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I will interpret my topic a little more broadly than it was given to me, which was focused on new technologies and competitiveness, whereas I will talk about changes in policy as well as new technology and the impact on competitiveness. Competitiveness is a word that trips off the tongues of politicians, journalists and others without being entirely clear what it means. What it means to an economist for a firm is relatively straightforward. We say a firm is competitive if it is profitable in its line of activity without losing market share, and it is super-competitive if it is actually gaining market share without losing profitability.

The term “competitiveness” has moved from that notion at the firm level into general discourse, and unfortunately it does not translate too well if you think about whole countries or larger entities. There was an American presidential commission on competitiveness some 15 years ago which, after wrestling with this definitional question, concluded that competitiveness for a country basically meant productivity of the economy as a whole, closely related to its standard of living. Therefore, as you move away from specificity the term loses its specificity, but everyone assumes he knows what competitiveness means, and I will assume we are all in that boat.

The first thing I want to talk about is the influence of climate policy on competitiveness. We do not actually have many parts of the world today that have a climate policy; the EU happens to be the leading part of the world that does have a climate policy. If we think that using the atmosphere as a disposal medium for greenhouse gases is socially undesirable in the long run – and that is what our concern with climate change is all about – then we need somehow to ration the flow of greenhouse gases into the atmosphere, and we have had discussions with the 18 FCCC Conferences of the Parties (COPs) and other fora on that question.

The problem is who is to pay for restraining emissions, and we all know that almost all governments of the world today are strapped for funds. There may be a few exceptions, like Qatar, but most governments, including China, India, the US, and Europe, are strapped for funds, so efforts are sought to impose the costs on somebody else. Who is that somebody else? It is us, it is we the people and the firms, but we basically do not want to face up to it. The fact is that restraining emissions cannot be done without incurring some costs, and the issue of who bears the costs is highly relevant; if the costs, directly or indirectly, are put on productive firms, then it affects their competitiveness - that is the link - particularly if the firms produce tradable goods, where imports or exports are important. If their government imposes the costs of reducing emissions on them and other governments do not impose the costs on their international competitors, they have a problem of competitiveness in world and even in home markets.

This is an issue which is mentioned from time to time in discussions on climate change, but it has not been central to those discussions. When you get to the politics of it in every country, it will be central to the discussion. The United States is notorious for not having a national policy on climate change, though some of its states do. We did, however, have a bill passed by the House of Representatives in 2009, called the Waxman-Markey Bill, after the two congressmen who sponsored it. It contained a politically important article, which said that goods coming from countries that do not have comparable measures to restrict greenhouse gas emissions would be subject to border taxes coming into the United States. The basic scheme of this bill was comparable, broadly speaking, to what exists in Europe today; it was a cap-and-trade system. But to repeat, for countries shipping goods to the United States that did not have climate change policies comparable to the one envisaged in this bill, border taxes would be imposed.

The Europeans have dealt with this issue in a different way, and some of you may not be familiar with this. The Europeans allocated their emission permits freely to over 12,000 firms covered by the cap-and-trade system; it is a huge operation from an administrative perspective. They were allocated freely, neutralizing the competitive effect. But this raises the question of what was the principle of allocation. The allocation was left to national governments, and each government allocated permits to those industries where it wanted to improve competitiveness. So, for example, Germany allocated a disproportionate number of permits, by any standard, to its steel industry, Italy allocated a disproportionate number of its permits to its ceramics industry, and so on; there is hardly a government that is innocent



in this respect. This was a very clever, largely covert, way of providing subsidies to industries that each national government conceived to be under competitive pressure in international markets.

Unfortunately, from the point of view of the EU, this distorted intra-EU competition as well as dealing with competition from outside, so in what is called phase three, which runs from 2013 to 2020, Brussels has taken over this allocation process so that there will not be such big discrepancies across Europe. But my guess is that we will see the same process; it will be done in a more uniform way, but the industries and tradable sectors will be allocated a disproportionate number of free permits, and the Brussels-preferred auctions will not dominate the allocation. It is a different mechanism from the one envisaged in the American legislation. The point I want to make is that policies to deal with climate change will be extremely sensitive, in all countries, to the issue of competitiveness and how this affects each country's firms.

The developed countries promised in the Copenhagen Accord, COP16, ratified in Cancun, USD100 billion annually by 2020 to developing countries for mitigation and adaptation to climate change, though it was a political commitment, not a legal obligation. I fear that the expectation of developing countries, assuming this money comes forward, is that the costs to their firms of actions to mitigate emissions will be financed by these funds. Pose that against the issue of competitiveness which I have just raised, and that will not work. We have expectations out there which are simply unviable. I am now making a political forecast: it will not be acceptable for India, to take that important example, to relieve Indian firms of the costs of mitigation, allow them to export their products to Europe, the United States and other parts of the world, and not attract effective resistance in the form of border taxes or some other restrictions in importing countries.

This is an issue that has not been much discussed in the climate change negotiations. There is a direct conflict with the viability of the trading system which we now have, represented by the WTO. There is tremendous tension between the WTO framework of trade rules and what we are thinking about doing for climate change. I believe the world has been extremely well served by the trading rules we have had over the last half-century. A large part of our growth and global prosperity is due to the growth in international trade and commerce among countries. So if we move ahead on climate change in the way we are doing so far, there will be tremendously damaging side effect if the trading system is undermined by climate change policy.

Fortunately, there is a natural solution to this problem, and the solution is to put a price on greenhouse gas emissions and charge the same price to everyone, worldwide. Just as we ration oil by charging a price for it, and the price has gone up over time to ration consumption of oil, and we ration copper by charging a price for it, so anyone who wants to use oil or copper pays the world price, we need to price greenhouse gas emissions into the atmosphere, and everyone who emits them pays the same price. That will create some tension between conventional notions of equity and what I think will be tolerable from the point of view of competitiveness in world markets, so it is something we need to think a lot about.

My next remark will be on what has now been mentioned several times, the tremendous, and for many people tremendously surprising, development of shale gas in the United States, with shale oil coming down the road, which may produce equally surprising results in a few years' time. Gas in the United States is between USD3-4 per 1,000 cubic feet, or a million BTUs, at the moment, which is less than half what gas costs in Europe. What is the actual price in Europe might not be a secret to Christophe, but it is a secret to the rest of us, because the contract terms are not publicly known. Gas is even more expensive in Japan.

A big decision the United States faces at the moment is whether to export any surplus gas it has, a matter of some controversy because domestic users of the gas perceive correctly that if the export market is opened up, the US gas price will rise. Political forecasting is highly risky these days, but my guess is that the US will decide to export the gas, and that will raise the price of gas as an input into the US petrochemical industry, as well as to the householders who burn gas to heat their homes, so both consumers and at least some firms will be adversely influenced. However, it will still be cheap gas compared to where it was five or six years ago and to forecasts made then.

I will leave the geopolitical consequences of that to our next speaker, but let me just say that, assuming the volumes are as we think they are, we cannot assume that other things will remain equal in the rest of the world. It will put a lot of



pressure, in particular, on Russian gas prices coming into Europe, to take one example. Coming back to the topic of competitiveness, insofar as it is an input into American industry, we now have reduced cost and ample supply of an important input, and that will at least make those segments of American industry using that input more competitive on world markets than they were before.

I want to close on the remark that Christophe already made, that he will have a completely different set of charts next year and the year after, that the technology is moving rapidly in this area, with strong interaction between economics and technology, that firm forecasts should be extremely suspect, because we live in a rapidly changing world. However, the direction of change is radically different from the thinking about fossil fuels five to ten years ago. The main impact of substitution in the US, by the way, will be for coal in power generation, so from a climate change point of view this development is highly desirable, because per unit of useful BTU, gas emits about half the greenhouse gases that coal does. Coal is expensive to move, so it will also affect the price of coal in the US as well as gas, so we cannot assume that other commodity prices will remain unchanged. Therefore, we will have a lot of fluidity.

My final remark has nothing to do with competitiveness. I was stunned that the IEA in its latest report translated its 25-year forecast in fossil fuel consumption into a concrete increase in temperature, 3.6 degrees centigrade, on their mainline projection. I am not a scientist, but I try to follow the climate science closely. We have hardly narrowed our understanding of the impact of greenhouse gas concentrations on global temperature at all over the last 20 years. It is still a very wide gap. A doubling of CO₂ equivalents from levels in 1800 was reckoned to raise average equilibrium global surface temperature by 1.5-4.5 degrees centigrade 20 years ago. To my understanding we have trimmed about two-tenths of a degree from that wide range. We have done an enormous amount of research on the climate over the last 20 years, and it is an indication of how complicated our climatic system is that we still have not significantly reduced that uncertainty in the sensitivity of temperature to atmospheric concentrations of greenhouse gases.

Therefore, get it out of your minds that it is 3.6 degrees; it could be half of that, or it could be over five degrees. There is still a tremendous amount of uncertainty in this area, in spite of the billions of dollars we spent on researching the climate.