on their own initiative or under stakeholder pressure, firms like Walmart or the FANGS contract some of their electricity from wind and solar producers. Whether such initiatives have a real impact has to be looked at with care, though; for example, it has been noted in the US that purchasing renewable generation in states where there is a mandate dictating the share of renewable generation in electricity companies’ production portfolio often leaves total renewable generation (and CO_2 emissions) unchanged: it does not generate more investment in renewables. Impact is what matters, not posture.

There cannot be too strong a divergence between the material interests of consumers, investors, suppliers and what is socially expected from them. Many of us are willing to pay a bit more for fair trade products or receive a smaller return on our savings if these

[1] In this respect, article 15 on public procurement (*commande publique*) of the proposed law following the CCC is of concern. It would mandate that public contracts take into account considerations related to the environmental aspects of the works, services or supplies subject to the contract.

contribute to a greener economy. There is no evidence however that allows us to count on massive *voluntary* sacrifices of purchasing power by a significant fraction of the population (which is confirmed by the perceptions reported above). Relatedly, private initiatives should not absolve governments from acting and governments should not ask the private sector to do their job. It should be borne in mind that 30 years of injunctions have not radically changed our carbon emission behavior, and that, although awareness has grown in the population, there is only so much that we can expect from non-incentivized private-sector behavior.

What to expect from the private sector?

So far, many of the encouraging private-sector news on the technological and managerial fronts have owed more to an increasing awareness of the enormous economic shock that the end of the waiting game will provoke than to effective governmental action. Corporations realize that global warming is an existential threat for their business as well as for the world. With mankind's having its back to the wall, the regulatory response will impose a large shock to their balance sheet if they are fossil-fuel dependent. Firms accordingly engage more and more in an assessment to their vulnerability to the climate risk (stress tests).

Shareholder insistence on knowing the carbon footprint and the exposure to regulatory risk makes good business sense, independently of any environmental consciousness. As shown for example by the behavior of some financial institutions prior to the 2008 financial crisis, corporate managers may adopt short-termist attitudes; they may cut corners to offer a flattering image of their performance at the helm of the firm, either to keep their job if the latter is imperiled, or to cash generous bonuses and exercise stock options if their compensation is not subject to clawbacks. Climate-related procrastination increases firms' short-term profits, but exposes them to a large but delayed macroeconomic shock. It is therefore in the interest of shareholders to curb a possible short-termism of their management and to make sure that the firm is not too exposed to climate risk, that it will not be left tomorrow with too many stranded assets.

What to expect from the Central Banks?

There is currently much discussion about "green central banks". Let us start with the uncontroversial part, which already lies within the mandate of central banks: Climate change should be embodied in the central banks' economic forecasts, banking stress tests, and assessments of the quality of the collateral they accept from banks. Climate change will create macroeconomic shocks (damages, properties under water, energy transition, high carbon prices and stranded industrial assets), whose likely size grows every day as we procrastinate. Various scenarios must be drawn so as to predict banking and insurance liabilities as the fight against global warming unfolds. Climate stress tests are about

financial stability and capital buffers that reduce the occurrence of banking bailouts. Several other policies have been proposed, that in contrast consume public funds and that we now discuss.

- *Risk taking and public finances*. Today, the current problem with green projects is not the availability of financing, but the lack of associated income prospects. The central bank can potentially boost the profitability of green projects in several ways. Two of them, well-meaning, have been recently suggested. To the extent that central bank profits go to the Treasury, both involve the use of public money. They are in our view misguided.

  First, the central bank could promote green projects by relaxing prudential standards: It has been proposed that capital requirements be loosened for banks' climate-friendly lending. Green projects are subject to substantial macro (political and technological) risk. One cannot help being concerned about such a policy increasing the risk of a banking crisis. Green finance should not be the new subprime, if at the end of the day greener corporations do not reap the expected revenues (for example, because governments fail to impose the relevant carbon price) or specialize in a technology that does not deliver.

  Second, the central bank can reduce spreads on bonds in a discretionary manner; it does so for example to shore up countries that face a speculative attack on their currency. It has been proposed that the central bank purchase green bonds to reduce their spreads if any. In contrast with the relaxation of prudential standards, such a policy would induce direct risk taking by the central bank, rather than an indirect one associated with the specter of new bailouts of the financial sector. Leaving aside the fact that a proper, impact-related definition of green bonds is still in the making, green spread reductions would open an environmental and political Pandora's box. For example, could the European Central Bank (ECB) refuse to buy German bunds on the ground that per capita emissions of CO_2 from the burning of fossil fuels for energy and cement production are 75% higher than those of France or that Germany is delaying the closure of its coal plants until 2038? Why not purchase bonds of firms or institutions which do good for the world, reduce inequality, give large sums to charity? This should be left to governments, not the central bank.

- *Legitimacy*. The European political institutions have the instruments and the mandate to fight climate change. A transfer of competences to the European Central Bank should at the very least be explicit. It would, however, provide governments with an excuse to make the ECB responsible for their environmental policies. Since these climate actions have a cost, the state spends public money, even if the operation is done through the ECB. It is the states that must take responsibility for this, in a

completely transparent manner and without jeopardizing the finances, credibility and independence of the ECB.

What to expect from the financial sector?

Public policy procrastination as we noted provides citizens, firms, and investors with incentives to do their own bit. Needless to say, we strongly favor such actions. But to be effective they require carbon accounting. Carbon accounting for a reporting company correctly emphasizes its direct and indirect emissions: direct emissions from owned or controlled sources; indirect emissions from the generation of purchased electricity, steam, heating and cooling; all other indirect emissions that occur in the company's value chain. The challenge here is to make sure that the proper information be available for these actors to direct their actions in the right direction. Current disclosures lack consistency, comparability and reliability. We should require that companies report their emissions in a verified and standardized way, with the same penalties that apply for inaccurate financial reporting.

We recommend, building on the implementation of the European taxonomy,[1] to extend the reflections carried out at the European level by bringing together rating agencies in environmental, social and governance matters, central banks, financial market regulators, accounting standards specialists, financial institutions, scientists and economists in order to develop a uniform method for assessing the environmental impact of companies.[2] Unfortunately, the task is far from simple. Indeed, our intuitions can be misleading and the adoption of "green behaviour" is much more complex than it seems: Investing in an installed base of hydroelectric plants or in a renewable energy that would have occurred anyway thanks to high-enough subsidies, does nothing for the planet, however green these energy sources may be. The plants already exist and better funding conditions (lower interest rates) amount to a mere windfall gain to the corresponding energy producers.

- To have an impact, green projects must not have taken place in the absence of lower interest rates paid to environmentally conscious investors. Such "additionality" is difficult to assess as we do not observe the counterfactual. Typically, the project developer puts an argument as to what would have occurred, absent the actions that

[1] As the first step in the "Financing Sustainable Growth" action plan launched in March 2018 by the European Commission, the taxonomy project, on which the European regulations on sustainable investment are based, has resulted in the publication of the report "Taxonomy: Final report of the Technical Expert Group on Sustainable Finance" in March 2020 et au "règlement (UE) 2020/852 du Parlement européen et du Conseil du 18 juin 2020 sur l'établissement d'un cadre visant à favoriser les investissements durables et modifiant le règlement (UE) 2019/2088."

[2] At the national level, there are platforms such as the one created by France Stratégie.

have been taken; the regulator, lacking precise information about the counterfactual, may certify additionality if politically or administratively expedient.

Similarly, well-meaning private policies such as carbon offsets and public ones such as the Kyoto Clean Development Mechanism (CDM), despite its emphasis on additionality, may fail to reduce carbon emissions and rather create a windfall gain for projects that would have taken place anyway or whose direct impact is nullified by carbon leakage. The Kyoto CDM rewarded carbon-saving projects in developing countries. It allowed industrialized countries to obtain carbon credits tradable in ETS systems by investing in emission reductions where it is cheapest globally. The CDM generated high transaction costs, as there were endless debates as to whether projects were additional or not.[1] Another issue is that the conservation of a forest in Indonesia would raise slightly the price of soy or timber, leading to substitute deforestation elsewhere – the leakage problem once again.

- Another case in point is the "exclusion vs. best in class" debate. For example, should environmentally responsible investors invest in a technology that still emits CO_2 but replaces another technology that pollutes more? Should we encourage firms in industries that pollute but cannot be phased out in the short run to reduce their pollution (for example, if oil is still going to be used in the short term for, say, driving, incentivizing oil companies to reduce their emissions at the extraction, transportation and refining stage has environmental benefits; the question is clearly more complex than one would think)?

- Finally, there is much discussion about divestment of carbon-intensive assets from portfolios, starting with immediate divestment from coal-related assets, in response to political authorities' failure to strongly act in this matter. But, while they have strong symbolic content, there is only so much we can expect from such exclusionary policies. Their efficacy is limited by yet another leakage problem: they have little impact if other investors jump at the opportunity of buying undervalued fossil fuel stocks and bonds (this was expressed – albeit in too extreme a form – by Bill Gates, who argued that campaigns to ditch fossil fuel stocks are a "total waste of time"). Quoting from the chapter, "it is not the divestment movement that weakened the tobacco industry, but the high taxes that were imposed on cigarettes in the western world." Once again, social responsibility is about impact, not posturing.

[1] See World Bank (2010), *World Development Report 2010: Development and Climate Change*, p. 265 and the reference therein. These debates of course subsided when the "currency" of the payment (allowances in the EU-ETS system) collapsed. A related issue is that of "carve-outs". A firm that otherwise has high carbon emissions, either directly or indirectly through its supply chain, can select a subset of assets that are clean and issue green bonds against them. Similarly, Poland, a high CO_2 emitter, was the first issuer of sovereign green bonds.

4. Summing up

Four observations shape our views on the first challenge. First, the climate urgency calls for swift and large-scale action. There is rapid change, but nowhere near fast enough. Second, we must adopt a holistic approach to tackling the challenge. Third, green policies will be expensive, but our planet is worth more than enough that we should have the courage to admit this fact; the more we procrastinate, the more costly it will be. Fourth, there is no need to inflate this cost by selecting low-impact policies.

Carbon pricing has many virtues. Unpopular for good as well as bad reasons (see the analysis of perceptions), it is nonetheless an essential piece of the puzzle. It has been poorly implemented in the past: it has been too unambitious to have the desired impact, admitted many exemptions, given way to numerous fossil fuel subsidies, raised concerns about offshoring to countries practicing environmental dumping, and offered low visibility as to future levels of the carbon price. The insufficient compensation of low-income suburban and rural dwellers has also contributed to its unpopularity. So, our first recommendation is an unambiguous endorsement of “carbon pricing done right”.

But much more is needed beyond carbon pricing. First, through a rapid intensification of the green R&D effort. Second, through standards, bans and targeted adoption incentives where carbon pricing is less adequate. These interventions are more discretionary than carbon pricing and therefore more prone to lobbying, regulatory capture and red tape. We highlighted how such concerns can be assuaged through a proper governance of the processes and the creation of independent agencies. On the R&D front, we proposed the creation of a European agency that would use peer reviews to fund high risk/high reward projects. On the standards, bans and adoption incentives, we proposed the creation of an independent commission made of high-level scientists and economists, who would help rationalize public choices without slowing down public decision-making. In both cases, sunset policies would phase out subsidies when projects do not perform and when subsidies are no longer needed. In sum, we view the state as a strategist that will take its responsibilities seriously (and not try to pass the buck to other actors, such as the central bank or corporations), unleash the private sector’s adoption and innovation, and reconcile urgency to act and cost containment.

Finally, France by itself will have a minor direct impact on climate mitigation. But, especially if designed at the European level, its indirect impact can be substantial: leading by example and showing that “things can be done”, putting pressure on free-riding countries through border tax adjustments, promoting technological and policy innovation that will benefit poor countries, and playing an intellectual leadership role in the building of international agreements.

SECTION 2

ECONOMIC INEQUALITY AND INSECURITY

Underlying Chapter Two written by Dani Rodrik and Stefanie Stantcheva

1. Facts and Perceptions

How bad is inequality in France? If one looks at standard quantitative measures, one is tempted to conclude that the answer is: not so bad. In most dimensions, France does as well or better than the European Union or the OECD averages:

Start with the standard measures: Pre-tax income inequality, as measured by the Gini coefficient[1] is a bit lower in France than the OECD average, 0.37 compared to 0.38. The same holds for post-tax inequality, 0.28 versus 0.29, the lower post-tax coefficients reflecting the redistribution coming from taxes and transfers.

At the top of the income distribution, the pre-tax income share of the top 10% is 32% in France, lower than in Germany, 37%, the United Kingdom, 35%, or the United States, 45%. At the bottom, the pre-tax poverty rate in France is higher than the OECD average, 26% versus 20%,[2] but the post-tax (and transfer) poverty rate is substantially below the average, 8.5% versus 10.8%, reflecting strong redistribution toward the bottom. Wealth inequality

[1] The Gini coefficient is a standard measure of inequality, which looks at how much the actual distribution of income differs from complete income equality; a Gini coefficient of 0 means complete equality, a Gini coefficient of 1 means full inequality, with one person receiving all the income.

[2] The proportion of people at or below the poverty rate pre-tax, constructed by the OECD, is slightly misleading as the OECD treats retirement benefits from the public retirement system as transfers. As a result, the pre-tax pre-transfer measure reflects the fact that, absent the public retirement system, many French people would indeed be at or below the poverty level. Other countries, in which private retirement systems play a more important role, are less subject to this problem. A way to avoid the issue is to look at the poverty rate excluding retirees. If this is done, France looks more similar to the average.

is, as elsewhere, larger than income inequality, with, for example, a wealth share of the top 10% in France equal to 55%, but in this respect, France appears to be roughly at the OECD average.

Furthermore, contrary to widespread perceptions and contrary to the experience of many other countries, income inequality, again measured by the Gini coefficient, has not increased: while the OECD average was increasing substantially, the Gini coefficients for both pre-tax and post-tax income inequality have remained roughly constant during the last two decades in France. And, again in contrast to many other countries, the bottom 50% has seen faster income growth than the top 10% in France since 2007.

Spatial inequality, which clearly has played a role in triggering the *Gilets jaunes* (Yellow Vests) revolt, is actually lower than in most other European countries: The coefficient of variation (a measure of variation, equal to the ratio of the standard deviation of the distribution to the mean) of disposable income across regions, is 0.05 for France, compared with 0.07 for Germany and 0.20 for Italy.

These statistics do not look so bad. They are however in sharp contrast with perceptions. In one of the surveys run by the commission, we found that 73% of people in our survey indeed see income inequality in France as a serious or very serious problem. 62% see wealth inequality as a serious or very serious problem. These are substantially higher numbers than the corresponding numbers for the United States, 50% and 46% respectively, where nearly all these measures of inequality are much higher, and trends have been much worse.

How does one reconcile the disconnect between facts and perceptions?

- The first answer is that there is no reason to take the average of other countries, be it the OECD or the European Union as the right reference point: this may still be too much inequality. The French may particularly dislike inequality, even if it is not as bad as in other countries.
- The second answer is that it may well be that these statistics do not capture relevant, more dynamic, dimensions of inequality, such as the ability or not to acquire a good education, to hold a good job.

This led the authors of Chapter Two on inequality to look more closely at perceptions and what people cared about, by reviewing existing surveys and carrying out two more on their own. These surveys give a good sense of what people think about when they talk about inequality:

People care about having “good jobs.” One of the surveys asked them what they thought a good job entailed. People saw a good job as one that provides them with a reasonably long tenure within the firm, pay progression and good benefits, responsibilities,

opportunities for promotion and a decent working environment. A good working life is one in which, in addition, if a good job is terminated, one can get another good job.

People do not think that everybody has a fair shot at a good education, and in turn a fair shot at a good job. When asked to rank from 0 to 10 the answer to "I achieve the education I seek", France has the second lowest score out of seven European countries for which data were collected, 6.6, with only Italy below at 5.9, and Germany for example at 8.1. When asked to rank the answer to "I get the job I seek", France again has the second lowest score, 5.5, with Italy at 4.5 and Germany at 7.0.

People worry about social mobility, how their children will fare. They believe that access to good education is highly unequal. From one of the surveys done for this commission, 70% of people believe that education is much better for children of high socio-economic status. When asked whether students have the same chances to attend the university, only 44% agree, the lowest percentage of the seven countries; the numbers for Italy and Germany are 49% and 70%, respectively. And the actual numbers support their views. According to the OECD, the social stratum is the most important factor explaining educational attainment in France. For instance, while average PISA (Programme for International Student Assessment) scores for 15-year-olds in France are slightly above the average of the OECD, five times more students from low socio-economic backgrounds do not meet the minimal level for reading. In terms of educational mobility from one generation to the next, France is second to last out of 27 countries. 87% of students in vocational training programs have parents without college degrees, as compared to 51% for students in general academic tracks. Going beyond education and looking at intergenerational mobility with respect to jobs: Only 14.9% of sons (that study looked at sons only…) with parents in the bottom quartile make it into the top quartile, a low percentage, and one lower than the OECD average of 16.9%.

People worry that good jobs will disappear. They see free trade, globalization, technological change as threatening their jobs. They see the decline in manufacturing, which now accounts for only 10.4% of employment and 13.4% of GDP in France – compared to 25.5% of GDP in Germany, 19.7% of GDP in Italy.

In this context, there has been much talk of the "hollowing of the middle class," of the polarization of employment, with the middle-skill jobs disappearing and being replaced by low-skill jobs. A recent study by France Stratégie shows that the picture is a more complex one.[1] It finds that the share of middle-skill jobs has indeed decreased by 6% from 1996

[1] See Reshef A. and Toubal F. (2019), *La polarisation de l'emploi en France. Ce qui s'est aggravé depuis la crise de 2008*, Cepremap n°50. The study by France Stratégie challenging some of their conclusions is : "Polarisation du marché du travail : y a-t-il davantage d'emplois peu qualifiés ?" by Jolly C. and

to 2007. It finds however that this has come with a nearly equal increase in the share of high-skill jobs, while the share of low-skill jobs has remained roughly constant. This must be seen as good news, but it comes with four large caveats:

- The first is that, looking at more granular decompositions, some categories of workers, such as small farmers or low-skill craft workers, have indeed seen their jobs disappear and their employment share substantially decrease.
- The second is that the spatial dimension is again very relevant. Once the flagship factory that provided the good jobs in a small town has closed, there is little hope anything similar will be created. Even if public subsidies succeed in bringing in a new flagship factory, the same mishap may happen again years later. And moving is not always an attractive option. On top of the loss of social links, which are particularly strong in small town and rural communities, comes an economic stumbling block: workers are stuck because the value of their house (their only wealth) has declined, so that the rational economic choice may be to keep on living there and earn less.
- The third is that, even if these evolutions continue and many middle-skill jobs are replaced by high-skill jobs, the decrease in those middle-skill jobs, the hole in the job distribution, makes it harder to move up the job ladder. Some of the middle rungs of the ladder are missing. When one more year of high school might have allowed a worker to move up, it may now take a full college degree, a much larger jump.
- The fourth is that future evolutions may be different, and the threats to good jobs may become stronger. Indeed, one of the conclusions of the study is that, even within this 20-year interval, trends have been quite different between the first and the second decades.[1]

Finally, the survey comes with a warning to policy makers. People expect the government to intervene. But they have limited confidence in the government to change things. Only 36% of them, when asked about the welfare state, have a positive opinion, the same percentage as when asked about globalization.

2. Conceptual Frame

The survey answers give a good sense of what people care about, and thus what policies aimed at decreasing inequality should try to achieve. Namely, to prioritize social mobility

C. Dherbécourt, *La Note d'analyse*, No. 98, December 2020. With a response by Reshef and Toubal in March 2021 on the CEPREMAP site.

[1] See for instance in the aforementioned study by France Stratégie the figure on the evolution by sector over the two decades. It is reproduced in Chapter Two of the present report (Figure C of Box 2).

and give as much of a fair shot at good jobs to all, while still protecting those who end up being worse off.

To do so, policy can intervene at three stages:

- At the pre-production stage, policy can make human capital and financial wealth less unequal, so that people start their life with more equal opportunities.
- At the production stage, policy can work on refreshing and improving skills; it may also try to shape technology and the organization of firms, so they create more good jobs.
- At the post-production stage, given the fact that not everybody came out equal at the production stage, policy can take measures to protect and redistribute.

The traditional focus of policies has been on the pre- and post-production stages, with more limited intervention in the production process itself. Clearly, better can be done on traditional pre- and post- production policies, e.g. on education, on inheritances, and more broadly on redistribution. The traditional redistributive tools may not suffice, however. Technological progress and globalization will continue to impact jobs and incomes, likely increasing polarization and pre-tax inequality. And there are limits to how much pre- and post-production redistribution can do, given the already high tax-transfer rates in France.

This implies looking into the production process itself. Some measures are no-brainers in their justification, although not in the details of their implementation: Professional training throughout life is essential and can be done better. But should one go further? Can firms be induced to reorganize to create more good jobs, give more responsibilities to low-skill workers, offer more ways to go up the job ladder? Can technology and technology adoption be made more good-jobs-friendly? Should trade be restricted if it eliminates (good) jobs domestically? These are difficult issues, and the commission spent a lot of time discussing them. They raise both conceptual and implementation issues. We thought it was important to put them on the table. They should be explored but, because some are new and they all raise serious issues of implementation, they must first go through further research and proof of concept stages.

Before we start however, a similar caveat to those made in the other two chapters. As the discussion we just had suggests, there are many aspects of inequality, and many policies, institutions, regulations which affect the outcome. We just could not discuss all of them. Thus, you will find only passing references to some policies, for example a universal basic income, or the optimal structure of wealth taxation (*impôt de solidarité sur la fortune*, ISF), in what follows. Our only excuse is that we just did not have the time to discuss it all.

3. Pre-production Stage Measures: Levelling the Playing Field

3.1. Education

The strengths and weaknesses of the French education system are well documented, the scope for reforms long discussed, and indeed some reforms are happening. But more must be done. The French educational system, from kindergarten to higher education, has at least two shortcomings.

First, except for a small and successful elite, the quality of education is only average – even though spending on education, 5.5% of GDP is higher than the EU average. For example, PISA scores for 15-year-olds are only slightly above the OECD average. This bodes poorly for the future as good jobs require the accumulation of soft and hard skills. Particularly worrisome for good jobs prospects is the mediocre ranking in science and mathematics. For example, the recent Trends in International Mathematics and Science Study (Timss) puts France in 4th and 8th grades mathematics performance last with Rumania and Chile among developed countries. France has dropped down not only relative to the best, East Asian nations (China, Japan, South-Korea, Singapore, and Taiwan) or Finland, but also compared with the average advanced country.

Second, as we saw earlier, education is highly unequal. Potential remedies have been repeatedly identified, and recent reforms have moved in the right direction. But the list of what remains to be done is both well-known and long: School segregation should be reduced. Still more must be spent on disadvantaged students; in line with the discussion of immigration in Chapter Three on demography, school integration and spending more on schools with disadvantaged students need to go together.[1]

The large apprenticeship shortfall must be filled (recent reforms making it more attractive for employers to take apprentices and for students to enter apprenticeship have gone some way). More effort should be exerted to link vocational training to jobs. Young people, especially those from disadvantaged backgrounds, need to be much better informed about the importance of qualifications, jobs and available careers (a theme taken up in Chapter Three on demographic challenges and the labour market participation of people

[1] More money may allow disadvantaged schools to offer special programs and attract better students. But evidence of the benefits of throwing money at disadvantaged schools without a better mixing of privileged and disadvantaged kids is limited. Because segregation is higher in schools than in the surrounding neighborhoods (Oberti-Savina 2019), desegregation is less of a problem that in the US, where neighborhood segregation is very high. Desegregation can be achieved through vouchers, quotas for disadvantaged students and other means. Oberti, M. and Y. Savina (2019), "Urban and school segregation in Paris: The complexity of contextual effects on school achievement: The case of middle schools in the Paris metropolitan area", *Urban Studies* 56, No. 15, February, pp. 3117-42.

with an immigrant background). They should have the means to navigate the maze of secondary and higher education tracks and be informed about the differences between tracks that are apparently similar but offer very different employment and career prospects. The choice of fields of study should reflect current and future employment opportunities.

The attractiveness of teaching careers needs to be enhanced. As in Finland, more autonomy (accompanied by accountability) must be granted to institutions and teachers to enable them to develop innovative approaches based on both experimentation and benchmarking. Finland also shows that career attractiveness is not just a budgetary issue. This country, which ranks among the world leaders in mathematics, science and reading and comprehension, has one of the most efficient and egalitarian education systems, despite a limited budget (of course, Finland has specificities compared to France, including a lower level of inequality due to family background and language). Autonomy and freedom of pedagogical methods can contribute to making the job more attractive, as well as solid continuous training for teachers.

That said, teachers' salaries are too low in France, so too few qualified candidates apply for teaching positions, especially in the scientific disciplines that are so essential for good jobs. Salaries should be more reflective of skills and bonuses should be high enough to encourage the most experienced teachers to work in disadvantaged areas. Raising the salaries of new recruits and enhancing their skills should not present any particular difficulties. On the other hand, applying the new salary conditions to existing teachers, while having a beneficial effect on their morale, would have a very high budgetary cost. Our commission did not have time to explore the ways of reform in this area; it will probably be necessary to think about new approaches, without prejudice, and also to look at what has been done abroad (for example, in Finland, South Korea or the Czech Republic).[1]

3.2. Inheritance

The logic of the inheritance tax (as opposed to a wealth tax, say) is to level the financial playing field for new generations. The survey evidence presented in Chapter Two shows that the French dislike inheritance taxes but are ethically conflicted in their assessment: A large

[1] In Finland, teachers are municipal civil servants. Employment protection is legally very similar to that of permanent employees, but in practice it may be higher. Dismissed teachers can appeal on the same grounds as employees, but disputes are handled by administrative courts rather than the ordinary courts. But other approaches can be contemplated. For example, the recruitment of new staff on indefinite contracts under private law rather than under civil servant status, as was done for La Poste and France Télécom, should be explored. Those on the new permanent contracts would receive a higher salary and existing teachers, whose civil servant status would be preserved, would be able to opt for the new status. They would then be subject to the new contractual terms and conditions, and retraining could possibly be offered to them if necessary. It may also make sense to pay more for math and science teachers, who are more difficult to recruit.

majority feels that parents are entitled to bequest their hard-earned wealth to their children without incurring a tax for the transfer; at the same time, however, most people feel that allowing inequality at birth through different endowments is unfair. While these beliefs exhibit an obvious tension, they reflect a demand for equal opportunity. This suggests a direction for reform. This logic of equal opportunity implies focusing not on people who give, but on people who receive, the tax base should be how much the beneficiary receives in total, "hard earned wealth" should be largely protected, through a relatively high exemption threshold, and tax revenues could be explicitly allocated towards redistribution.

This is not the case today. First, the inheritance tax is donor-based rather than beneficiary-based. For example, the tax rate is lower if the beneficiary inherits from two persons (say, the two parents) than if he/she inherits the same sum from only one (say, a single parent). Yet, consistent with popular preferences, it is not how much is given, but how much is received that counts for equal opportunity. The second violation is that the tax code allows for exemptions every 15 years, and so benefits donors and beneficiaries who are knowledgeable and can plan long in advance relative to those who do not; the logic here is to take into account the sum of donations over lifetime in the computation of the tax.

Chapter Two's recommendation that beneficiaries be taxed on the lifetime income they receive from donors is appealing; we endorse it subject to the same caveat that is added by the authors: we have little evidence on the actual implementation hurdles (the only European country having adopted this approach is Ireland, where the total of all the gifts or inheritances received throughout lifetime – over €335,000 for parent-child transfers – is the tax base).

This intergenerational transmission of wealth is far from negligible. The ratio of yearly transmissions (gifts and inheritances) to yearly disposable income is estimated to be 19% and is forecast to increase to 25% to 32% by 2050. It is, not surprisingly, higher for higher income groups. Despite high tax rates[1] however, the inheritance tax represents only 1.2% of overall tax revenues: In reaction to the unpopularity of the inheritance tax, the French legislator reacted not by changing rates or the progressivity of the inheritance tax system, but by creating loopholes and exemptions, a familiar French disease. We do not see how fairness is improved by encouraging savvy households to engage in tax optimization. The chapter points for example at the treatment of life insurance policies (with an exemption capped at €150,000 per beneficiary and given preferential rates above that threshold).

Despite the commission's push for better rather than higher taxes, we suspect that even "better" inheritance taxes will remain unpopular. Two policies may help reduce the disconnect between perceptions and the commission's recommendation:

[1] France has the 3rd highest top rate on inheritance to children in the OECD (45%), behind Japan (50%) and South Korea (55%).

Regardless of one's ethical views on taxing inheritance, we should all agree on the need to make it fair, that is based on what is received by the beneficiary. Making it focused on the beneficiary is also the only way to make it truly progressive. This requires moving away from donor-based taxation and eliminating the loopholes. The emphasis on equal opportunity that is implicit in a beneficiary-based, no-loophole system may help make the tax more legitimate. One can argue about tax rates, but not about features that make the tax random or subject to gaming. To reflect the legitimate concern about being able to pass on "hard earned" wealth, the threshold for taxation should be high. Consultations with citizens and public discussions of the matter might contribute to lowering the unpopularity of the tax.

To further emphasize its redistributive role, it may make sense to violate the principles of public finance and to allocate the inheritance tax revenues explicitly to financial redistribution that fosters equal opportunity. Without pushing any action specifically, this earmarking could go to the creation of individual accounts that the disadvantaged young could spend to avoid having to work while studying or training, or to financial accounts that disadvantaged kids could access when becoming adults; alternatively, it might finance early childhood programs.

This being said, the issue of tax avoidance is a serious one. Taxpayers can patiently give money to their children (for smaller amounts); and they can move abroad (for larger amounts). There needs to be more work as evidence is extremely scarce on these issues; and there is barely data on core descriptive statistics on inheritances and wealth for France.

4. Post-production Stage Interventions

(Because some of the production stage policy proposals are the most controversial, we have put a discussion of these policies last.)

All taxes and transfers have redistributive aspects and thus affect inequality. A discussion of the overall French tax/transfer system, considering its implications for inequality, would have gone far beyond what the commission could do. What makes the issue complex is the potential tension between efficiency and distribution. Efficiency suggests taxing factors which are less mobile, leading to fewer distortions; the quintessential example is the taxing of pure rents. But taxes, and transfers even more so, have distributional implications. The example of a tax on real estate is revealing in this respect. The value of real estate reflects mostly the value of the land, an immobile factor. From an efficiency viewpoint, the tax creates few distortions. But the tax also falls largely on the middle class, households for whom real estate is the main source of wealth. What the right tax rate should reflect the

trade-off between efficiency and inequality, and in turn reflect society's preferences.[1] Economists can point to the trade-offs, but policy makers must decide where to put the needle.

What we could do however was focus on parts of the tax/transfer system where taxation could be done better. For that reason, the authors of Chapter Two decided to focus for the most part on the treatment of capital income, where there is room for improvement.

Capital is mobile, labor much less so. Governments have found that, when they tried to tax capital, capital fled, and high tax rates often led to low tax revenues. This is why recent reforms in France have narrowed the capital-taxation gap with abroad. But the result of tax competition between countries has been a combination of low tax rates on mobile capital and a race to the bottom. Countries have tried to attract mobile capital, kept high tax rates on the less mobile parts, allowed for many loopholes and exemptions, and faced high both legal and illegal tax avoidance.

The challenge is thus to have better capital taxation, i.e. lower tax rates but higher tax revenues and fewer distortions. Progress has been made in France in the recent past. For example, some of the extremely high tax rates on capital, which sometimes exceeded 100%, have been eliminated. The introduction of the *Prélèvement forfaitaire unique* (PFU), also called "flat tax", has put a ceiling on marginal tax rates on capital income, reducing distortions.

However, more can be done thanks to technological progress, information sharing, and emerging international agreements.

Technology. Two strategies that may foster increased compliance include data analytics and third-party reporting (third-party reporting already exists for salaried work or for the VAT). An example of progress in this direction is the proportion of controls targeted by artificial intelligence and data-mining algorithms, which is expected to reach 30% in 2020 and is targeted to reach 50% in 2023. Such compliance-increasing schemes not only raise tax collection, but also promote fairness (rather than a society in which the scrupulous pay more taxes than the opportunistic) and finally redistribution: To quote from the authors: "While regular workers are mostly the recipients of wages and employee income that is third-party reported, higher income individuals receive much more of their income in the form of capital gains, dividends, rental income, and proprietorship or business income. These forms of income have much higher rates of non-compliance."

[1] Although we realize that it is prominent in the French political debate, we do not provide a detailed discussion of the wealth tax (*impôt de solidarité sur la fortune*, ISF) for several reasons. First, its magnitude (the cost of the switch to the *impôt sur la fortune immobilière*/IFI is estimated around €2 or €3 billion per year) is minuscule relative to the sums involved in any of our three challenges. Second, the evidence on the effects of a wealth tax – in terms of the trade-off between efficiency and redistribution just mentioned – is limited. Third, the consistency of a wealth tax with the points on capital taxation and the inheritance tax developed in Chapter Two requires further study.

Information. One key here is automatic exchanges of information among countries. France should keep playing a major role in promoting such exchange and stress the need for a broader exchange including all classes of assets, including real estate and private business assets (the current EU regulations have a broader scope than the OECD's and already include some non-financial assets such as immovable property).

International agreements. The commission is highly supportive of the Base Erosion and Profit Shifting (BEPS) initiative by the G-20 and the OECD.[1] Many multinationals choose to declare profits in low-tax countries, no matter where they actually set their products. The first pillar of BEPS attempts to redistribute in part taxing rights among countries away from residence and physical presence (ownership, production facilities and employees) to include the demand-side (sales, revenues and customers) dimension. The second pillar is aimed at reducing tax competition by giving countries the right to "tax back" in cases where other jurisdictions have not ("sufficiently") exercised their primary taxing rights; if not agreed to, an alternative could be an agreement on a minimal tax rate to avoid a race to the bottom. Finally, and importantly, the taxation of multinationals should include all industries, and not only digital firms.

International coordination would also be desirable on the household income front. To quote from the authors: "Preferential tax regimes for foreigners are widespread. As a result, in many countries, the top tax rate for foreign high-income earners is below that for domestic high-income domestic earners." Of course, different countries may legitimately have different preferences with regards to tax rates; but reducing, sometimes considerably, income taxes on mobile high talent does not work towards more equality and is hardly justifiable by efficiency considerations at the global level. An example close to us is the extremely generous tax treatment for Italian professors abroad if they come back to Italy. A discussion of this matter should be undertaken, at least at the European level if not more broadly. An alternative, in use by the United States, is to make French citizens living abroad subject to French taxation (in excess of what they have to pay in the country hey are living in), at least for a number of years.

These changes will not by themselves eliminate all the loopholes that limit the tax system's efficacy and fairness. The difficulty here lies beyond the temptation for policy makers to condemn tax loopholes in general but introduce new ones to please constituents. Some loopholes actually have efficiency rationales, such as the regressive exemptions on services to individuals, meant to prevent moonlighting; or the Plan d'épargne en actions (PEA) which provides tax relief for returns on financial market investments up to €150,000

[1] This was written before President Biden's endorsement of a minimum capital tax of 15% worldwide, thus reinforcing the OECD approach. While the fairness of the breakdown of its proceeds among countries and the presence of exemptions will have to be monitored, the willingness to limit tax competition among countries is excellent news.

(and somewhat offsets the strong French preference for investing in safe life insurance *fonds en euros* over investments in the productive assets that will contribute to growth). But many loopholes have neither redistributive nor efficiency rationales. For instance, empirical work has repeatedly shown that real estate subsidies – such as the *loi Pinel*, tax exemptions on the principal residence, rental subsidies – benefit mainly property owners by raising real-estate prices and rentals in city centers and do little for their intended beneficiaries. Put differently, the redistributive impact could be much higher if the public funds were used differently.

Accordingly, a process should be put in place that assesses and reconsiders various tax exemptions. For example, by setting up an economics commission that would define and track loopholes and issue public recommendations to the government and the Parliament. The challenging part is to make sure that its recommendations do not go unheeded.

5. Production-stage Policies: Fitting Skills to Technology and Technology to Skills

Both technological progress and trade have profound and complex effects on the structure of production, and by implication, on the job distribution. Sometimes, technological progress substitutes capital for labor, leading to the elimination of low-skill jobs or even middle-skill jobs with a large repetitive component. Sometimes, it acts as complement to labor, allowing low-skill workers to achieve more complex tasks, or allowing middle-skill workers to do what previously were high-skill jobs. For example, nurses and emergency medical technicians may perform tasks that are today the prerogative of physicians, increasing the demand for middle skills and reducing that for high skills. Although we can assess which types of jobs have been transformed or eliminated so far, it is harder to foresee the longer-run impact from technological change on the job distribution.

Trade creates jobs in export industries, but it also leads to the closing of firms in sectors exposed to imports, and the disappearance of some low-skill and middle-skill jobs. Perhaps because job losses (which have a face) are more salient than job creations (which do not), but also because new job creation does not necessarily occur where jobs have been destroyed under the pressure of foreign imports, polls show that trade is perceived by workers as the main culprit in the loss of middle-skill jobs. In our survey, 57% of respondents thought of outsourcing and globalization as the main cause, and only 28% blamed technology. Most economists by contrast have concluded that skill-biased and routine-biased technological progress is the more important factor.

The traditional policy approach has been to take these technological and trade evolutions as given, to try to train workers for the existing jobs, and help the unlucky workers adjust to the disappearance of their jobs through unemployment benefits and retraining.

The question the commission debated is whether policy should be more ambitious in two ways: First, by trying to affect the job distribution itself by giving incentives to firms to make more jobs good jobs, and to adopt technologies that complement rather than substitute for labor; and second, by putting restrictions on trade to prevent good jobs from migrating to countries which do not have labor protections comparable to those of France or other developed countries.

5.1. Training workers

There is no question that preparing workers for the best jobs they can get and helping them to fill those jobs are essential. The set of programs that do so goes under the name of active labor market policies (ALMPs), ranging from skill training, to employment subsidies, to public sector work, and to assistance with job search and matching.

The evidence on the impact of these programs is mixed. Sectoral training programs, when well designed, have proven the most useful. The evidence is that the most successful programs have been those which were most employer-focused. The experiences of Germany, Sweden, Luxembourg, and Switzerland described in Chapter Two, all show how closer interactions with firms, in the design of jobs by the firms and the design of training by the programs, can lead to more successful outcomes. A much-studied program is the QUEST program in Texas, focused on jobs rather than just good jobs and with exceptional outcomes (estimated increases in annual wages of $3,000-6,000 at a one-time cost of $5,000-10,000). Based on that evidence, we believe that Pôle emploi would benefit from closer contact and interactions with private-sector employers and use the information to better serve both employers and jobseekers.

France has just embarked on a major reform of professional training. First, by creating a personal training account (*Compte personnel de formation*, CPF); second, by creating a new structure to coordinate, fund and certify vocational training (France Compétences). This is potentially an important progress, although the jury is still out. In particular, compared with the current situation, key challenges for France Compétences will be: to reduce the excessively large number of training providers; to provide training seekers objective information on the value of available courses; to carefully certify training programs; and to direct training seekers towards actual jobs and those more in need of training. Singapore, which has a list of certified providers that citizens can finance with their personal training account, and Germany are good examples to study.

We believe that there are three ways in which the workings of Pôle emploi and France Compétences might be further improved. First, by having the two institutions work together more closely to identify the needs of firms. Second, by being more proactive in assisting workers at risk because of anticipated company reorganizations. Third, by exploring with

firms how to design jobs and job career paths to make them more attractive to workers. Again, much is to be learned from what other countries have done.

We have focused so far on improving the training of workers. Another lever is to give workers and firms additional incentives to respectively get and give such training. Here, France faces a problem due to its generous tax-transfer structure. The combination of a negative income tax, direct subsidies to employers for low-wage workers, and large reductions in employer social security contributions (SSCs) at the bottom have both decreased the cost of low-skill workers for firms and increased the income of low-skill workers. This explains in part why post-tax poverty rates are low in France and it is clearly good news. But these various reductions, as well as the disappearance of housing allowances, exemption from income taxation and workfare (*prime d'activité*) are phased out as income increases and disappear for wages around 1.6 times the minimum wage. The result is very high effective marginal tax rates for workers earning close to the minimum wage, giving them few incentives to get better jobs and, symmetrically, making it expensive for firms to give workers additional skills and move them up the job ladder. This suggests areas for reform.

One obvious possibility is to make the phase-out happen over a wider wage range, but this can rapidly become expensive for the state. Another is to provide specific incentives for firms to offer training, and for workers to acquire training.

On the firm side, a possibility to counter the insufficient incentive for training is to condition receipt of the SSC reduction on the provision of qualification training. The firm could top up the worker's personal training account. This top-up would thus be integrated within the overall reform to training of low-skill workers and should satisfy the requirement for some nationally accredited vocational education. Qualifications would have to be fully certified and tailored to local sectoral needs. Conditioning receipt on the provision of such training would raise the cost of employment, part of which may have to be offset, suggesting some sharing of the top-up between the firm and the state. To the extent that, more recently, it is also older lower-skilled workers that have been supported by reduced SSCs and other subsidies, it could also align with the policy suggestions in Chapter Three on demography for improving training and job opportunities for older workers.

On the worker side, similar incentives could be given to acquire training, for example in the form of grants, or loans partially forgiven if the funds are used for training. Here, the experience of other countries is again useful. In Norway for example, each student receives a loan of €1,150 a month, with reimbursements conditional on future income, but with the debt obligation being reduced with student performance and the timely obtention of diplomas. It would be worth thinking about how to design a similar policy for young workers. Finally, if our suggestion to dedicate inheritance taxes to training or education accounts for the young was followed, the two could indeed be combined.

Well-designed labor market policies also have the potential to promote good jobs. In particular, experience rating ("bonus-malus" in France) makes employers accountable for the consequences of their layoffs while providing them with flexibility to adjust their labor force to economic shocks. They thereby mitigate the harmful duality between precarious jobs ("CDD"), which are short-lasting, and overprotected jobs ("CDI"), that are longer lasted but in short supply as firms are concerned that they will not enjoy enough flexibility if they face demand or cost shocks. In France, workers on short-term contracts have limited prospects in the firm (their contract cannot be renewed repeatedly without being transformed into a long-term contract) and receive no training because they are "disposable workers". For such workers, experience rating, to the extent that it increases tenure, contributes to good lives, if not better jobs; and it also gives firms incentives to invest more in their workers, and thus to improve jobs. Interestingly, French workers on long-term contracts report often suffering from anxiety and are sometimes bored in their job: because it is hard to find such jobs, such workers often cling to their job, hoping that it will not be suppressed, and they cannot take on some new challenges elsewhere. There have been recent efforts (2019) to create experience rating in France. Typically for France, many exemptions have been created (it applies to only 7 industries), and, where it applies, the incentives thus created are still too small. But this is a useful start and the reform should be driven home.

5.2. Improving the number and quality of jobs

There are two related issues concerning the supply and the nature of jobs.

- The first is that, with artificial intelligence and robots, some jobs considered as good jobs risk being destroyed at an unprecedented pace in the years to come. Any transition is costly, and this one may be particularly so due to its scale and speed.
- The second is that workers who hold those jobs are exposed to downward social mobility. Although we cannot predict well the consequences of the forthcoming technological upheaval, there is a substantial probability of further increase in polarization (the gradual disappearance of the middle class, the barbell tilting in favor of high skills and against low skills). The disappearance of good jobs has, as detailed in this Chapter Two, led distressed communities to experience serious health and crime problems, generating despair and a rise of populism.

As stressed by the authors of Chapter Two, the current policy framework presumes adjustment by workers and their skills to new technologies and leaves aside an adaptation of technologies to the labor force. Technological progress and especially adoption are not, however, exogenous processes that a country must take as given and adjust passively to. Firms have a choice as to how they organize internally, how they set up job ladders, what technological choices they make, what machines they choose. The issue is whether and how policies can be used to bend those decisions and lead to more good jobs.

To be certain, such bending may increase production costs and lower the consumers' purchasing power. As in the case of climate change, though, one may conclude that it is worth incurring a cost in our standards of living to foster a better "environment", in this case a more equal society. Put another way, one may argue that the prioritization of consumer needs over worker welfare has gone too far and should be corrected. The choice must be left to society and to its representatives rather than to the experts. But experts can explore the nature of the trade-off, and this is what the authors of Chapter Two tried to do, and what led to an intense but useful discussion within the commission.

One can think of two approaches. The first is to decrease the cost of labor across the board relative to the cost of capital, either through changes in taxation or changes in labor market regulations, leading firms to adopt more labor-friendly technologies. This raises however larger issues about the relative taxation of capital and labor and about labor market regulations, with their many other desirable or less desirable effects. The second is to do more targeted interventions, and this is what Chapter Two focused on, and what we now turn to.

R&D, technological adoption, and (good) jobs

The authors suggest several ways in which progress could be made. They propose a specific structure to lead firms to supply more good jobs: "Regional Business Bureaus" (RBBs). The RBBs would engage in a dialogue with local firms to provide a portfolio of services or prospective investors to assist them to offer more good jobs, by redesigning work, offering a higher probability to move up within the firm. They would add to the usual list of criteria for investment subsidies a criterion based on the firm's expected job quality performance; and they would monitor the outcome. The authors emphasize the need for not adding another big institution to the existing ones, that would increase the already high bureaucratic burden on firms; they accordingly stress the obligation to investigate the best reorganization of work among financiers (BPI, localities, regions), employment services (Pôle emploi), and training institutions (France Compétences) to achieve maximal efficiency for the RBBs.[1]

Similarly, the authors of Chapter Two propose that innovations that are compatible with (good) jobs be incentivized. Accordingly, the authors recommend that a "prospective employment test" be applied to determine public spending priorities for innovation. Currently, R&D subsidies and programs are often targeted toward specific sectors (for example, batteries, or more generally green technologies under the EU green deal), but do not reflect the impact of these technologies on jobs. This impact, when it can be assessed, could be taken into account. Conversely, equipment and innovations that destroy jobs would be taxed

[1] It is worth noting that Pôle emploi has moved in that direction already. More than 5,000 counsellors have as their primary charge to build relations with firms, helping them define jobs and find applicants.

or deprived of access to R&D subsidies. The difficulties here should not be underestimated. Take for example the proposal to "tax robots". Are robots physical machines or also software? Both can eliminate jobs. If robots destroy jobs in one firm but increase its productivity and thus decrease costs in other firms, they may lead overall to an increase rather than a decrease in jobs. Empirical evidence on both the direct and indirect effects of automatization on employment is just starting to be collected. Initial results are mixed.[1]

Chapter Two recommends a series of softer interventions, meant to persuade firms and researchers to be more aware of the implications of their investment and research on worker welfare. This includes raising awareness and consulting workers when firms contemplate organizational design, and making for example AI researchers more sensitive to the implications of their work (as was the case for researchers involved in controversial defense projects). The overall strategy is to combine a norms-based intervention with material incentives to implement the required change.

Trade and (good) jobs

When technology is incentivized toward a (good) jobs approach, then, by definition, policy makes a difference whenever the firm would otherwise have reduced its costs at the detriment of jobs. At the aggregate level, a good-jobs policy will likely increase domestic production costs even if consists in subsidies, as these subsidies must be financed through taxes on production either on beneficiaries or elsewhere. One risk then is leakage, just as in our discussion of the imposition of carbon taxes in Chapter One on climate change, namely that cheaper, non-labor-intensive products be imported from other countries. Should there be restrictions on trade (at the European border, as the single market prevents raising barriers to trade within Europe)?

As politically popular as they may be, general trade restrictions whenever good jobs may be lost would be counterproductive, even if the goal is to save good jobs: Such restrictions would lead to retaliation, and the loss of jobs, possibly good jobs, elsewhere in the economy. But what the survey evidence shows that part of what is behind anti-trade sentiments is a sense of unfairness, that competition and trade are not fair if the other country's competitive advantage is built on weak regulations to protect labor.

With this is in mind, the authors propose a two-fold solution. First, at the national, or preferably at the EU level, discussions would be organized among stakeholders, producers, and consumers: Is there a case strong enough to bring to the WTO? While it is

[1] See the different conclusions reached by Aghion, P., Antonin, C. Bunel, S., and X. Jaravel (2020), "What are the labor and product market effects of automation? New evidence from France" (*CEPR Discussion Paper*, No. 14443, March), versus Acemoglu, D. Lelarge, C. and P. Restrepo (2020), "Competing with robots: Firm-level evidence from France" (*AEA Papers and Proceedings* 110, May, pp. 383-388).

difficult to aggregate the votes of those who gain (say, workers and investors in import-competing industries) and those who lose (say, workers and investors in export industries, consumers) from trade restrictions and some groups might be more vocal than others, such a consultation might develop better societal understanding of the relevant trade-offs. If the case is deemed worthwhile, it is then sent to the WTO, which decides whether to accept the charge of "social dumping" as a rationale for the imposition of anti-dumping duties on the country charged with the violation.

The obvious and difficult question is where to draw the line in deciding what unfair trade based on social dumping is. The authors suggest that child labor, forced labor, dangerous and unhealthy working conditions, or the violent repression of labor rights, be included in the definition of social dumping, but not low wages, which would open a Pandora's box on how many jobs in poor countries are worth a job in a rich one.

Can it be done?

The commission agreed on the devastating effects of job and status losses on distressed communities, and the need to think about good jobs in general. The debate was about whether the theoretical recommendations could be made operational.

While the (good) jobs approach is theoretically sound, its implementation clearly requires addressing difficult challenges.

Direct approaches, such as reduced taxation of labor and better ALMP, are non-targeted policies, as are a variety of other public policies (R&D tax credits, experience rating, carbon tax, most Covid-19 related policies such as furlough schemes or credit guarantees…). The benefit of such policies is that they do not require fine information about technological and financial idiosyncrasies of firms; relatedly, they create no scope for favoritism, quid-pro-quos, and similar abuses of public policies. Their cost is that their lack of targeting creates windfall gains for those firms which would have done the job (keeping workers, reducing pollution, etc.) even in the absence of incentives.

Industrial policies in contrast try to use fine information to favor the worthiest beneficiaries (firms, industries, technologies). An "additionality criterion" (already discussed in the context of climate change) is often introduced to avoid windfall profits: It is then required that the beneficiary would not have adopted the proposed policy in the absence of incentive.

The limits to industrial policy, i.e. more targeted intervention, are the need for fine information and the design of a governance ensuring integrity in the awarding process. Focusing on bending innovation and technology adoption, informational requirements include: (i) whether the technology is a complement or substitute for jobs (in some cases, the answer is simple: thermal retrofitting is more labor intensive than the installation of wind farms); (ii) whether, even if the technology is a substitute for labor and destroys good jobs

in the firm where it is introduced, the increase in productivity may decrease the costs of other firms, leading them to expand and create good jobs elsewhere (iii) whether projects are additional (which require contemplating a counterfactual and is complex as shown for example by the experience on Kyoto's Clean Development Mechanism).

In the special case of good jobs, one must further specify an operational definition of a "good job". What we learned from the commission's survey is what workers think constitute a good job. The notion of "responsibilities", "promotions", "decent working environment", "good benefits" are not easy to evaluate and quantify; some are manipulable by employers through job relabeling. "Pay progression" is easier to measure but, if it conditioned subsidies, would lead to more backloading of compensation, with adverse consequences for the young (low wages, job immobility). A "reasonably long tenure" is subject to relative (job and sectoral) interpretation. Hopefully, future research will refine these notions and their measurement. It will also have to attribute weights on the various characteristics: as most jobs do not offer all attributes, trade-offs will have to be contemplated. Jobs at MacDonald's certainly do not tick all boxes, but they offer more opportunities for promotion than many other jobs.

Expertise and integrity go hand in hand with the choice of governance for agencies in charge of industrial policy. Here again the practice of the French administration must be benchmarked against the best practices in the world (DARPA in the US for instance; see our discussion of climate change). These agencies must be led by managers who are accountable for their performance, enjoy much discretion and are protected from political interference. They must be agile, define goals instead of selecting specific means of achieving these goals, refrain from sprinkling the money, and able to interrupt non-performing projects (not always the characteristics of such agencies in France). They must also involve the private sector. They must hold the beneficiaries of public funds accountable in case they do not deliver what they promised on the job front. Transparency, although desirable, is a very insufficient rampart against arbitrariness, given that the citizens have no information regarding the choices and especially no personal interest in delving in the details of such decisions.

Some commission members made the point that, even if these measures are taken and are successful, many jobs cannot easily be turned into "good jobs", raising the question of what can be done for these "bad jobs". For those jobs, other avenues, higher financial compensation (as in the case of care to the elderly), must be explored. In this context, an issue which was not taken up in Chapter Two but has figured in many popular discussions is the potential introduction of a universal basic income (UBI). We (the two rapporteurs) do not favor the creation of a universal basic income. Our reasoning is straightforward. We believe that there are enough potential jobs for all workers, skilled, or unskilled. It may however be that some of these jobs have low productivity and thus will be offered by firms only if wages they must pay are sufficiently low. Indeed, it may be that these wages may

be below what is considered living wages. We believe that the solution in this case is a combination of a low minimum wage and a negative income tax *prime d'activité*, in France). The low minimum wage allows these jobs to exist; the negative income tax can ensure that workers still earn a living wage. This may however be expensive for the state to provide, thus providing an additional incentive to transform as many jobs as possible into good, or at least better, jobs.

Finally, the multilateral approach to defining, and dealing with social dumping raises more broadly the possibility of agreements on labor standards. The contours of such standards require further thought. While we favor a multilateral approach, there are also weaknesses. While many countries share concerns about the effects of trade on good jobs, they may not be able to agree on enforceable labor standards in trade agreements for good (difficulty in specifying what is social dumping) and bad (beggar-thy-neighbor) reasons. And in the developed world, the reluctance to go in this direction may not stem from the United States and China only; a case in point is ILO's various labor regulations, that France has shown more eagerness to ratify than all but one country. A related issue is that the single market requires an agreement among European nations; imposing constraints on French firms might jeopardize jobs if some other member states objected to the trade policy.

To end this part: We should be clear. There was wide agreement among the commission that pre- and post-production redistribution, with an emphasis in particular on education and professional training are essential. But there was also wide agreement that there are limits to pre- and post-production redistribution, and that one should explore whether production and trade can be organized differently. There is a high probability that technological change and globalization will continue to exacerbate inequality and hollow out middle-skill and middle-income jobs. We think it is important to open the discussion, and to put several ideas on the table. We realize that they are not ready for use but hope that they will lead to more exploration and the adoption of new policy tools.

SECTION 3

DEMOGRAPHIC CHANGE: AGING, HEALTH AND IMMIGRATION

Underlying Chapter Three written by Axel Börsch-Supan, Claudia Diehl and Carol Propper

Just as with inequality challenges, demographic challenges are multidimensional. Again, we had to pick and choose among them. We decided to focus the work of the commission on two of them. The first and main one is the implications of aging and its connection to health. The second is immigration, or more precisely, immigrant integration in the labor market. We realize there are many others, such as whether demographic evolutions are an important factor in explaining low interest rates, and therefore what the future may hold, or gender differences between men and women in the labor market, and so on.[1] The only excuse for not treating them was the need to narrow our scope.

That France is aging is too often perceived as bad news. It should not, for it reflects for the most part a major societal achievement, namely a steady increase in life expectancy together with an increase in the quality of life in old age. It is thus fundamentally good news. It requires however adjustments in the way life is organized, the main one being maintaining the right balance between work and retirement. For countries such as France which rely on pay-as-you-go social security, longer life expectancy implies either a

[1] We did not in particular consider the wider theme, dating at least back to Alfred Sauvy, that aging societies are less dynamic in many dimensions, economic, sociological, political. While economic research on this issue is limited, macro-economic research has not found much relation between productivity growth and demographics (for example, Acemoglu, D. and P. Restrepo [2017], "Secular stagnation? The effects of aging on economic growth in an age of automation," *American Economic Review* 107, No. 5 [May]: 174-179, and the conclusions of micro research, discussed in the text, are that productivity does not seem to decrease with age until at least 65).

decrease in benefits, an increase in contributions, or a higher retirement age.[1] This choice cannot be avoided.

Because overall social security contributions are already very high in France, we believe that the adjustment should come through a combination of an increase in the effective retirement age and a relative decrease in benefits, with the priorities depending on current circumstances. This involves rethinking the pension system.

Pension reform should satisfy four goals.

- The pension system should be unified, to become more transparent and fairer.
- It should allow for individual flexibility in the choice of retirement age versus the level of retirement benefits.
- It should recognize the large differences in life history and life expectancy across workers.
- Finally, it should be flexible enough to maintain financial balance, now and in the future, by balancing adjustments between retirement age and retirement benefits, so as to reflect societal preferences in response to macroeconomic and demographic evolutions.

What should be done must not however be reduced to a series of technical changes in the rules of the retirement system. Like the inequality and climate challenges discussed in Chapter One and Chapter Two, and to the extent that demographic evolutions require a longer working life, this requires a holistic approach (an expression we use in all three chapters), i.e. a larger set of measures making it more attractive for firms to keep older workers and for older workers to be willing to work longer. This implies, among other things, changes in the organization of firms and how they treat older workers, more professional training for middle-age and older workers, and a focus on the prevention and the treatment of chronic illnesses.

To anticipate our conclusions:

- We agree with the Delevoye report and the subsequent proposed law that a prerequisite is a rationalization of the existing system. Once this is done, there are various ways to introduce flexibility, to account for differences in work histories and life expectancies, and to achieve the goals above.

[1] With a few exceptions, we use “retirement age” for “claiming age”. This is standard usage. But the two actually differ in France, where, because of various pre-retirement programs, the average retirement age is roughly one year less than the claiming age.

- For the sake of concreteness, we propose a specific set of reform measures, which builds on and enhances the existing retirement reform project. It is based on an easy to understand point accumulation system; a retirement window with an earliest retirement age; benefits that increase roughly actuarially neutrally if workers prefer to retire after the earliest retirement age; a system of point adjustments for low-income workers that gives them a decent pension even if they stop working at the earliest retirement age. We believe that such a pension reform, plus measures to increase both the demand for workers by firms and the willingness and the ability of older workers to work longer can allow for a smooth and fair adjustment to demographic changes.

- We could have extended our focus to look at not just the participation rate of older workers, but the participation rate of workers of all ages. A general increase in the employment rate would increase the tax base of contributions and facilitate the adjustment. Lowering the average unemployment rate, which is high in France, would go some way. We decided not to discuss the issue of what lies behind the high average unemployment rate in France and what policy measures should be taken, as this would require another report. We decided however to focus on one striking characteristic of the labor market, namely the low labor force participation of immigrants. Better integration is obviously essential for many reasons, but it is also of relevance for retirement reform. We see this as a major issue, which should be given higher priority by the government. We propose several measures, none of them particularly new, but all of them probably needed to lead to better integration.

1. Facts and Perceptions

France is aging. The demographic dependency ratio, defined as the ratio of those over 65 to those between 15 and 64 years, which is equal to 33% in 2020, is expected to increase steadily, to reach 45% in 2040. The good news is that it is primarily due to an increase in life expectancy, together with a temporary bulge reflecting the aging of the large baby boom generation, rather than to a decrease in fertility. Fertility in France, at 1.9, is close to the replacement level.[1]

Public pension expenditures are high, equal to 15% of GDP according to the European Union definition, 50% higher than in Germany. Italy, the only EU country with a higher ratio, at 15.6% of GDP, has a much older population. The French pension system is more generous than that of comparable countries such as Spain, Italy, or Germany. Due to high

[1] The fertility rate has decreased since 2014. It is too early to say whether this is a permanent or a temporary decline.

benefits and early retirements compared with other countries, the average contribution rate (the levy on employees and employers) dedicated to pensions is high, 27.5% of earnings, and can be much higher for those with high earnings. The system is nearly balanced, with a small deficit in 2019 (the deficit is expected to be larger in 2020 and 2021 because of Covid-19).

One issue we would have had to discuss in the past is whether the system should build a substantial trust fund and move from a pay-as-you-go system to a partially funded one. The argument used to be that such a fund would increase national saving, and thus increase capital accumulation and output. This discussion made sense when saving was perceived to be too low. It does not make sense in the current environment in which the current interest rate is very low, reflecting an incipient excess of saving over investment. Additional saving would lead to an even lower rate, and if monetary policy were constrained by the zero lower bound and could not implement such a low rate, would lead to a deficiency of aggregate demand and higher unemployment. Furthermore, moving toward a funded pension system would impose a “double whammy” on current French workers, who would have to pay the pensions of their elders, in this case the unusually large generation of baby boomers, as well as part of their own pension, a costly transition for a generation facing more job insecurity than in the past (the aftermath of Covid-19 crisis in the short term and AI and robot revolution in the medium term).

The issue we must discuss however is whether the system will remain in balance in the future, or whether structural adjustments are needed to achieve it. There is no question that past reforms have improved the financial outlook substantially. The latest report from the Conseil d’orientation des retraites (COR) concludes that the share of pension expenditures in GDP will actually decrease slowly over time. Using their methodology (which gives a slightly lower ratio of pension expenditures to GDP than the EU number cited above), and their most pessimistic assumption about productivity growth, i.e. 1%, the ratio of expenditures will decrease slightly, from 13.6% in 2019 down to 13.4% in 2070, this despite an increase in the demographic dependency ratio (defined here as the ratio of people 60 and over to those between of 20-59) of 37%.

There are however two reasons to believe that this forecast is too optimistic.

The first is that even the COR most pessimistic assumption about productivity growth, 1% per year, may still be too optimistic. Over the last 15 years, productivity growth has been only 0.7%.[1] The reason productivity growth matters is that, in the current system, revenues

[1] Projecting productivity growth is very hard. It is worth remembering that the cross-decade correlation in productivity growth rates is around 0.1 to 0.3. See Easterly, W., Kremer, M., Pritchett, L. and L. Summers (1993), “Good policy or good luck? Country growth performance and temporary shocks,” *NBER Working Paper Series*, No. 4474, National Bureau of Economic Research.

grow at the rate of wage inflation, while expenditures grow at the rate of price inflation. The higher the rate of productivity growth, the larger the difference between wage and price inflation, the more favorable the system's financial balance. Symmetrically, the lower the productivity growth, the worse the system's financial balance. (This dependence of the financial balance on difficult-to-forecast productivity growth in the near and distant future is undesirable. One element of our proposal is indeed to eliminate that dependence and the associated uncertainty by letting benefits be indexed by wage inflation. Details on this later.)

The second reason is related to the first. The way balance is maintained under the COR simulations is through the role of price indexing in both the determination of initial retirement benefits and also benefits in payment, resulting in a decrease in average benefits relative to wages. What happens in the simulations is that the large increase in the dependency ratio (moderated only by a slight increase in the average retirement age) is offset by a large decrease in the ratio of benefits to wages. The COR simulations imply a decrease in the ratio of retirement benefits to wages of 20% by 2070. Even if one may want to reduce slightly the average income of retirees relative to the average income of workers (a ratio which is high in France), this strikes us as too mechanical and too extreme an adjustment, and more relevant perhaps, politically unfeasible since it brings very old retirees to an average very near to the poverty line.

Numbers on labor force participation of older workers in France are striking. The labor force participation rate for those between the ages of 55 and 64 is 56.2%, compared to a European average of 66.6%, with most of the difference coming from the participation rate of workers between the ages of 60 to 64. Most workers claim benefits at the age of full replacement rate, which is now 62. But many retire earlier, relying on various pre-retirement mechanisms, so that the average retirement age is 60.8 for both men and women. This compares to 65.2 for men and 63.7 for women for the OECD average.

Contrary to common perceptions, there is no evidence that decreases in productivity should motivate early retirement. Indeed, studies of the automotive and the insurance industries suggest that there is no evidence that productivity decreases with age until at least 65. On average, disability-free life expectancy at 65 is 10 years. Chronic illnesses are however an issue: 20% of those age 60-64 have at least two chronic conditions, with large disparities across income or education groups. Chronic conditions have a major impact on labor force participation: For the 50-64-year group, having a chronic illness multiplies the probability of being out of work by 3, the probability of being retired by 2, the probability of being unemployed by 1.5.

These large disparities extend to life expectancy in general. Life expectancies vary with gender, education, current income, wealth, health behavior, and genetics. A striking statistic of our report is the difference in life expectancies across income levels for example (income

not being necessarily causal but being largely an observable proxy for some of the underlying factors, type of job, etc.). At age 62, men in the lowest income decile have a life expectancy of 19.5 years, compared to 26 years for those in the highest income decile. Put another way, if these two workers retire at the same age, one of them can expect to live 6.5 years less than the other. Differences across income levels for women are slightly less dramatic, but still substantial, 5 years between the highest and the lowest income deciles.

2. A Holistic Approach

Start with pension reform. The detailed architecture of any pension scheme is complex, and the reader is referred to the underlying chapter for more details, more discussion of alternatives, and more discussion of the relation to the law presented by the government in January 2020. What we do below is give a sense of the main choices we recommend and their motivation.

2.1. Shifting from price to wage indexation, with a demographic adjustment

Any pension system has to weather various shocks: transient (such as the financial or Covid-19 crises, the consequences of the end of the baby boom), or long lasting (the increase in life expectancy, the advent of AI and robots and their implications for the labor market). Faced with such shocks, no system will be automatically watertight for many decades; but repeated pension reforms is not the way to go either. Some automatic adjustments are required to provide the system with some sustainability.

Another important point is that macroeconomic and demographic risks have to be borne by someone, either the pensioners through an adjustment in their benefits, or the workers through higher contributions or a longer working time, or both; there is no way out.[1]

In particular, faced with the increase in life expectancy, there are three ways of adjusting: higher contributions, lower benefits, or an increase in the retirement age. As we saw, the way it is forecast to happen under current law is mostly through a decrease in benefits relative to average wage, engineered through price indexation which automatically decreases the replacement rate over time by the difference between the rate of wage

[1] There is yet another possibility, which is that the system runs a deficit, and the burden is absorbed in the general budget, and thus eventually by current or future taxpayers. While the low interest rates raise issues about the scope for debt finance, we assume in this chapter that the retirement system remains balanced, and that the issue of debt finance applies to the rest of the budget.

inflation and the rate of price inflation, a difference which depends in turn largely on the rate of labor productivity.

There is a better way. We believe that the contribution rate, which is already very high, cannot be increased, and that the adjustment must involve nearly exclusively both replacement rates and retirement ages. We do not believe however that price indexation of benefits is the right tool to do it. It was useful in slowing down the growth of benefits, but it has three shortcomings:

- The first, which we discussed, is that because wage inflation is very likely to be higher than price inflation, reflecting the increase in productivity over time, it implies a steady decrease in benefits relative to wages, which, at some stage, becomes socially unacceptable.
- The second is that it makes the social security fund balance too dependent on the highly uncertain rate of productivity growth in the future, with a strange welfare implication: The higher the rate of productivity growth, the more the adjustment falls on the retirees through a decreased ratio of benefits to contributions.
- The third is that it makes benefits sensitive to the path of individual earnings. Compared to wage indexing, it penalizes early earnings relative to later earnings. There is no reason for that to be desirable.

Thus, we argue for the reintroduction of wage indexation – adjusted by the dependency ratio in a way described below – for both contributions and benefits, to achieve financial balance through more transparent, more predictable, and more fair adjustments.

To describe the architecture of the system we propose, we start by showing how the system looks to an individual worker, and then return to how best to balance the system as a whole.

2.2. A point system proposal

Transparency is important. We propose a point system which (leaving aside important adjustments for special circumstances discussed later) is straightforward:

- During their working life, workers receive points in proportion to their wage, for example 100 points if the worker's wage today is equal to the current average wage, 200 if it is twice the average wage, etc. Under some conditions, they also receive points when they are not working (as is already the case in the current system for maternity and other care, or unemployment). Determining the number of points as a percentage of the average wage ensures that early gains have the same value as later ones: for

example, receiving the average wage today or receiving the average wage 10 years from now gives rise to the same pension rights.

- Points are accumulated on an individual account over the entire work life until claiming a pension.
- At the time of claiming, the accumulated points are converted into an initial pension benefit, in proportion to the average pension benefit for that year. (As described below, low earnings may receive additional "bonus points" at that time.) A point gives a right to a certain number of euros (the "service value") annually. Each year, this service value is adjusted for all pensioners equally to take account of wage inflation and demographic changes, as described below. This implies that, if a pensioner has 1.2 times the average number of points of pensioners that year, then (s)he receives 1.2 times the average pension benefit; and that, each year, all pensioners have the same service value per point, whether they are 62 or 83 years old.
- Complementing pension income with work income is allowed past claiming the pension: someone in good health and still enjoying work contributes to society by continuing work. One can think of two fair arrangements here, one in which this additional work does not lead to more contributions or more benefits, or another in which additional work comes leads more contributions and thus more benefits.

2.3. Allowing for flexibility of individual choices

To allow for flexibility of individual choice, Chapter Three suggests that rather than set a retirement age, the system sets a retirement window, with an earliest claiming age, and possibly a latest claiming age.

- The earliest retirement age or earliest eligibility age (EEA) is the earliest date at which the worker can claim retirement benefits. It is the same for all workers.
- Workers who keep working beyond the EEA and do not claim benefits until later, keep receiving points for additional years worked and get the value of their points adjusted in a roughly actuarially neutral way, reflecting both their not-drawing on the pension fund in the meantime and the decrease in their remaining life expectancy at retirement. By "roughly actuarially neutral", we mean that the delay in claiming the pension makes the pension system roughly even.

Chapter Three does not take a position on whether there should be a latest claiming age. Conditional on the employer and employee both agreeing to continue the work relation, there seems to be little reason to impose a latest claiming age. But this may require

adjustments in the nature of employment protection legislation and employment contracts past the EEA.

2.4. Recognizing individual differences

A fair retirement system must recognize the fact that workers differ in many ways. Some have checkered work histories. Some have had painful jobs. Some have had low income and may have accumulated fewer points, and, as a result, may face old age poverty. Some have low remaining life expectancies. The question is how to deal with those differences in a way which is transparent, fair, and avoids abuses.

The easy part is checkered work histories and low lifetime income in general (and thus fewer points in the system we propose). Like the current system, the system can take into account periods of unemployment or maternity by providing additional points. To the extent that society wants the retirement system to be progressive, workers with low lifetime incomes more generally can get additional points.

The current system has a “contributive minimum” (this minimum pension should not be mixed up with the so-called “old-age solidarity allowance”, the latter being a means-tested social benefit, taking into account the overall income defined at the household level). Chapter Three suggests doing pretty much the same, but in a smarter way to keep some incentive for workers to accumulate points when the number of accumulated points is low. In the current system, workers in the bottom two income deciles receive a minimum pension (with the result that France has one of the lowest old-age poverty ratios). The existence of the threshold below which the pension is independent of income introduces an undesirable kink. Chapter Three argues that a better approach (or at least a complementary approach) might be to give additional points to the four bottom deciles of the income distribution, in a way that makes benefits grow with accumulated contributions even for low incomes (as is the case in some other countries).

This leaves the issue of different life expectancies. Those differ from many reasons, income, gender, education, penibility, genetics, health habits. As we saw, some of the differences are striking: Life expectancy at 62 for male workers in the highest decile of the income distribution is 6.5 years higher than for those in the lowest decile. Some correlates, such as income or gender, are observable. Some are not. Some, such as genetics, are given; some, such as the effects of smoking, depend on behavior. The question is how best to take these factors into account, and on this, there was no agreement within the commission.

The authors of Chapter Three did not want to offer adjustments beyond those described above. They pointed out that, given the large set of factors, observable or unobservable, there is no way to do a fair adjustment, and that, given the correlation between income

and life expectancy, the additional points already given to low-income workers or workers with checkered work histories went a long way towards allowing workers with lower income, and thus likely lower life expectancy, to claim and retire earlier. They also pointed out that workers with low income typically start work earlier and thus reach the earliest claiming age, the EEA, with more points, and therefore a higher replacement rate, than people who enter the labor force after acquiring further education and presumably have higher income. Finally, they insisted on keeping the same EEA for all. They argued that the EEA plays an essential role as a social norm and allowing for different EEAs would undo that role (this is clearly a potential issue in a country like France, where, as we saw, the age of exit from the labor force is lower than the minimum claiming age).

Some members of the commission wanted to go further. While income is indeed not the only cause of life expectancy and may indeed be mostly a proxy for other factors, the correlation is sufficiently strong that workers with low income could be given additional points beyond those given above so as to have a higher replacement rate at the EEA. They thought that some workers might want to retire and claim earlier than the EEA even if this meant a lower replacement rate. This could be done either by explicitly linking the EEA to the income decile, for example, allowing workers in the bottom four deciles to retire earlier, with an actuarially neutral discount; or instead keeping the EEA (which would probably have to be given another name) but allowing low-income workers to claim earlier, albeit at a larger discount. They also thought that, if the average effective retirement age had to be increased over time, and the increase in life expectancy was, for example, more pronounced for high income, allowing for different EEA adjustments and, for example, increasing the EEA for high-income workers but not for low-income workers, might give an additional degree of freedom in adjusting to changes in life expectancy. This might not only be more fair, but also facilitate politically the increase in the average retirement age. The issue must be resolved but there was no resolution within the commission.

2.5. Arduous work

How to take into account hardship, painful working conditions, is a harder issue. Hardship is real, but it is much harder to assess and measure than, say, past periods of unemployment, thus raising the risk of abuse. One insight is that social partners in each industry have decentralized knowledge about working conditions. It is then natural to let them jointly reach an agreement as to how to account for the "*pénibilité*" of specific jobs. To avoid the risk that each industry tries to get it financed by the rest of the pension system, the commission proposes that each sector fully bear the cost overrun that its decisions impose on the system.

To give an example, suppose that a worker would normally retire at the age of 62. The sector can decide to let the worker de facto retire at 55 because of painful working conditions and then pay the worker's benefit and social security contributions between the ages of 55 and 62; the worker would then enter the general retirement system at the age of 62. The details of this proposal require further elaboration; this early retirement must be guaranteed through a fully funded reserve fund that will prevent the liabilities from being transferred to the general regime if the firm is in default or the sector shrinks to the point of a couple of firms bearing an unacceptably high burden. Similarly, one must as usual allow firms to opt out of the sectoral agreement.

Overall, making firms and sectors accountable for what they impose on the rest of society is good public management. As noted in Chapter Three, the Dutch experience consisting in strengthening incentives on the employers' side proves interesting: putting more of the costs of disability insurance on them led to a large reduction in the disability rolls while increasing employment of older workers.

2.6. The determination of the service value

Turning to the financial balance aspects, the first point to be repeated is there is no possible way to insure citizens against permanent macroeconomic and demographic shocks. Stabilization in the face of a transient shock (Covid-19) can however be achieved.

At some level, system balance is simple accounting. For a given contribution rate, and starting with a balanced system, keeping the system balanced requires that the percentage increase in the average pension benefit be equal to the difference between the rate of growth of the average wage and the rate of change of the system dependency ratio (the ratio of retired over active workers).[1]

The system dependency ratio depends on the average effective age of retirement. Chapter Three argues that the retirement window should shift as life expectancy increases. The question is by how much? A useful benchmark is a rule such that the increase in life expectancy goes for two-thirds to an increase in work life, and for one-third to an increase in retirement duration. This rule can be motivated as follows. If longevity increase were the

[1] At retirement, points are converted into some date-t benefit. The aggregate balancing formula, written at date t, is $c_t w_t a_t = b_t r_t$, where c_t is the contribution rate (to simplify, let us take it the same for everybody; if not, this is the weighted-average contribution rate), w_t the average wage, a_t is the number of active workers, b_t is the average pension benefit, r_t the number of retired workers. It implies that if we keep the contribution rate constant over time, $c_t = c$, then the average benefit should grow at the rate of growth of the average wage, minus the rate of growth of the dependency ratio: $\frac{\dot{b}_t}{b_t} = \frac{\dot{w}_t}{w_t} - (\frac{\dot{r}_t}{r_t} - \frac{\dot{a}_t}{a_t})$.

only demographic change, then keeping the ratio between average career length and average duration in retirement constant would balance the pension system. Since a career is about 43 years and duration of retirement about 21 years, hence roughly 2:1, every 3 years of additional life expectancy should be divided 2:1 between a shift of the retirement window by two years and an extension of the retirement duration by one year.[1] If such a rule were used, the system dependency ratio would remain roughly constant, and the replacement rate could then remain roughly the same. The service value of a point would then increase for all pensioners at the rate of average wage inflation.

In general, however, people may want adjustments that involve both an increase in the retirement age and a decrease in the replacement rate. Chapter Three thus recommends the use a more flexible rule, reflecting societal preferences, and discusses what form such a rule could take.

2.7. A reserve fund, and an independent board

Whatever rule is chosen, in the case of transient shocks, be it macroeconomic fluctuations, or the bulge created by the retirement of the baby boomers, it makes sense to allow for temporary deviations from the rule. To do so, the natural solution is the creation and monitoring of a reserve fund. This fund could be drawn upon temporarily in a difficult year and would not be meant to partly fund the retirement system on a permanent basis, in contrast with some proposals of the past. To avoid temptations to unduly snatch from the fund for political expediency, the management of the fund should be entrusted to an independent body, whose mission can also include the monitoring of demographic and other macroeconomic evolutions, and the adjustment of the retirement window (see below). The discretion granted to this independent body must of course come with some control. Were the reserve fund to fall below some threshold level, generating a signal that the fund is structurally unbalanced, the body would be instructed to rebuild the fund through a combination of adjustments in the replacement rate and the retirement window to make the system sustainable. One difficult and important issue here (an issue recurrent in Chapter Three) is how to make the board both politically independent but reflective of societal preferences and the opinions of citizens.

[1] If such a rule is used is to adjust the earliest claiming age, the effective claiming age may not change one for one, as workers may, for example, decide to retire at the same age as before. If the adjustment for the claiming date is actuarially neutral, as we have argued it should, the decrease in the accumulated points implies that the decision of workers as to when to retire given the new EEA does not affect the decrease in total benefits which come from the increase in the EEA.

2.8. Dealing with the transition

Our report agrees with the Delevoye proposal that the transition from the 38 current regimes to 1 should be gradual but probably faster than complete grandfathering of current workers, which would take a generation. We believe that a transition over 15 years is reasonable. We also agree that current retirees and those who will retire soon should not see their situation changed. (While the commission realized that the transition may have to happen in different ways in the public and in private sector, it did not feel competent to discuss how the transition should be engineered in the public sector versus the private sector.)

3. Accompanying Labor Market Policies

Just as important as the retirement rules of the pension system is the quality of jobs available to older workers, a theme that parallels the discussion of "good jobs" in Chapter Two on inequality.

The evidence suggests that what motivates workers to remain employed is not only income but also staying in contact with the world of work and having a sense of purpose. At the same time, older workers often want more flexibility in the balance between leisure and work. This suggests focusing on improving part-time arrangements for older workers. This clearly must be a multi-dimensional effort:

One dimension of improvement is, in the pension reform, to make the adjustment associated with working longer actuarially neutral, which is not the case at this stage, but we suggested earlier should be. This would make it more attractive for workers to work longer.

Another is to focus on professional training for workers throughout their work life, again a theme that parallels our discussion in Chapter Two on inequality. The evidence is that skill levels are substantially lower for older than for younger workers: This however appears not to reflect age per se, but the recency of education and the lack of updating. Based on a 2011 survey, only 51% of French workers had further education after their formal education, compared for example to 72% in Sweden.

Yet another is to deal better with chronic illnesses. Perhaps most important is the need for a change in attitude towards those with chronic illness in the workforce. The goal must be to allow workers with disabilities to remain in work, rather than to want to drop out. (For several chronic illnesses, not working makes the chronic illness more debilitating.) Reviews of best practice based on international evidence indicate that strategy to improve the health capacity of older workers needs to combine three different types of policy and interventions.

- The first are workplace-based health and wellness interventions to promote health and increase the work capacity of older workers.
- The second are employer accommodation practices to help older workers with health problems to stay in work.
- The third are to address features of the disability insurance system to ensure that older workers who experience functional problems do not leave the labor force.

The experience of Sweden shows that these reforms can make a large difference. Not only that, but it also shows that social norms and attitudes can shift as a result.

Focusing on the chronic illnesses when the workers are old is too late. Chronic illnesses start earlier. The general proposition here is that preventative care can be improved: the current system focuses too much on cure. The report goes into detail about foreign experiences, and a number of potential technical reforms of the health system, from greater use of pay for performance and payment for bundles of treatments rather than pay for act, to a pre-defined basket of fully insured preventative care treatments. Telemedicine, whose usefulness has been evident in the Covid-19 crisis, can also play a role. It can help establish better services for many chronic illnesses, for example mental illnesses or depression. And it can seriously alleviate the medical desert problem.

4. Immigration and Labor Participation

Immigration, both its nature and its size, raises many economic, social, and political issues, most of them going much beyond what our commission had the expertise to study. We decided to focus on the labor participation of immigrants, which is obviously of intrinsic relevance, but is also relevant in thinking about the financial balance of the pension system.

The employment rate of immigrants in France is 58.5%, compared to 66.4% for native-born workers. The unemployment rate of immigrants is 14.6% relative to 8.3% for natives. In these two respects, France does about the same as Germany, and does better than Sweden.

Some of the difference reflects the initial adaptation. The employment rate for the first five years after immigration is 41% but increases to 60% after five years. As always, the averages hide substantial heterogeneity across gender and origin. For example, after 6 to 10 years, non-European women immigrants still have a participation rate that is 15% lower than for native women. Interestingly, much of the difference disappears for those belonging to the second-generation (i.e. the sons and daughters of immigrants). It however remains lower for second-generation women of non-European origin.

This situation reflects a list of factors:

– For first-generation immigrants, language skills play a large role, and so does the lack of social capital. An interesting finding is that language courses increase labor force participation but do so not so much through the acquisition of language skills themselves than through access to better information about the labor market.

– Immigrants face a tough labor market. While true qualification is difficult to assess, a study has found that 55% of North African immigrants appear overqualified for the jobs they have, compared to 39% for all immigrants, and 20% for native born.

– Discrimination plays a role. Studies indicate that candidacies from people with ethnic-sounding names get less call backs than others. And so does culture. Only 25% of Turkish women are employed and a large share of those who are not employed is not even active on the labor market.

– Turning to the second-and-third generations, school segregation plays an important role and contributes to the intergenerational transmission of low levels of education. The proportion of students from migrant background in disadvantaged schools is high, and so is the proportion of students from migrant background in the low performing reading proficiency group.

Given this list, it is obvious that there is no single magic bullet. There are however three directions to explore.

- **More coherent policies to support recognition of existing credentials and acquisition of new skills**

  Lack of (partial) recognition of foreign degrees is sometimes due to information problems on the part of immigrants. This can be improved. Increasing the number of language lesson hours (which has already been increased to 400 hours) would be another important starting point since language skills have a strong impact on labor force participation. Providing more focused occupation-specific language training and enabling women with children to take part in such classes has proven successful in Germany.

  In that respect, Chapter Three provides an interesting computation. Closing the gap between overall labor force participation between France and the European Union could be achieved (arithmetically) with a 10-percentage point increase in the participation rate of the 55 to 64-year-olds. Taking the proportion of immigrants who would benefit from additional language training, together with the estimated effect of language training on labor force participation (an estimate which must be taken with a grain of salt), language training could by itself fill 60% of the gap. In short, it would make a substantial difference.

- **Counteracting intergenerational transmission of low levels of education**

  It is well documented that school segregation is much worse than residential segregation. This has been recognized and addressed by many programs in the past, the most recent one being the *réseaux d'éducation prioritaire* (REP). We believe that more should be done, in particular by providing incentives for a better mixing of children from privileged and disadvantaged family backgrounds in private and public schools. Children from immigrant parents would disproportionally benefit from this.

- **Detecting and reducing discrimination**

  The hesitancy to collect data on employees' immigrant background have led to limited information about the effects of immigrant origin on labor force outcomes. There are however ways of improving our knowledge without compromising anonymity or putting those reporting such information at unease.