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The Just Transition Challenge: Avoiding Carbon Leakage and Jobs Off-Shoring in Decarbonising International Supply Chains

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Summary
Industrial decarbonisation is a major challenge in terms of both emissions reduction and the 'just transition' element of the 2015 Paris Agreement. It raises issues of potential carbon leakage and associated off-shoring of jobs and economic value (GDP) if carbon reduction policies impact the location decisions of industry. We use economic multiplier metrics to help quantify the extent of these potential displacement effects. Focussing on cement production as a particular decarbonisation challenge, we demonstrate that **displacement of currently EU-based production activity could potentially lead to reductions in domestic jobs and GDP, combined with a net increase in global CO_2 emissions.**

Our key conclusion is that a strong argument exists to address the industrial decarbonisation challenge where emissions are currently located. The 'just transition' element of the Paris agreement emphasises the **need to retain and grow jobs and GDP whilst meeting climate targets in the long term.** This will always be a preferable outcome over jobs off-shoring/GDP loss and not meeting targets in the short and long term.

The policy challenge

Decarbonising the EU economy in line with the commitments set out in the 2015 Paris Agreement will require a step-change in climate change policy that goes well beyond decarbonising the electricity sector. Decarbonisation of industry represents a particular challenge. The work presented here seeks to shed light on the nature of that challenge and potential solutions, by exploring the **potential cross-sector and cross-border impacts on global emissions, jobs and GDP if carbon-intensive industries were to relocate production overseas** as a consequence of stringent climate policy.

Industrial decarbonisation poses two particular challenges. First, CO_2 is not just produced as a by-product of energy use. A number of important industries within Europe, such as steel and cement manufacturing, generate significant amounts of CO_2 through industrial processes rather than the actual *use* of energy. These industries will need to be decarbonised if the EU is to achieve its Paris 2015 emissions reduction goals.

Second, considering potential changes in industrial activity brings into sharp focus the 'just transition' element of the Paris Agreement, which commits signatories to take into account ***'a just transition of the workforce and the creation of decent work and quality jobs'*** (UNFCCC, 2015, p4). As the recent Zero Emissions Platform report 'The Role of CCUS in a Below 2 Degrees Scenario' notes:

> *'there is a need to retain and ultimately grow jobs and production activity, rather than risk displacing emissions to other countries where global climate impacts may outweigh any economic gain.'* (ZEP, 2018, p.4)

The crucial point is that any displacement of emissions must be understood in a context of potentially off-shoring production and, thus, jobs and GDP.

Currently, industrial emissions in EU countries are managed largely via a combination of regulations and regulated market-based measures, including the EU Emissions Trading System (EU ETS). In 2015, EU industries in EU ETS had to pay on average US$8.21 per tCO_2e. At the same time in China, the emissions credit scheme in place has never had a carbon price over US$5.7 since its introduction.

Moreover, it only affects industries operating within specific city and regional locations. As the need to decarbonise EU industries becomes more pressing, there is a risk that 'ratcheting up' of existing and/or introduction of new regulations and other policy instruments across and within member states could drive industries to relocate production outside of the EU, to countries such as China. Here we consider how this is likely to result in trade-offs between jobs and GDP in different countries, accompanied by a potential net increase in global CO_2 emissions.

Key results

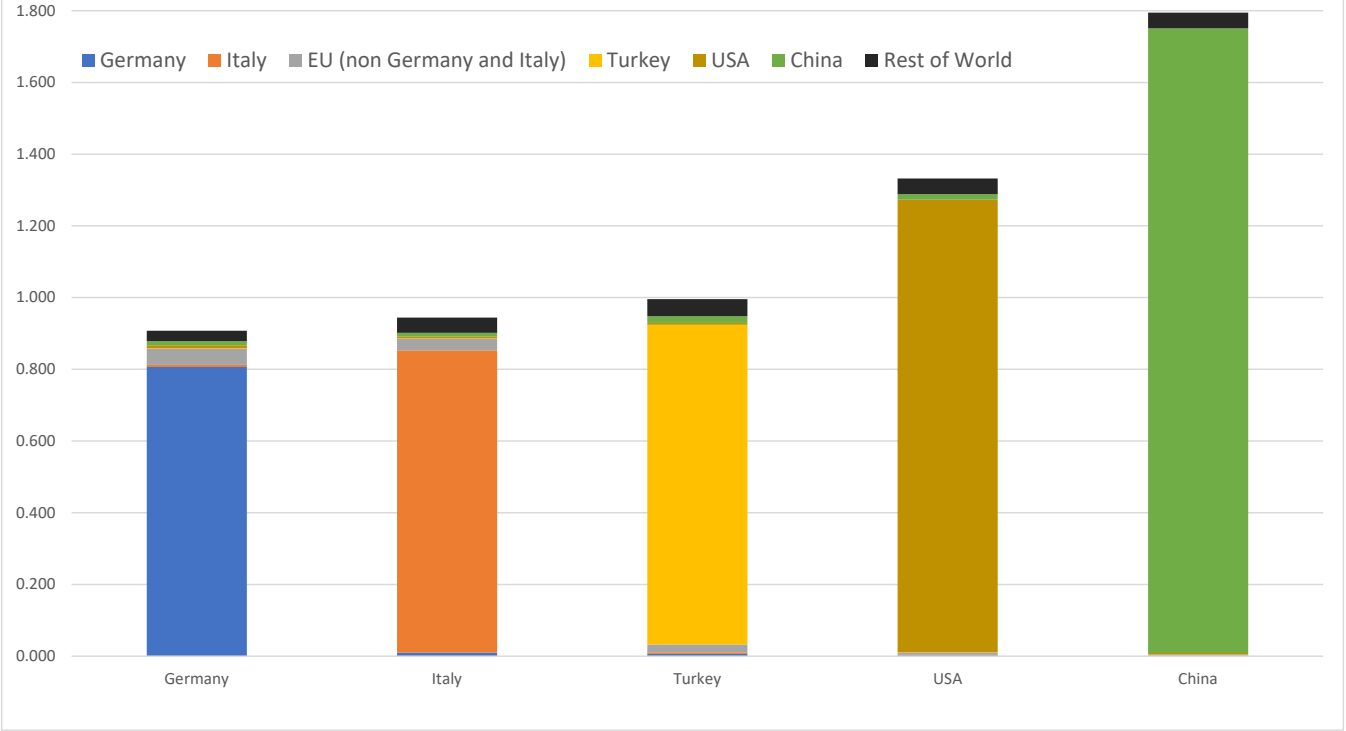
We use 'economic multipliers' to consider the extent to which emissions, jobs and value-added currently generated both within existing national EU-based industry and upstream supply chains may be displaced across borders, with emissions potentially increasing while GDP simply relocates, if production were to move overseas. We use German cement production as a case study.

We reviewed the **direct and supply chain emissions** of cement industries in a range of countries, including one other large cement-producing EU nation, Italy. We note that the most recent (World Input-Output Database) information available to compute multipliers relates to 2014, so that caution should be exerted in citing specific results.

We found that Germany and Italy have very similar emissions 'footprints' per $1m of final demand (respectively 0.91 and 0.94 kilotonnes of CO_2 produced throughout the global economy per $1m of final demand served by the national industry). We also considered three examples of non-EU cement producing nations: Turkey, USA and China. For these countries, emissions per $1m of final demand tend to be higher. The multiplier value is 1.33 kilotonnes (kt) for the US, 1.79kt for China, although with Turkey more in line with Germany and Italy at 1.0kt (and lower than other EU nations such as Spain and Poland).

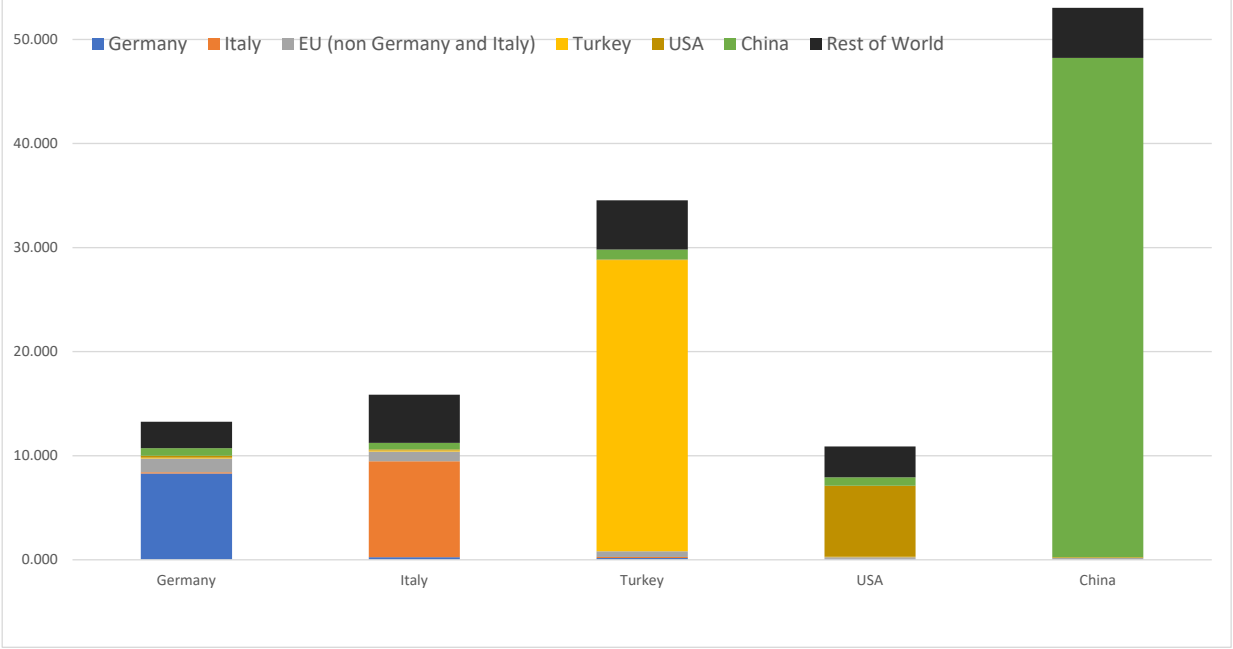
Figure 1 illustrates these differences.

Figure 1. Output-CO_2 multipliers by location of required direct and supply chain emissions (kilotonnes of CO_2) required per $1m of final demand for 'Cement etc.' industry output



The first key insight that can be drawn is that (in the absence of any new policy action) relocating cement production outside of the EU is likely to generate a spatial displacement - or off-shoring - of CO_2 emissions and an **overall increase in global CO_2 emissions.**

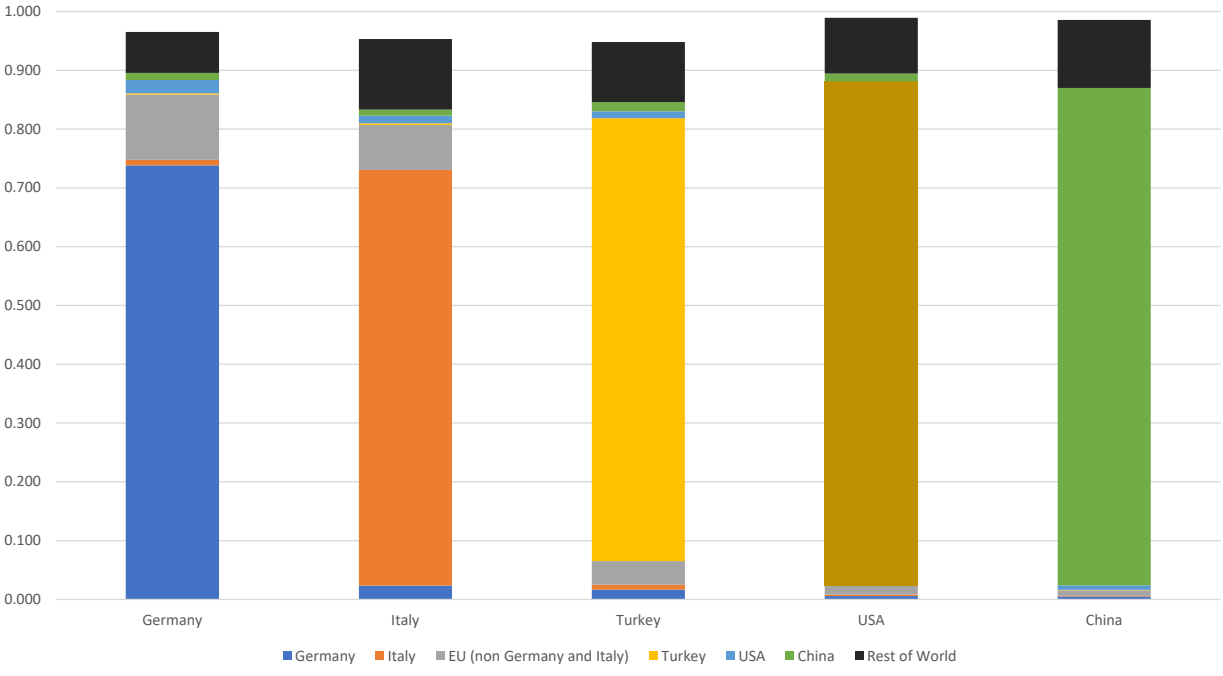
Figure 2. Output-employment multipliers by location of required direct and supply chain jobs (numbers employed) per $1m of final demand for 'Cement etc.' industry output



A second key result can be drawn from considering comparable multiplier results for GDP and jobs. Figures 2 and 3 (respectively reporting number of jobs and $m of GDP throughout the global economy per $1m of final demand served) reflect the fact that off-shoring of emissions is likely to be accompanied by **displacement of GDP generation** overseas. This may be associated with a net increase in global employment (though we note that the data available report 'head count' jobs which may not be directly comparable across countries with different working hours). Turkey and China have significantly higher numbers of direct and supply chain jobs associated with each $1m of final demand than do Germany, Italy and the USA.

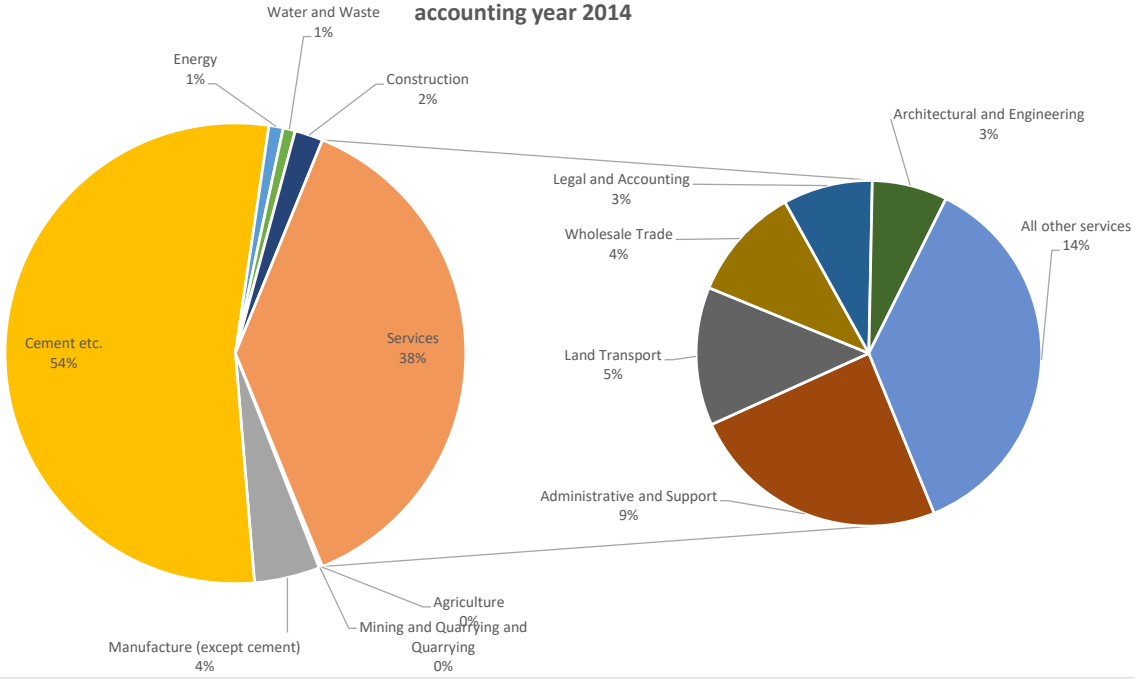
On the other hand, the wider GDP value of each job is lower (i.e. the employment of labour is less productive in China and Turkey). If we are interested not only in the level but also the quality of employment (no matter where these jobs exist), we might be concerned at this potential consequence of off-shoring cement production.

Figure 3. Output-GDP multipliers by location of required direct and supply chain value-added ($million) per $1m of final demand for 'Cement etc.' industry output



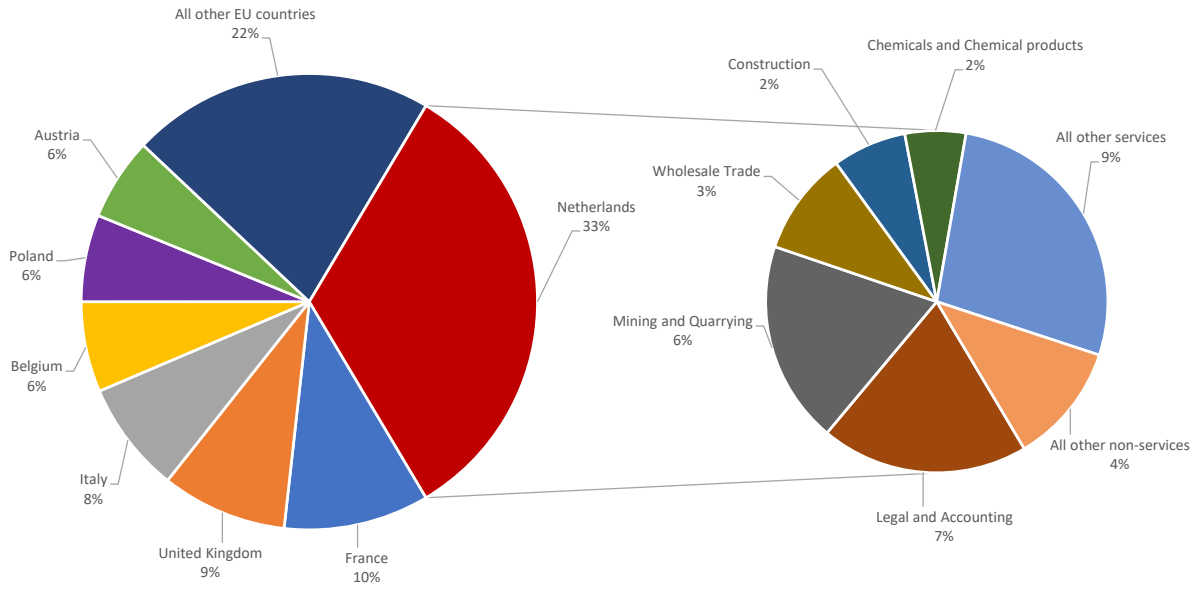
A third key result is the importance of **domestic supply chain employment** associated with cement production. In particular, we analysed the breakdown of supply chain jobs located within Germany itself for German cement production and found that 38% of these are in the services sectors (see Figure 4). This is a key information set in considering the 'just transition' element of the Paris 2015 agreement from a German perspective. The focus there on nationally defined development priorities with respect to the 'imperatives of a just transition of the workforce and the creation of decent work and quality jobs' demands a focus on the areas of the German economy where jobs may be affected by off-shoring of cement production.

Figure 4. Distribution of German employment multiplier effects by sector required to support final demand for German 'Cement etc.' industry output: 8.29 jobs per $1m or 90,915 jobs in accounting year 2014



Finally, we analysed cross-border linkages between German cement production and supply chains in other EU states. We found that, because of the interconnectedness of EU members' economies, the wider EU supply chain GDP associated with German cement production is substantial, in particular for the Netherlands, as illustrated in Figure 5.

Figure 5. Spatial distribution of supply chain GDP generated to support production of output to service German 'Cement etc.' final demand (with industry level detail for the Netherlands)



Conclusions

This briefing paper presents research that explores these potential impacts for German cement production. It is intended as an example of the type of broader economy analysis that is essential to inform policy consideration of the full range of impacts of potential decarbonisation solutions in terms of actions that may induce retention or relocation of industry activity.

More generally, our analysis highlights the importance of considering how shifting locations for manufacturing processes (such as cement production) from their current locations to ones with less strict environmental regulations may lead not only to an increase in global CO_2 emissions but an off-shoring of jobs and GDP that may violate the 'just transition' imperative of the Paris Agreement. In particular, multiplier analyses permit consideration of how jobs and GDP off-shoring will impact not only in the industry itself or be limited to the original host region through a chain of upstream supply chain impacts.

This focuses attention on the need to decarbonise industrial activities in their current locations, by means that do not negatively impact key performance indicators for both industry and the wider economy, such as competitiveness. **The challenge underpinning the 'just transition' element of the Paris agreement is to retain and grow jobs and GDP whilst meeting climate targets in the long term as opposed to production relocation that triggers both job off-shoring/ GDP loss and the risk of not meeting targets in the short and long term.**

Domestic industrial decarbonisation is likely to involve a range of approaches. As argued in several key recent reports (see ZEP, 2018, for a review), **Carbon Capture and Storage (CCS) is likely to constitute an essential part of the lowest cost solution**, particularly in the context of reducing emissions from 'hard to mitigate' sectors such as industrial processes, along with distributed heating. Introducing utilisation of captured carbon to the CCUS mix does have the potential to strengthen business models for industrial emissions reduction. However, at this time the market for CO_2 use is minimal compared to the amount which will need to be permanently stored. Thus, CCS, along with hydrogen, remains a challenge that will require public and private sector coordination and contribution. In this context, the type of economy-wide focus embedded in the multiplier approach proposed here becomes crucially important.

Our analysis provides a first step in considering both the potential wider societal costs of relocation and the benefits of retaining activity. Fuller consideration of potential outcomes under particular scenarios will demand extensive research and more sophisticated methods. Our research aims to set out a more formal grounding for future development of a body of evidence in this area.

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Data statement: This study involved analysis using existing data that are publicly available from the WIOD database (http://www.wiod.org/release16); the 2014 IRIO table (http://www.wiod.org/database/wiots16); associated Socio-Economic Accounts (http://www.wiod.org/database/seas16) and corresponding 'CO_2 emissions' data (limited to CO_2 emissions from energy use) for each country (http://www.wiod.org/database/eas13). No new data were created during this study.

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