Overview of competitiveness issues in Japan

In the absence of a single global carbon price, the competitiveness impacts of domestic climate policy and pricing are often cited as a concern by industry. A number of studies have explored this issue in depth for regions where carbon pricing exists or is being developed. They have revealed that based on current carbon prices, the impacts are usually confined to only a few subsectors of the economy. This paper offers a brief insight in to what the expected impact of carbon pricing may be for Japanese industry subsectors if a carbon price of 3000¥/t (approx 30 USD/t) was introduced. It identifies the 17 subsectors most at risk, comparing them to those identified by similar modelling exercises undertaken in other regions. The subsectors are broadly similar with the exception of pig iron. Although steel is identified as one of the key sectors at risk, the Japanese pig iron subsector appears to be disproportionately affected. A reason for this may be the recent export-led growth in the Japanese steel sector but further analysis is needed than this initial study allows

Introduction

Competitiveness is an important concept at both the economy and industry level. At the country-level, an uncompetitive economy would have lower GDP or employment rates with the quality of life of its citizens diminishing over time. At a firm level, uncompetitive companies may lose market share, have lower profits and, at worst, may shed staff, close down or relocate abroad. A number of definitions for competitiveness are commonly used but there is no universal consensus on the term. This paper will attempt to draw on some of the most commonly used theories.

Macro-level definition

The World Economic Forum offers a clear and succinct definition of macroeconomic levels of competitiveness, proposing it is "*the set of institutions, policies and factors that determine the level of productivity of a country".* Productivity in simple economic terms is the value of goods and services (output) generated per unit of a country's input to production (human, physical and natural capital). A country's relative productivity can be viewed as a proxy for relative competitiveness and can be assessed using a combination of socio-economic variables[1]. Often, an index of measurements will be used to reflect the multiplicity of the issue. However the complexity and comprehensiveness of this measurement is rewarded by the depth of insight it can offer about a country's economic prosperity. An economy which is relatively more competitive than its counterparts abroad will be more prosperous and its citizens will have both a high level of income and standard of living. An economy that continues to be competitive over time will also have strong returns to investment which allows for an improvement in the nation's standard of living in the future.

Micro-level definition

A firm or sector that is relatively competitive in the production of a particular good or service is said to have comparative advantage and will increase its global market share of production through trade. Again, we can turn to the more easily measurable "productivity" to approximate a sector or firms level of competitiveness relative to their counterparts abroad e.g. value or cost of a product per unit of input. However, as with macro-level competitiveness, this uni-dimensional approach which focuses on costs is insufficient for explaining why domestic production may still continue to grow even in light of international firms with apparent comparative advantage. Again, a range of factors must be considered which offer more insight on why a less productive firm or sector may continue to be competitive. The Carbon Trust[2] offers a list of some of these and suggests that; transport costs, the balance between capacity and consumption, import restrictions, instability, product differentiation and marketing, brand

[1] The World Economic Forum suggests assessing, weighting and aggregating the following components which determine competitiveness: institutions, infrastructure, macroeconomic stability, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market sophistication, technological readiness, market size, business sophistication and innovation.
[2] The Carbon Trust (2008), "*EU ETS impacts on profitability and trade – a sector by sector analysis"*

reputation and service differentiation may also affect how competitive a firm or domestic sector is in the international market.

This introduction to competitiveness is crucial for understanding the complexity of its drivers and their interactions. Climate policy is only one of a number of these factors that may affect the competitiveness of a country's economy or domestic sectors. International trade theory suggests that those domestic sectors which are CO2 intensive and trade exposed will be at a competitive disadvantage if their competitors abroad do not face similar carbon pricing[3]. In addition to industry fears, in a world of unequal carbon prices, there is the environmental threat of so-called carbon leakage. This is the situation where there are either increased imports from, or relocation of industry to countries that don't face such stringent carbon prices. Emissions in these countries would increase with production, negating any impact of reduced emissions derived from domestic climate policy; rendering it ineffective from a global environmental viewpoint.

Several studies have been undertaken to examine this issue where carbon pricing already exists, predominantly in the EU, and evidence to date has suggested that realistic current and future carbon prices would only pose a threat to competitiveness for a few subsectors of the economy for those countries with or anticipating carbon pricing. This is because cost differentials due to labour and other input costs such as raw materials will frequently outweigh any international differences in the cost of carbon.

This short paper hopes to build on the body of existing literature by exploring in more depth the nature of the competitiveness impacts posed by the introduction of a carbon price of 3000¥/tCO_2 in Japan.

Country Specific background

In the immediate post-war period until the mid 1980s, Japan experienced strong positive economic growth. This slowed in the 1990s largely due to the effects of inefficient investment and an asset price bubble in the late 1980s. The economy entered a recession in 2007, dipping to a low GDP growth rate of -0.7% in 2008[4], and saw a return to 0% interest rates in an effort to stimulate consumers spending in the country. The global economic downturn has reduced demand for Japanese exports and business investment and thus exacerbated the recession. According to the World Trade Association, its main exports in 2007 were: motor vehicles, machinery, electrical machinery, optical and medical instruments, iron and steel, plastic, organic chemicals, ships and boats and iron and steel products. Their largest expenditure on imports in 2007 was on fossil fuels. In 2006, Japan generated around 40% of its electricity from crude oil, 21% from coal and peat, 15% from gas and 15% from nuclear. It is the third largest generator of nuclear powered electricity (behind France and the USA) and has indicated a long term commitment to nuclear energy as part of its energy mix. Renewables accounted for approximately 3% of the total electricity generated and its renewable technologies and practices, particularly solar photovoltaics, are some of the most advanced in the world.

Key Findings

The key findings from this study were derived from a piece of analysis by Asuka, J. (2009). Using a methodology introduced by Hourcade et. al (2008)[5], the research identifies Japanese subsectors[6] which are most carbon intensive and industrially competitive, and may require policy protection.

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[3] A number of studies have been undertaken which explore the prevalence of this hypothesis amongst firms in the EU covered by the EU ETS, who face a fluctuating carbon price. Please see Climate Strategies (2008), Hourcade et al. for a literature review of some of the key studies undertaken to date.
[4] World bank, country statistics – Japan
[5] Please see Climate Strategies (2008), Hourcade et al. for a technical explanation of why this methodology was used.
[6] Classified at the 4-digit SIC code

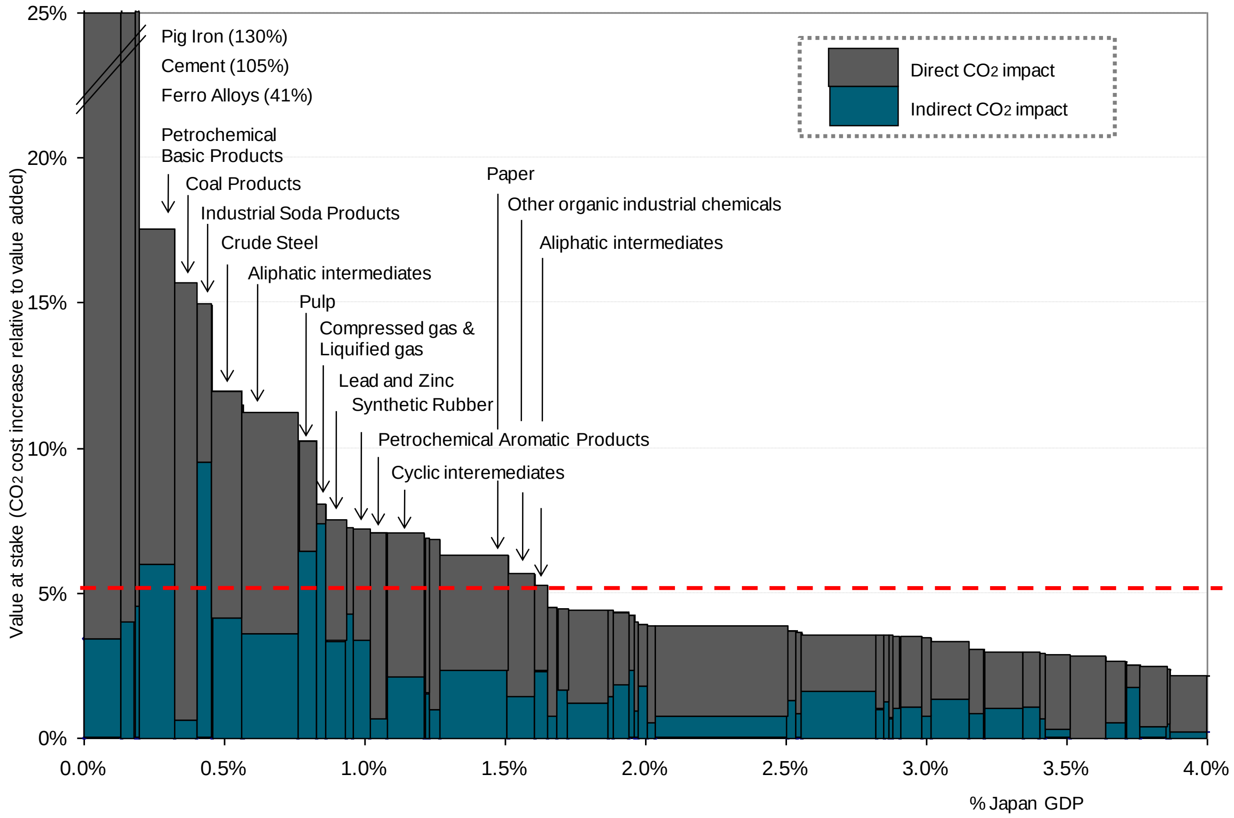

Chart 1 – Japanese subsectors most cost-sensitive to direct and indirect CO_2 pricing
Source: Asuka, J et al (2009), *ETS and International Competitiveness Issue,* a paper prepared for the SEEPs Annual Meeting, Japan, Oct 2009

The vertical axis shows the cost increase brought about for Japanese industry if they pay the full cost of CO_2 emissions, at 3000¥/t (i.e. there is no free allocation of permits), as a percentage of the subsector's current level of value added. The horizontal access indicates the percentage that each industrial subsector contributes to Japanese GDP. The area of each column is proportional to the CO_2 emission from each subsector. The blue bars show the cost of carbon that will be paid through higher electricity prices and the grey bars show the carbon cost from generating emissions from direct fossil fuel consumption and manufacturing processes.

The red dotted line is set at a level of 5% Maximum Value at Stake. All the subsectors that fall above it are identified as those that are the most carbon intensive and therefore potentially at risk of impacts on competitiveness, if there is no free allocation of emissions permits[7].

This analysis has been replicated for a number of regions, inlcuding Germany, the USA and the UK, allowing for a comparison and identification of sectors commonly at risk. The Carbon Trust proposes 6 of these for the UK (iron & steel, aluminium, nitrogen fertilisers, cement and lime, basic inorganic chemicals, pulp and paper) which are commonly of concern ("significantly" or "plausibly"). These sectors generally make up less than 1% of all of the regional studies' GDP[8].

Like in Germany, UK and US, potential competitiveness impacts are concentrated on specific subsectors as shown in chart 1. With a notable absence of Aluminium, the sectors at risk are similar to other country studies - these include petro chemical products, cement, basic steel.

[7] This threshold was determined by the European Commission
[8] Climate Strategies (2009), Grubb. M & Sato.M *Ten (plus one) insights from the EU Emissions Trading Scheme – with reference to emerging systems in Asia*, Cambridge, UK (www.climatestrategies.org)

Here, given the finer resolution of sector definition, it is possible to see that most of the risk in basic steel making is focused on the pig iron production. Crude steel is lower at 12%. Asuka et al (2009) estimates that for a 3000¥/t CO_2, it can be expected that the price of flat steel will increase by 1.25% as carbon pricing affects various stages of the production process. The study further assesses that if 100% of this price increase was passed on to consumers, there would be an approximate 3% fall in demand for domestic products and a 1% fall in international competitiveness. Compared to trade patterns in the past 10 years the impact is likely to be minimal.

The pig iron subsector in Japan, an intermediate product produced in a blast furnace for steel production, has very high carbon costs relative to subsectors abroad. This suggests high sensitivity to carbon costs and also lower economic value added per unit of energy (and associated carbon emissions). The analysis does not show linkages between upstream and downstream activities and it is possible that the impact of carbon pricing on Japanese steel may actually affect a larger percentage of total GDP, for example in construction and automobile production, than is suggested by the chart above. This may be an area for further research, along with the identification of a portfolio of possible remedial climate policy options to equalise carbon costs amongst trading partners.

The Japanese subsector definitions differ slightly from equivalent studies undertaken in the US, Germany and UK. This makes comparisons more difficult as one is not always able to compare like-with-like. In the case of steel, the Japanese sector classification disaggregates the production processes whilst the other studies refer to the subsector simply as "Iron and Steel". Similarly, the Japanese study explores in more depth the exact inorganic and organic chemicals and their stage of production that may be most at risk; it identifies industrial soda products, aliphatic intermediates and cyclic intermediates. Similarly, in Chart 1, there is a distinction made between petrochemical basic products and petrochemical aromatic products whilst in other studies this sector is simply defined as "refined petroleum". This point also holds for the production of pulp and paper. Because of these differences, it is very difficult to make any comprehensive subsector comparisons beyond those which have been asserted here. Further research would be required to understand the exact nature of these subsector inputs to Japanese manufacturing. It would be preferable if other countries also adopted this higher resolution of sector definitions as it makes it easy to assess in more detail which subsectors are more at risk.

Conclusions

This preliminary analysis shows that

a) The Japanese subsectors at risk of competitiveness concerns are largely similar to those identified by similar studies undertaken for the UK, Germany and the USA.

b)The exception to this is Aluminium which is comparatively less at risk in Japan.

c) Differences in subsector definitions in Japan can allow for additional insight into what stages in the production chain will be most at risk.

d) The pig iron subsector, an input in to the steel making process, appears to be more at risk in Japan.

e) However, analysis suggests that the impact of carbon price on flat steel (the final product) on industry competitiveness will be minimal relative to other trade influences over the past decade (see Asuka et al (2009)).

Further work is needed to ascertain the exact nature of these subsector inputs to Japanese manufacturing.

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