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HOW EUROPE COULD BECOME A WORLD LEADER

(WITH A LITTLE HELP FROM LOW INTEREST RATES)

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Among the telluric forces shaping the future in the post financial crisis world are technology trends on the one hand and the policies pursued by the two powers competing for global supremacy, the United States and China on the other. From this angle, Europe and other regions of the world look like corks of various shapes and sizes floating up and down in the midst of Chinese and American cross currents. Depending upon the pace of technological innovation and on the outcome of the trade war, very different global scenarios may shape the world. For Europe the picture emanating from these trends can indeed be bleak. Such global dynamics may lead to Europe's further decline, perhaps even to a chaotic outcome, whereby the institutions painfully built in the aftermath of World War II would be destroyed and where the specter of violent conflicts could come back.

I will argue in this note that the future does not have to be that gloomy, provided that Europe shows the courage and tenacity to take some tough decisions regarding the allocation of its vast resources and to assume global leadership in the action against climate change. Associating with Turkey to move forward on these goals would be precious and of mutual interest.

In section A of this paper, I will first explore four scenarios generated by the diverging trends of globalization and technology. In all but one of these stylized worlds, Europe is on the losing side unless its domestic policies change significantly.

Section B will look at alternative policy options, from what has been tried and did not work or is still in the making, to bolder options focused on investment in research and carbon pricing.

The concluding section will argue that business as usual is not really an option for Europe and that there are other ways of being a world leader than having the largest military, population or GDP.

A. TWO AXES TO HELP THINK ABOUT THE FUTURE OF THE GLOBAL ECONOMY

Technology and trade policies, two powerful forces shaping the world

To get a glimpse of what the future may hold for Europe, I will use a 2-axis diagram: technology and global trade politics. In the first instance at least, one may assume that they are independent. In the short term, that is less than five years, this is a safe assumption, given the inertia of technology developments. Beyond ten years, this is almost certainly wrong. For instance, it is plausible that the decline of scientific and technological progress in China during and after the Ming dynasty was at least partly the consequence of the Middle Kingdom isolating itself from the rest of the world in the late 15th century. Yet, since our purpose is to shed light on the next several years, not decades, the independence hypothesis is a workable assumption.

Regarding technology, two schools of thought are in dispute. On the pessimistic side, Robert J. Gordon, professor of economics at Northwestern University, posits that the digital revolution has failed to deliver a sustainable acceleration of productivity and that it pales in comparison with the technological innovations of the past two industrial revolutions, such as the steam engine, or, later, the electrical engine and the electrification of industrial economies[1]. Extrapolating from his analysis of the last decades, Gordon assumes that labor productivity growth in the US will continue to grow at a miserable rate, not exceeding 1%, while its average growth between 1950 and 2018 was 2.1%. His analysis builds upon not only a sober view of technological innovation per se, but also the poor quality of the US education system and lack of competition in product markets. No other economy in the world has ever matched the level of productivity of the US since the decline of the UK as the leading industrial economy after WWI. Therefore, what is bad news for the US is probably also bad news for the rest of the world.

At the other end of the spectrum, Erik Brynjolfsson and Andrew McAfee, both professors of economics at MIT and co-authors of the best seller 'The Second Machine Age'[2], take a more positive view on the impact of the ongoing technological revolution[3]. The former believes that the traditional measure of GDP, based on production, is missing a significant part of what is actually increasing consumers' welfare, via free internet services, possibly by as much as 0.5% growth per year[4]. The latter, in a recent book[5], shows that, at the turn of the millennium, technological innovation and market pressure have caused a dramatic divergence as the GDP went up and the consumption of material resources (steel, copper, aluminum, fertilizers, carbon…) went down.

Time will tell who's right, who's wrong, or, more probably, it will show that things are not

[1] See 'Secular Stagnation : A Supply-Side View', Robert J. Gordon, American Economic Review 2015, 105(5): 54-59.
[2] The Second Machine Age – Work, Progress, and Prosperity in a Time of Brilliant Technologies, Erik Brynjolfsson and Andrew McAfee, Norton & Company, 2015.
[3] So does Philippe Aghion, see for instance 'Missing Growth from Creative Destruction', Philippe Aghion and alii, Federal reserve of San Francisco Working Papers.
[4] See 'Using massive online choice experiments to measure changes in well-being' Erik Brynjolfsson, Avinash Collis and Felix Eggers, PNAS, 2019 02.
[5] More from Less, The surprising story of how we learned to prosper using fewer resources – and what happens next, Andrew McAfee, Scribner, 2019.

that clear cut. For the purpose of the analysis, I will remain neutral and consider a horizontal axis spanning technological progress along one dimension only, from slowing technological innovation (iPhone X forever, if you wish) on the left hand to technological innovation accelerating and turning more disruptive (think of a mix of full-fledged Libra and quantum computing).

Turning to trade policies, which are an inseparable part of economic and strategic policies, some background is necessary. The secular trend fueling globalization, i.e. a continuous although not linear, opening of borders to make trade between countries to flow more freely, seems to have come to an end, with the great financial crisis (GFC) of 2008 and its immediate impact on trade. One way to measure whether the world is moving toward more or less globalization, is to measure the elasticity of world trade relative to global GDP. By elasticity, economists mean the ratio between the growth rates of the two variables. Before 2008, the trade elasticity was superior to 1, oscillating between 1.5 and 2, when trade is restricted to manufactured products. Since 2010, that is after the great contraction of global trade at the end of 2008 and its subsequent rebound in 2009, the elasticity of global trade has fallen to less than 1. Trade between countries is now growing more slowly than the size of their economies, a clear evidence that the secular "open-the-borders" trend is over.

Since President Trump started to raise tariff barriers in late 2018, initiating retortion measures in what has become an endemic trade war, things have taken a turn for the worse. While global GDP growth remains positive, although weak by pre-GFC standards, global trade has been actually shrinking since then. Accordingly, the trade to GDP elasticity has become negative, a totally and yet largely unnoticed new pattern, which is, by definition, unsustainable in the longer run.

At this stage, it would be unwise to predict which trend, positive GDP growth or negative trade growth, will have the upper hand. Since the trade war is harming all trade partners, China, Europe but also the US[6], reason and national interests should convince the US and China to bury the trade war hatchet. In that case, damages would be limited, but it is hard to imagine a resumption of the globalization trend given the hostility expressed by public opinions in many countries, starting with the US. We call this benign scenario 'soft globalization', characterized by a low but positive trade elasticity relative to global GDP.

Yet, domestic political agendas as well as some irreversible consequences of the trade war on value chains that can now be identified more clearly, may snowball on their own dynamics and fuel the escalation of the trade war and especially its technology dimension. This would happen irrespective of who wins the 2020 presidential contest. Since the EU would most likely be also engulfed in this escalation, we call this scenario 'balkanization', with a dramatic reduction of trade flows between large economic regions, America, Asia and Europe, and a possible reallocation of trade within these regions. In this scenario, the trade elasticity relative to GDP would turn negative for an extended period of time.

[6] See 'Trade War and Trade Deals, Estimated Effects using a Multi-Sector Model', Carlos Caceres and alii, IMF Working paper WP/19/143, June 2019. See also 'The Economic Effects of Trade Policy Uncertainty, Dario Caldara and alii, International Finance Discussion Papers, Board of Governors of the Federal System, Number 1256, September 2019. In the latter, the authors show that the mere effect of the uncertainty created by the trade war is likely to cut the US GDP level by 0.9 percentage point.

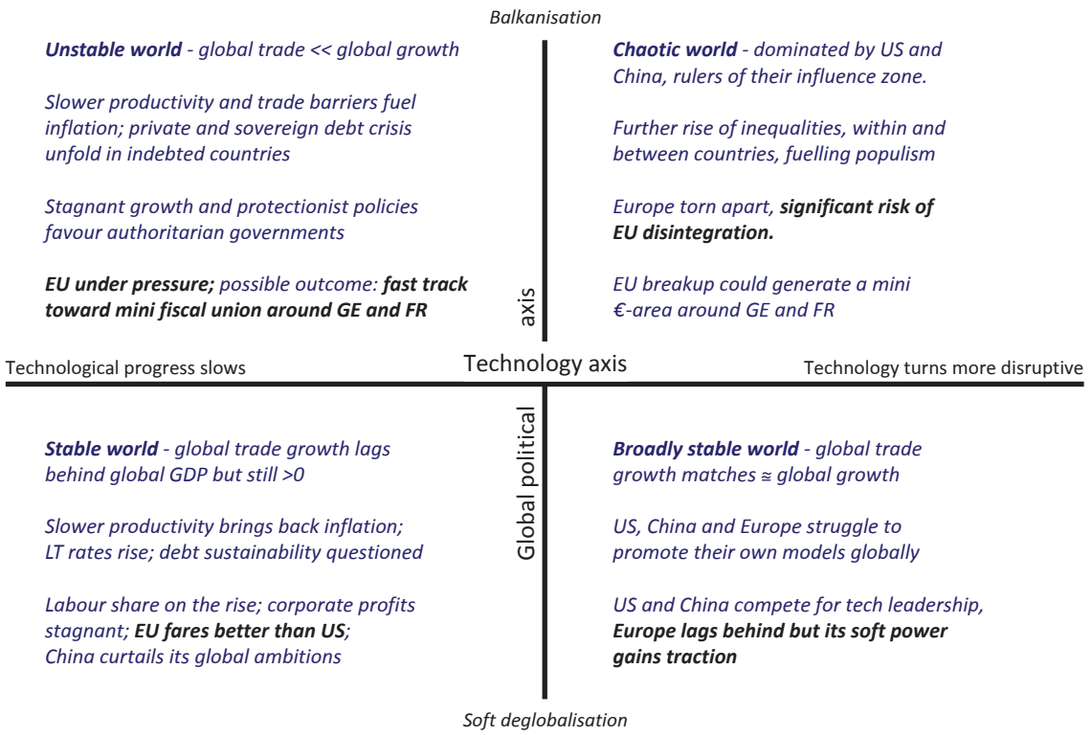
Four polar worlds where Europe is found struggling at best

Combining the technology and politics axis yields a diagram with four quadrants, that we will review from North-East to South-East, counterclockwise. Since we are mostly interested in the future of Europe and the European Union in particular, and for the sake of the analysis, we assume in the following description of the four stylized worlds that the management and the governance of the European Union do not depart significantly from the current state of affairs –call it 'politics as usual' or 'kicking the can down the road'.

Exhibit 1

Crossing technology and politics: four polar worlds

Europe's future in the 'politics as usual' case



North-East: Chaotic world, possible unwinding of the European Union

With trade barriers erected around the world, the world's #1 exporter, Germany, is seriously hit in the first stage, which could lead to domestic political turmoil, before corporate Germany adapts to the new landscape by focusing on its close trade partners, i.e. EU countries. This will unavoidably exacerbate the tensions with its weaker trade partners. Since technology ignores trade barriers. It will become more disruptive. Europe would be lagging behind both the US and China and socially shaken by the fallouts of the technology revolution. At some point, tensions may test the very fabric of the post WWII Europe, i.e. incremental economic and political integration, up to the point where centrifugal social and political forces have the upper hand. As the EU begins to unwind, France and Germany would confront their own intertwined

and more than often bloody histories. If reason, helped by the fear of chaos[7], prevails both countries may opt for a deeper economic union, that is a full-fledged fiscal union, with a joint elected representation.

North-West: Unstable world, fast track to mini € fiscal union

Sailing eastward, the balkanization of the world economy —reminiscent of what happened in the 1930s after the disastrous Smoot-Howley Tariff act— creates a very unstable global economy, as in the previous scenario. While the slowdown of technological innovation may limit the damages caused by this otherwise chaotic world, slower productivity growth also means that there is less to redistribute. The combined effect of trade barriers and very slow productivity growth fuels inflation. Coming as a surprise, inflation causes a reassessment of the fair value of bonds, which would trigger a sudden rise of long-term interest rates as happened in 1994. Highly indebted agents, including some governments, are suddenly seen as virtually bankrupt by the financial markets, triggering self-fulfilling prophecies. As for Europe, Italy is the first casualty. Since the Italian government debt is the second largest in the world, bailing out Italy is a very tall order. As in the previous scenario, Germany and France are forced into a fiscal and political union, but in this case with a higher probability. In this quadrant technology is less disruptive than in the north-eastern one, and thus leaves more space for reason to prevail.

South-West: Stable world, More favorable to Europe than to US

Now sailing southward, we are in a world more similar to the one we are living in. With technology innovation dimming, and globalization at a standstill, productivity does not grow fast enough to prevent a steady rise of inflation, limited by what is left of a global free-trade system. In this slowly moving world, where the labor share of value added is increasing at the expense of the profit share, Europe is on the winning side and therefore, doesn't do much to overhaul her political framework.

South-East: Broadly stable world, Europe lagging US but raising its soft power

We end our roundtrip with the South-East quadrant, where global trade is hampered though not disrupted but where technological progress accelerates and becomes more disruptive. By and large, this world is stable, though technology may destabilize political and business establishments. It is not the best of all worlds for Europe, because Europe is lagging behind the US, and soon China, but it is a world she can accommodate herself to. Technological disruptions may be a competitive disadvantage for corporate Europe, but it is also an avenue for European soft power to thrive, as the example of GDPR **(General Data Protection Regulation)** is showing.

In sum, the 'politics as usual' backdrop doesn't look bright for the future of Europe in a world shaped by technology and trade policies. In the most favorable scenario, that is in a world not very different from the current one, Europe would benefit from its soft power and do reasonably well. In all other scenarios, tensions would rise, possibly unwinding the Union, but also possibly convincing the peoples of a small group of countries to steam ahead toward deeper economic, fiscal and ultimately political integration, without any guarantee that the trial will succeed.

[7] The fear of geopolitical chaos following the demise of the Soviet Union and of the German hubris that may result, convinced Wolfgang Schaüble and Karl Lammers to write their famous 'white paper' for the CDU 'Überlegungen zur europäischen Politik', in which they advocate for a monetary union of like-minded, as far as economic stability is concerned, European countries. In my view, this document gave the green light to the euro (called ECU back then).

B. EXPLORING ALTERNATIVE PATHS FOR EUROPE

Holzwege[8] and slow motion tracks

Many economists, starting with the majority of US macroeconomists, have a simple verdict on the euro area (86% of EU GDP post Brexit) troubles. Their starting point is that a monetary union without a fiscal union is half-baked and will be plagued by widening economic divergences. Here is what a US economist would say – "Dear Europeans, why don't you have your Hamiltonian moment, 240 years after our first Treasury Secretary Alexander Hamilton paid off the debt of the newly federated states and issued the first US Treasury bonds. Believe us, it was a good decision".

The problem is that the painfully negotiated Maastricht treaty explicitly excluded a fiscal union, asking instead member states to embrace cautious fiscal behavior, in order to prevent free-riding strategies –exactly what the Greek government did before and even more after joining the euro. Arguably, what had been agreed upon in 1992 could be revisited. The French political establishment has called for a deeper fiscal integration from day one, calling for a common budget, which would be a big leap toward a full-fledged political union. Their calls, backed by the IMF, have not convinced the Germans, who do not forget that, during the EMU negotiation in the late eighties, the French were arguing that a political union was not a necessary condition for a successful monetary union, against the German view. Germany and other high savings countries, fear that a fiscal union would boil down to a 'transfer union', something acceptable within a country if this is the people's will[9], but not between countries which do not have a joint elected representation trusted by the peoples. The North-South divide is actually deeply rooted in the economic infrastructures of the participating countries: The North has built funded pension systems relying on pension funds on top of government transfers, while the South has dug its heels in pay-as-you-go systems.

Therefore, and unless dramatic domestic and/or geopolitical circumstances (such as in the North-East scenario) make a political union palatable to the peoples, a genuine fiscal union will remain a federalist dream, not a reality. I would put the industrial policies inspired by the Airbus experiment in the same 'Holzweg box'. If Airbus was eventually successful, it is because there was a global duopoly (Boeing and McDonell Douglas) that could be successfully challenged. There are no obvious similar cases today, even in the technology sector: tech giants such as Google, Facebook or Amazon have smartly used network externalities and increasing returns to scale to 'take it all', which means that only economic areas protected by internet firewalls, such as that of China, can mimic them within their borders. Only a breakup of these companies by the US government could open the way to European competitors.

There are other paths that can help improve the functioning of the euro area. Some of them are actually already on the table. To name but a few:

- Building a European defense industry by pooling research funding and procurements;
- Completing the banking and the capital market union. This would open the door to genuine European banks, if fintech has not already covered the ground;

[8] Holzweg is the German word that refers to forest paths cleared by forestry workers and which end where they cut trees.
[9] The German unification is a good example of a massive transfer union. Despite a lot of dissatisfaction from West German taxpayers and frustration on the part of East German subsidy receivers, the transfer union has never been called into question in any federal or even state election since 1991.

• An interesting proposal was made by Ursula von der Leyen: a EU wide re-insurance fund bailing out national unemployment benefit systems in case of large asymmetric shocks. This would have some of the features of a common fiscal instrument;
• Building a labor market union, by making it easier for wage earners or independent workers to cross borders. This could be achieved by creating transferable rights to unemployment and retirement benefits.

Yet, each of these improvements, welcome as they may be, is incremental and unlikely to change significantly the destiny of Europe in the next 5 to 10 years. More energetic measures will be needed to awaken the sleeping beauty.

Two initiatives which could change the future of Europe

1. Take advantage of low interest rates to invest massively in research

Looking through the volatility of the financial markets, one of the most extraordinary consequence of the financial crisis is the very low level of long-term interest rates, especially those borne by government bonds, a development which has fueled a lively debate among policy makers and economists on this very simple question: how to take advantage of such historically low borrowing costs. Two opposite schools of thought are competing: on the one hand, "spenders" are pointing out that, when the risk-free interest rate (the public debt's rate) is lower than the growth rate of the economy, public debt does not entail any additional budgetary costs in the future[10]. On the other hand, "conservatives" like German Chancellor Angela Merkel are asking: "If we are unable to get rid of our debt when rates are low, how will we do it when they are high?"

The discrepancy between these otherwise respectable points of views is largely due to diverging assumptions about the future. Spenders believe that interest rates will remain very low for many years to come, due to a global structural excess of savings. More cautious conservatives consider it unwise to assume that rates will remain this low forever.

To get out of this dialogue of the deaf, let us ask the question: is there a way for taking advantage of very low rates by borrowing to finance projects that are known, with reasonable certainty, to generate a long-term return on investment for the community that exceeds any reasonable expectation of future interest rates, for instance above 10%?

There is one area where long-term returns are well above the 10% threshold, although it cannot be evaluated with methods used for traditional investment projects: **basic and applied research.** The key difference between the return to research and, for example, road infrastructure is depreciation. **There is no depreciation for scientific discoveries,** quite the opposite: return on investment increases when technological innovations make use of it. Archimedes' principle has not aged one bit and we still use it!

Let me use two examples to illustrate. Niccolò Fontana, an obscure 16th century mathematician better known as Tartaglia, invented imaginary numbers (today complex numbers) to solve the 3rd degree equation. Évariste Galois, killed in 1832 in a duel at the age of 21, had solved the enigma of the 5th degree equation, by demonstrating there are no solutions that could be

[10] See Olivier J. Blanchard opening speech to the American Economic Association annual meeting in January 2019. See also Blanchard's prepared testimony **[https://budget.house.gov/sites/democrats.budget.house.gov/files/documents/Blanchard_Testimony.pdf]** for the US House Committee on the Budget "Reexamining the Economic Costs of Debt"

expressed with algebraic formulas. To do so, he had to develop a new conceptual framework: group theory. In both cases, this is very abstract research and one wonders what relevance it has in everyday life. The truth is, none of the technologies invented since the 19th century would exist without the powerful tools offered by complex numbers and group theory. The social return on these two inventions is immeasurable and continues to increase year after year.

Of course, basic discoveries generating extraordinary and growing social returns, such as those of Tartaglia, Newton, Euler, Galois, Pasteur, Einstein, Planck, Heisenberg, Crick and Watson, are rare. Although no one has ventured to estimate them, it is accepted that their statistical distribution is "heavy-tailed"[11]–that is, their rarity is compensated handsomely by their high social return. **Borrowing to finance basic and applied research is thus the most profitable long-term investment one could think of.** In practice, only governments can afford to do so, because the horizon for return on investment is sometimes much farther than what is conceivable for a private investor.

Moving away from the abstract world of fundamental discoveries to consider the social return of research and development (R&D) in general. A report prepared by Frontier Economics in 2014 for the UK Department for Business, Innovation and Skills concludes that R&D financed by public funds, which is minimally subject to depreciation – within R&D, the depreciation rate of basic research is zero, if not negative – social return would approximately be 20%, which still exceeds by far the threshold of 10% indicated earlier. This should facilitate reaching a consensus between "spenders" and "conservatives".

Since we can see that it is fiscally virtuous to borrow for financing R&D, why don't EU governments do it, or at least do it more? Beyond the reluctance to spend today for a certainly high social return, but in an uncertain time horizon, three other reasons emerge:

- Spending on research can only generate high social returns if public funds are allocated efficiently, based on objective rather than political criteria.
- Every country in the euro area is either constrained by the Union's budgetary rules or its own budgetary rules.
- National policymakers often have limited interest in public research because it produces outcomes that are by nature public goods: a new mathematical theorem or a new superconductor at room temperature can be used by everyone in the world.

While the first challenge is a well-known governance issue, and the second is more political and institutional in nature, these two are in fact closely linked. How can they be overcome? Considering the euro area only, the obvious solution is to review the criteria used by the European Commission to evaluate excessive budget deficits. Borrowing, therefore increasing current public debt, to invest in projects whose social return is far superior to a cautious assessment of the upper bound on future interest rates, ultimately leads to public debt reduction, all other things being equal. It would therefore be perfectly justified for investments in research to be excluded from excessive deficit calculations, on the one condition, however, that the allocation of these investments is based on scientific rather than political criteria, even if disguised under the word 'strategic'.

[11] See What's so special about Science, by William Press, Science, 15 Nov. 2013

Raise €500bn to endow the European Research Council, Europe's best investment

It happens that the European Union has an institution that remarkably fulfils the governance criteria outlined above: the European Research Council (ERC) has acquired a worldwide reputation[12] thanks to uncompromising scientific governance: project funding is granted only on the basis of its scientific quality. It is not based on the research laboratories' nationalities, nor their congruence with the economic objectives of the Union or member states. Today, the ERC has a budget of €13 billion as part of Horizon 2020, allowing the distribution of just under €2 billion funding per year, that is, a mere 0.012% of the European Union's GDP, to researchers in the countries that participate to this fund, namely the EU and a number of associated countries, including Turkey.

Given the ERC's tremendous success, the ridiculous amount of its annual budget is confusing. To significantly increase the ERC's budget, the most sensible policy would be to provide it with capital whose financial income would fund the institution's annual budget, and therefore no longer be part of the EU budget. To fund the current budget, a capital of around €100 billion would be required, with an expected financial return on investment of 2%. A fivefold increase in the ERC's budget would require a capital of €500 billion. The additional debt (3.1% of EU GDP in the case of a capital of 500 billion) would not change the net wealth of member states, since they would be shareholders, instead of financiers, of the ERC. Thus, the institution could be recast as the "European Research Fund" (ERF) with a potential annual funding of up to €10 billion for EU and associate members' scientific projects of excellence.

Participating countries could borrow jointly by issuing long-term, or even very long-term, 50 years, 'research' bonds, this debt being excluded from the excessive deficit calculations. Akin to the bonds issued by the European Investment Bank (EIB), these assets would be added to the pool of 'safe and liquid' assets which the ECB has been calling for to strengthen the euro area's financial stability.

2. Take the global leadership of carbon pricing policies

It is beyond doubt that increasing the stock of greenhouse gases (GHGs) in the atmosphere and in the oceans (for CO^2) is the main cause of climate and ecological change. This will accelerate in the coming decades because of the concentrations already reached. Such changes could have serious consequences in the next decades and very serious ones for future generations if we do not stabilize rapidly the GHG stock (mainly CO^2, which has a long cycle) in the atmosphere. From this point of view, it is encouraging that per capita CO^2 emissions have been declining in the US and the EU in the last ten years, and have stabilized in China. But if the reversal of the trend is good news, we are still far behind the target, if we want to limit the increase in global average temperature to less than 2 °C.

For Europe, which contributed in 2013 to 11.7% of global CO^2 emissions from a consumption perspective[13], it is urgent to reduce emissions

[12] A photo that went viral on social media illustrates the degree of excellence achieved by the ERC: Sir Peter Ratcliffe smiling as he learned that he had earned the 2019 Nobel Prize in Physiology or Medicine, while he was dutifully filling the form for a research grant from the ERC! Sir Peter is the seventh ERC-funded scientist to receive a Nobel award.

[13] Source Global Carbon Project 2018, Le Quéré et alii. The most frequently quoted data from this source is that the EU-28 emitted 9.8% of the CO^2 emitted worldwide in 2016. These are territorial emissions. The consumption approach adds to the territorial production the CO^2 needed to produce imports net of the CO^2 needed for exports (the latter to avoid double counting). This concept is more relevant than the only CO^2 emission on the territory, since it takes into account the 'leakage' of carbon linked to the structure of production and demand. Note that China has a lower carbon footprint from this perspective, for obvious reasons.

as quickly as possible to zero because, in any plausible scenario, those of Asia and even more of Africa cannot but increase in the future, for economic development and demographic reasons. Moreover, an overwhelming majority of European Union member states, including the UK, have adopted a carbon neutrality target for 2050.

Carbon pricing is a necessary condition to change behaviors and cut CO^2 emissions

To achieve large-scale emission reductions -- a 50% reduction from the 1990 level by 2030 would put Europe on the road to its 2050 goals in a credible way - the price signal is the most powerful lever at our disposal because it modifies behavior in a coordinated and decentralized way: a single carbon price included in the goods and services consumed in the EU, provided it is high enough to be consistent with the reduction objective, makes it useless to regulate this or that industry, to favor or punish such and such behavior. Producers and consumers adapt on their own, by arbitrating within the supply and demand sides of the economy, in more granular and efficient ways than any centralized or regulatory attempt, including subsidy policies to such or such alternative energy. The immense advantage of the price signal is that it coordinates a very large number of economic decisions, taken individually by companies and consumers, without any other intervention by the authorities than to enforce the single price of carbon.

In the absence of international coordination, how can the European Union make its deeds consistent with its good intentions - carbon neutrality by 2050? I believe that without a strong and respected price signal throughout the Union, or at least a large majority of its members, failure is guaranteed. A high and increasing carbon price over time may not be enough to achieve the objectives, but without the strong incentive it offers, any cocktail of regulatory measures and equipment spending, however sumptuous, will fail.

The indispensable complement to a high carbon price in the internal market is the imposition of an adjustment at the borders (import taxation, export abatement) to pass the price signal to all goods and services consumed in the Union. These should include imported goods, so as to take into account the challenge of 'carbon leakage', ensuring at the same time a level playing field between the Union and its trading partners.

Compared to other developed countries, in which we should include China, the EU is now relatively advanced in the use of the carbon price, with both a trading system (ETS) and a carbon tax in some countries. Yet, neither the implicit ETS carbon price (circa €26 per ton of CO^2 in 2020 future contracts) nor the various carbon taxes, ranging from € 15 / tCO^2 in Spain, € 45 in France, to € 109 in Sweden, are mutually consistent.

The first step will therefore be to agree on a single carbon price trajectory across the EU, based on IPCC reporting impact studies, which allow for an estimate of the discounted cost of damage caused by the emission of one additional ton of CO^2, a rigorous foundation of the concept of the social cost of carbon.

For the price of carbon to act effectively on behavior, all goods and services must be allocated on the basis of their carbon content. In a closed world, the simplest is to tax at the source, i.e. fossil resources regardless of their use, as well as industrial activities that produce CO^2 in addition to the use of fossil energy (cement, steel, chemicals, etc.). Once the tax is collected by the

national authorities, it is the economic actors, producers and consumers, who will decide on its impact on the price system, without the intervention of the authorities, which guarantees the most optimal allocation of resources.

As the European Union is not closed, taxation must also apply to imports. For the sake of analysis, let's say for a moment that the EU is the only area to impose a carbon price. For fossil fuel imports, the formula is simple: taxation at the same level as in the domestic market. For other imported goods and services, taxation must be applied according to their carbon content. Conversely, goods and services produced in the EU and exported from the EU should be exempted from the carbon tax (or benefit from a similar rebate if they fall under a trading system).

In reality, a growing number of countries or regions have adopted carbon pricing policies. The previous rules must therefore be amended according to the carbon price already included in the imported products. In the case of a price policy of a partner similar to that of the EU, which would require verification, no adjustment at the border would be necessary on either side. Intermediate cases are more delicate. Import taxes could be agreed in accordance with the carbon price required on both sides, the EU and the partner country, as well as an export exemption. This way, double counting would be avoided, and level playing field respected.

Redistributing the bulk of carbon price dividends to citizens

Whether generated by carbon taxes levuied by national tax systems or the proceeds of CO^2 emission auctions, national public authorities would benefit from a hefty windfall, which immediately raises the question of its use. The experience of the yellow jackets in France, the ideas that underlies the appeal of American economists[14] as well as many European studies are weighing in favor of a full redistribution of carbon price dividends. We propose to redistribute the bulk of carbon dividend to households on a national basis, with the proceeds of the border tax being prorated according to the carbon content of each country's imports, and let each country decide how to redistribute. A small slice of the carbon dividend would be ear-marked for redistribution across countries, in order to deal with unequal initial endowments -some countries have natural clean energy resources (Norway, Switzerland…), while others have large reserves of carbon intensive resources such as coal (Poland for instance). In addition, a part of the ear-marked resources could be used as an incentive in negotiations with trade partners.

Promoting a 'carbon club' around the EU, thanks to the size of her market

As Nobel laureate William Nordhaus has reiterated with force, the peculiarity and difficulty of the fight against GHG emissions is that they constitute a 'public evil', the exact opposite of what Paul Samuelson called public goods. Reducing emissions increases the well-being of every individual on the planet, living and future, while policies can only be national and are thus sensitive to populism, as exemplified by the withdrawal of the United States from the Paris agreement.

Although her political clout is not enough to weigh decisively on the world stage, the European Union has an incomparable asset to convince some of its trading partners of the benefits of a carbon policy: the size of its domestic market, which is today the largest in the world as an integrated market.

[14] Economists' statement on carbon dividends **[https://www.econstatement.org/]**organized by the Climate Leadership Council. The letter, was originally published in the Wall Street Journal, on 16 January 2019, and was signed by practically all American winners of the Nobel prize in economics.

Put more bluntly, the stick would be the border tax, the carrot its exemption, and therefore privileged access to the internal market, assuming that all EU partners do not adopt the same carbon price. The idea is nothing other than the 'climate club' idea developed by Nordhaus. The future Nobel Prize winner showed in a 2015[15] article that without sanctions against countries that do not participate in decarbonization strategies, there can be no stable coalition of countries committed to climate change. It showed that, conversely, even modest penalties imposed on the recalcitrant via import taxes could favor the emergence of a broad and stable coalition leading to a strong reduction of emissions.

On the condition of agreeing on a credible carbon price trajectory for the achievement of its carbon neutrality goal, the European Union is in the extraordinary position of being able to gather a mass of countries large enough to reduce GHG emissions much more than its own efforts would produce.

All the countries having thus far a privileged access to the EU market would have a great interest in implementing a carbon price policy. Reciprocally, EU countries would have a great interest in helping these countries, especially lower income partners, by using the ear-marked slice of the EU carbon dividends to help them implement a carbon price policy.

CONCLUSION: COOPERATING FOR A BETTER WORLD

While shifting gears on these two policy fronts –massive investment in research and carbon policy—is clearly in the interest of the European Union as a whole[16], since it is conducive to Europe's soft power and welfare enhancing in the long run, I will also argue that it is in the mutual interest of both Turkey and the EU to cooperate on these policy goals.

Starting with research, Turkey is already a member of the *Horizon 2020* club. Its research teams are thus eligible to European Research Council grants. According to ERC statistics, Turkish research teams have won 11 grants since Turkey joined the program. As for 2019, two teams, from Orta Dogu Teknik Üniversitesi and Bilkent Üniversitesi have won prestigious starting grants in hot scientific fields –cancer research and material science[17]. A 5-fold increase of the ERC funding capacity would have a disproportionately strong impact on the Turkish scientific community. It would open the race to research teams which, thus far did not even consider applying for a grant. In all likelihood it would also allow the ERC, or ERF as we suggest to name it, to consider riskier research, or less mainstream research projects. From the EU side, any policy that helps the Turkish scientific community to thrive and have closer links with its EU counterpart, is positive, inasmuch as it increases the weight of values shared by the two partners, a very precious commodity in times of rising nationalism and communication barriers.

Cooperating on a genuine carbon pricing policy may prove more challenging. If the EU is to implement a consistent carbon pricing policy, there will be a carbon border tax, which will, in due time, apply to all trade partners, including Turkey, which ships 50% of its exports to the EU. This would imply a renegotiation of the 1995 customs union agreement between Turkey

[15] 'Climate Clubs: Overcoming Free-riding in International Climate Policy', William Nordhaus, American Economic Review, 015, 105(4): 1339–1370.

[16] Since both investment in research and decarbonization are tantamount to producing public goods, some countries may be tempted by free riding strategies, just as Greece did after having joined the euro area. Therefore, a mix of incentives and sanctions might be necessary to convince all or at least an overwhelming majority of members of the Union to implement these policies.

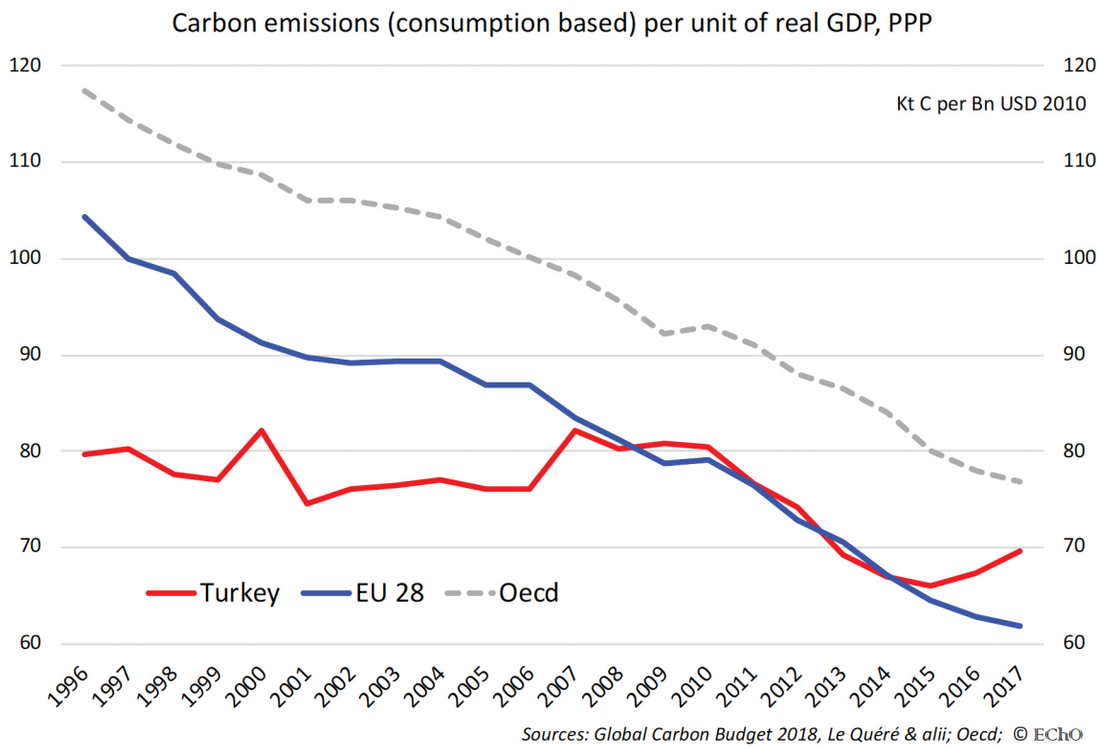
[17] ERC Starting Grants 2019 – List of principal investigators – all domains
[erc.europa.eu/sites/default/files/document/file/erc_2019_stg_results_all_domains.pdf]

and the EU, as well as many other trade agreements. I believe it would be in the interest of Turkey to join the carbon club, for mercantilist reasons –access to the EU market is vital for Turkey—but also for a much more fundamental reason: according to IPCC fifth assessment report, Turkey is on the losing side of the impact of climate change, with a significant increase in the probabilities of droughts, fast floods, a rise in the sea level and a significant decrease of arable lands. In the baseline scenario, while global average temperature would increase by circa 4°C, it would increase by 7°C in inland Turkey[18]. Yet embracing a proactive climate policy is a tall order for Turkey, which is subsidizing the use of fossil fuels abundantly, and has not managed to trim significantly its CO^2/GDP ratio since 2000.[19]

Exhibit 2

Carbon emissions (consumption-based) per unit of real GDP

Turkey has not significantly reduced its CO^2 emissions per unit of GDP



Sources: Global Carbon Budget 2018, Le Quéré & alii; Oecd; © EChO

[18] See Dr. Leo Meyer slide deck on the IPCC Fifth Assessment Report. Bogazici University, 10 September 2015.

[19] See 'Warming a frozen policy: challenges to Turkey's climate policy after Paris', Dr. Ümit Sahin, TPQ **[http://turkishpolicy.com/article/818/warming-a-frozen-policy-challenges-to-turkeys-climate-politics-after-paris]**

Since Turkey is a net importer of hydrocarbons, it would benefit from a border tax (at least the government coffers would), but such tax would not be consistent with coal/petrol subsidies. Therefore, Turkey would have to overhaul its tax policy, from carbon subsidy to carbon tax and use the proceeds to redistribute income towards the poorest households. Eventually, Turkey would benefit from a genuine and inclusive (by redistribution of carbon dividends) policy, yet, the transition might prove politically costly. It would therefore be in the interest of the EU to use a part of the ear-marked financial resources generated by its own border tax, to mitigate a portion of the transition costs borne by Turkey.

I will conclude this comment by a thought experiment. Let us assume that, at the end of the mandate of the new EU Commission, the Union has made basic and applied research a top priority and provided the European Research Council, renamed European Research Fund with a €500bn endowment. Let us assume that a large majority of EU member states have agreed on a single carbon price path and decentralized carbon pricing policies, and that the EU has initiated negotiations with her trade partners with the aim of introducing a border tax adjustment and creating a 'climate club'. Let us assume also that Turkey is on board on each of these initiatives, as partner and beneficiary of the ERF, but also as a contributor to the trend in devising a national carbon pricing policy.

Not only Europe, but the world would be different. The scientific and innovation battle would no longer be a two-player game, thanks to Europe regaining her historical rank in the scientific and technology fields, but with a cooperative and peaceful mindset, in contrast with the two superpowers. A large, more or less informal, carbon club would be taking shape, including major regional powers such as Turkey, Canada, where several provinces have their own ETS and many Asian countries committed to CO^2 emissions reduction that have a big stake in exports to the EU. Once such a critical mass is achieved[20], it is likely that China, where carbon pricing policies are already at work[21] would join in one fashion or another as well as the US, depending on the winner of the incoming presidential elections,. The odds in the battle against global warming would have dramatically changed, thus reducing the probability of local conflicts and migration flows triggered by climate change.

For sure, technology and trade policies would continue to shape the global economy. But the outcome would be different. In each of the scenarios described in section A, I believe that Europe, Turkey and their cooperative neighbors would fare better, in a more peaceful world.

[20] See 'Climate Clubs: Overcoming Free-riding in International Climate Policy', William Nordhaus, American Economic Review, 015, 105(4): 1339–1370.

[21] The regions of Beijing, Shanghai, Shenzhen and others have developed emissions trading systems (ETS) since 2014. The resulting carbon price for Beijing was $12/tCO2 in mid 2019.

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