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The limited effect of EU emissions trading on corporate climate strategies: Comparison of a Swedish and a Norwegian pulp and paper company

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Abstract: This article examines to what extent and how the EU ETS has influenced the climate strategies of two Nordic pulp and paper companies: Swedish SCA and Norwegian Norske Skog. Rising electricity prices are perceived to be the greatest effect of the scheme. The EU ETS has served to reinforce commitments to improve energy efficiency and reduce CO_2 emissions in both companies studied. Procedures like monitoring of CO_2 emissions and accounting for CO_2 prices have become more significant since the introduction of the EU ETS, but the scheme has not triggered a search for innovative, low-carbon solutions. Due to differences in market factors and production factors, SCA has been more active than Norske Skog in investing in and implementing CO_2-lean actions. Future studies of climate-mitigation activities, strategies and innovations in the pulp and paper industry should involve more in-depth investigation of the interactions between such factors and the EU ETS.

Keywords: emissions trading; corporate climate strategies; pulp and paper industry

1. Introduction

The EU Emissions Trading System (ETS) was the first international policy instrument to introduce regulation of fossil CO_2 emissions of pulp and paper companies in Europe. Of 11,500 installations introduced to the system, about 900 were pulp and paper mills. In terms of allocated EU Emission Allowances (EUAs) the pulp and paper industry (hereafter PPI) represents two per cent of EU ETS (Hyvärinen 2005: 40). Can the ETS induce companies in the PPI and other energy-intensive industries to adopt proactive climate strategies? That will represent a crucial test of the EU's ability to achieve a low-carbon economy. Further, how can divergent corporate climate strategies be explained? Examination of this question can shed light on the conditions under which different corporate climate strategies emerge.

This article examines to what extent and how the ETS has influenced the climate strategies of two specific pulp and paper companies and the European PPI more generally. One of the few works on this topic is Rogge et al. (2011), whose study, based on survey data of paper producers and technology providers in Germany, found their innovation activities to be governed mainly by market factors, not the EU ETS or other climate policies. As the EU ETS is the first EU-wide regulation to target PPI CO_2 emissions, we were puzzled by the finding that the scheme apparently had scant effect on innovation activities, and suspected that the methodological approach of Rogge et al. had bypassed important aspects of corporate responses to the ETS. Complementary interview-based studies with relevant company representatives can identify more nuanced perceptions about corporate climate strategies, including the possible influence of the EU ETS on innovation activities. This has motivated our approach to examining the effect of the EU ETS by analysing the status and changes in climate strategies in two comparable yet different pulp and paper manufacturing companies: Svenska Cellulosa Aktiebolaget (SCA) and Norske Skog, with headquarters in Sweden and in Norway, respectively. Both companies appear to have progressive climate strategies, having been ranked as the best Swedish and the best Norwegian company in the 2010 Carbon Disclosure Project (CDP) appraisal. The two companies display some variation in climate strategies and development over time, with SCA apparently experimenting more with innovative abatement projects than Norske Skog. Further, Norske Skog specializes in newsprint production, and is smaller and less diversified than SCA. Due to the market situation with surplus production capacity of newsprint, Norske Skog has recently sold assets to reduce debts, and has shut down several mills to cut costs (Norske Skog 2011).[1] By contrast, SCA develops, produces and markets a broad portfolio of products and ranks among the world's leading forest industry companies. This variation in company type and performance enables exploration of the conditions under which different corporate climate strategies may emerge.

This article proceeds as follows. Section 2 presents the analytical framework and methodology applied in this study. Section 3 examines the corporate climate strategies of SCA and Norske Skog in presence of EU ETS. In section 4 we analyse the link between the EU ETS and the changes in corporate climate strategies in light of three causal mechanisms that shed light on corporate responses to regulation. Section 5 explains the divergence in corporate climate strategies of SCA and Norske Skog. In the final section 6, we identify some patterns in the complex process of EU ETS adaptation in the two companies and reflect on the future outlook of EU emissions trading and the PPI.

2. Analytical framework and methodology

The concept of 'corporate strategy' has been defined variously in the management literature. Building on scholars like Mintzberg (1987) and Leong and Ward (1994), we view corporate climate strategy as being composed of three main constituents:

1. recognition of the problem of anthropogenic climate change and acceptance of responsibility in mitigating greenhouse gas (GHG) emissions
2. manifestation of company responsibility for problem-solving, expressed by a target for reducing GHG or CO_2 emissions and related monitoring practices
3. actions or a pattern of actions: investments or implementation of technical and organizational abatement measures for climate-target achievement.

These constituents have guided our research and interview questions, and serve as indicators, framed as headings in this article, under which empirical results are described and analysed. In analysing the influence of the EU ETS on corporate climate strategies, we see three complementary causal mechanisms as providing explanatory power. First, the EU ETS may influence the cost-benefit calculations of companies. According to a rational-calculative model of corporate behaviour grounded in the mainstream economic view of the firm as a unitary profit-maximizing agent (e.g. Gravelle and Rees 1981), the principal function of emissions trading is to *restructure incentives* by putting a price on CO_2 emissions. A unitary profit-maximizing actor with full information on the relative costs of various alternatives will rank the different alternatives according to cost, phasing in the lowest-cost option first. If the allowance price is low, or expected to be low in the future, the company will prefer minor, low-cost adaptation such as

trade in allowances. Many studies of the effects of the EU ETS are explicitly or implicitly based on this understanding of corporate behaviour (e.g. Egenhofer 2007; Hoffman 2007; Ellerman, Convery and de Perthuis 2010).

Second, drawing on Porter (1990) and Porter and van der Linde's (1995) seminal work on the link between environmental regulation, innovation and competitiveness, we propose that the EU ETS may trigger exploration, experimenting and learning across companies. In line with this Porter Hypothesis, the key assumption is that the EU ETS may alert and educate companies to the benefits of reducing emissions, raising the likelihood that product and process innovations will be environmentally friendly. Lack of 'stringency' is the factor most often mentioned when scholars seek to explain why the EU ETS induced relatively little innovation in the first phases (De Bruyn et al. 2010; Ellerman, Convery and de Perthuis 2010; Rogge and Hoffmann 2010; and Martin, Muûls and Wagner 2011). According to the Porter Hypothesis, environmental regulations can – if stringent enough – stimulate companies to be innovative, adopt and develop new technologies and practices, and gain competitive advantages. The main implication is that companies *need* regulation in order to recognize new and innovative opportunities that may pay off in the short or long term (Porter and van der Linde 1995).

Third, drawing on neo-institutional theory, we expect that companies may internalize norms and rules about appropriate conduct by participating in schemes like the EU ETS. Sometimes referred to as 'the logic of appropriateness' (March and Olsen 1989), this internalization of norms and rules constitutes the prime causal mechanism seen as connecting institutions and policy instruments to behavioural change. Studies have shown that institutions and regulations can create new norms of responsibility based upon the matching of situation and role rather than on cost-benefit calculations (Vogel 2005; Barth and Wolff 2009; Flohr et al. 2010). This literature questions the profit-maximization motive and opens up for intrinsically norm-driven behaviour to explain why some companies go beyond compliance with environmental regulations (see e.g. Flohr et al. 2010, Gulbrandsen 2010). Companies guided by the logic of appropriateness can be expected to invest in long-term carbon solutions beyond minimum compliance measures, once they have recognized the climate change problem and responsibility for contributing to problem-solving efforts.

Our research methods include interviews, surveys of company documents and reports, and quantitative data analysis. Semi-structured interviews were conducted with company management representatives responsible for strategic and operative matters concerning environmental impacts, including climate change and other sustainability issues. Some complementary interviews were conducted to obtain representation from other stakeholders in the European pulp and paper industry and EU ETS policy experts. Company documents and reports (annual reports, sustainability reports etc.) have been used to examine the companies' external communications and outside recognition. Data, originally from the Community Transaction Log (CITL 2011), on allocated allowances and verified emissions under the EU ETS have been analysed to examine the relation to cap from the initiation of the scheme until 2011. By combining methods we have been able to cross-check the consistency in company statements, reported actions and compliance with the system. In addition, since the EU ETS is one of many factors that may influence corporate climate strategies, the effects of other relevant variables have also been taken into account. We have examined how the EU ETS and other EU policy instruments as well as domestic-level policy instruments interact and co-produce outcomes. The use of these different methods has proven practical in informing the analysis of factors that have conditioned corporate responses to the EU ETS.

3. Corporate climate strategies

3.1 Company backgrounds

SCA was founded in 1929 through a merger of several Swedish forest companies. The internationalization of the company started in the 1960s; today it ranks among the world's leading forest industry companies. It develops, produces and markets a broad portfolio of products within the main segments of personal care (e.g. baby nappies and incontinence care); tissues (e.g. toilet paper and napkins); packaging material; publication paper and newsprint; and solid-wood products (SCA 2011). In

2011, SCA operated some 250 production facilities, of which 45 were larger pulp and/or paper mills, in 60 countries, and sold its products in more than 100 countries. Europe represents a strong base, with 75% of total net sales (€11.7 billion for 2011), 75% of the total number of 44,000 employees, and 75% of group-wide energy use (fuel, heat and electricity) (SCA 2012; Isaksson, interview 2011).[2]

Norske Skog is Norway's only major pulp and paper company. It was founded by Norwegian forest owners in 1962 to refine national timber resources. During the 1990s, the company grew internationally, first in Europe and expanding further through the acquisition of newsprint and magazine paper mills in Asia, Australasia, and South America (Sæther 2004). Since the mid-2000s, a difficult market situation with surplus capacity of newsprint has been challenging for the company. Between 2005 and 2011, global production of newsprint decreased by almost 20% (FAO 2012). In recent years, Norske Skog has closed or downsized some of its production units and sold others; production has fallen by 37% since 2006 (Norske Skog 2012). The company has shown negative results for several consecutive years and has debts. However, with an annual production of 4 million tons it is still among the world's largest producers in its segment of publications paper. In 2011, the company operated 13 wholly-owned mills located in 10 countries, with annual sales around €2.6 billion, and had 5,075 employees worldwide. The European part of Norske Skog's business is represented by seven mills and accounts for 70% of total production capacity (Norske Skog 2012).

3.2 Recognition of the climate change problem

At an early stage both SCA and Norske Skog expressed acknowledgment of the climate change problem and their responsibility for contributing to problem-solving (SCA 1999, 2002; Norske Skog 2002). The companies already had considerable experience of dealing with local air and water pollution at their mills, and were thus prepared for developing corporate climate strategies when the climate change problem emerged on the international agenda. Norske Skog and SCA have monitored and reported their CO_2 emissions since 1996 and 1998, respectively – much earlier than many other PPI companies. They were also relatively quick to express support for intergovernmental efforts to reduce GHG emissions, like the Kyoto Protocol (SCA 1999; Norske Skog 2002). Among companies based in Norway and Sweden, Norske Skog and SCA scored highest on carbon accounting in the 2010 Carbon Disclosure Leadership Index (CDP 2010). Our expectations that the two companies would be PPI frontrunners were confirmed by examination of the corporate climate strategies of the 10 largest pulp and paper companies in Europe, which indicated that the big Nordic forest companies – Stora Enso, SCA and UPM – have adopted more ambitious climate policies and programmes than have companies from other countries (Gulbrandsen and Stenqvist 2013). [3]

In the planning and formulation phase of EU ETS, SCA and Norske Skog were positive to the idea of a carbon trading scheme, i.e. conducting climate-mitigation efforts where most cost-effective, although they would have preferred a global scheme. By contrast, the broader European PPI sector, represented by the Confederation of European Paper Industries (CEPI), initially opposed the ETS, arguing that its design 'raises several concerns for the competitiveness of EU industry' (Hyvärinen 2005: 41). There has been significant focus on the regulatory risk of the system due to carbon intensity and international competition in the PPI. Nordic pulp and paper companies have a higher share of renewables in their energy mix than most other European pulp and paper companies, which means they face lower regulatory risk.[4]

For SCA, expectations as to the allocation of EUAs were generally fulfilled. Due to international competition it was expected that EU member states, in their National Allocation Plans (NAPs), would propose generous allocations to domestic industries (Isaksson, interview 2011). Indicative of the political importance of getting the scheme up and running, the NAPs were also approved by the European Commission (Convery and Redmond 2007). For many pulp and paper companies, including SCA (although not Norske Skog), this resulted in 'long' positions (whereby the cap of allocated EUAs clearly exceeded verified fossil CO_2 emissions) in the first trading period.[5] In the course of the EU ETS, both SCA and Norske Skog have anticipated successive reductions in allocated EUAs. For individual installations this has sometimes been the case, but the aggregate amount of allocated EUAs has increased for both companies from the first to the second trading period (see below).

While generally content with the allocation procedures, both companies still perceive the risk of carbon leakage as a weakness of the EU ETS, and would prefer a global emissions trading scheme (interviews, Strandqvist 2011 and Carlberg 2011). Another issue that SCA and Norske Skog noted also prior to the introduction of EU ETS concerned the potential effects on electricity prices. Moreover, the companies had warned decision-makers of the risk of windfall profits in the power sector (interviews, Isaksson 2011 and Carlberg 2011).[6] Norske Skog and SCA share frustrations concerning electricity prices: sales of surplus allowances have not compensated for the rise in electricity prices; and the higher costs cannot be passed on to consumers because of the sharp competition in many market segments, especially newsprint.

3.3 Manifestations by target formulations and monitoring practices

In 2001, SCA made a group-wide commitment to reduce CO_2 emissions from fossil fuels in relation to production levels (SCA 2002). This commitment was strengthened in 2008, when SCA announced it would reduce the CO_2 emission intensity per unit of product from fossil fuels and from purchased electricity and heat by 20% by 2020, compared to 2005 (SCA 2009). In 2011, SCA reported a reduction of 7.3%, so it has been making progress towards its target (SCA 2011). Recently, the company also adopted a target of 14% improvement in specific energy use between 2010 and 2020 (SCA 2012). While some of SCA's other environmental and social commitments have been changed or replaced over the years, its commitment to mitigate climate change has remained firm since 2001.[7] In the late 1990s, the SCA Resource Management System (RMS) brought in monitoring and reporting practices for CO_2 emissions – as well as other emissions to air, water and various material flows (SCA 1999). This system was introduced due to internal driving forces, independent of any expectations about a future emissions trading scheme (Isaksson, interview 2011). The RMS has since been used and developed for group-wide bottom–up compilation of GHG emissions data from most production sites (SCA 2012).

Norske Skog has also, since 2001, made clear its objective of reducing GHG emissions. In 2007, this objective was quantified: the company announced it would reduce direct emissions from pulp and paper production and indirect emissions from purchased energy by 25% by 2020, compared to 2006 (Norske Skog 2010). As of 2011, GHG emissions (including CO_2, CH_4 and N_2O) had been reduced by 18.2% (Norske Skog 2012). Whereas SCA's target is production-related (as is common practice in the industry), Norske Skog has set an absolute emissions-reduction target. Such targets leave less room for manoeuvring than production-related targets, but can prove tactical when a production decline can be foreseen. The fact that Norske Skog has reduced its total production level by almost 40% since 2006 has contributed directly to progress towards its target.

In connection with the companies' targets formulations it is relevant to assess their CO_2 emissions and cap of allocated EUAs as regulated by EU ETS. The development of emission levels indicates whether progress is consistent with group-wide targets. The ratio between verified emissions and allocations indicates to what extent EU ETS incentivizes companies to reduce CO_2 emissions.

Figure 1 shows the CO_2 emissions and EUA allocations for 41 of SCA's installations, all covered by the EU ETS. During the first trading period, the emission-to-cap ratio remained unchanged at around 90%. With some acquisitions introduced in the second trading period, emissions reached a high of 1.52 Mt CO_2 in 2008 (Sandbag 2012; communication with Eriksson 2011). These new installations entitled SCA to additional EUAs in the second period. In 2011, the EUA surplus was 450,000 tons CO_2 and the emission-to-cap ratio was 75% (Sandbag 2012). For unknown reasons, one particular SCA mill, Mannheim (Germany), received a large surplus in the second period, compared to its stable CO_2 emissions between 2005 and 2011 (Sandbag 2012).

For the third trading period, which will span the period January 2013 until December 2020, SCA expects a decrease in allocated allowances compared to earlier periods (Isaksson, interview 2011). Allocation in line with best-practice benchmarks means that mills with less favourable fuel mixes will receive fewer EUA allowances than currently needed (Strandqvist, interview 2011).[8] That should provide strong incentives for those mills to implement abatement actions in the third trading period. SCA as such may still receive a surplus of EUAs, since some of its larger mills are heavily reliant on biomass fuels (Fält,

interview 2011). As SCA has a diverse product portfolio with major operations in up to ten EU ETS countries, a more in-depth analysis would be required to assess the group-wide situation for 2013–2020.

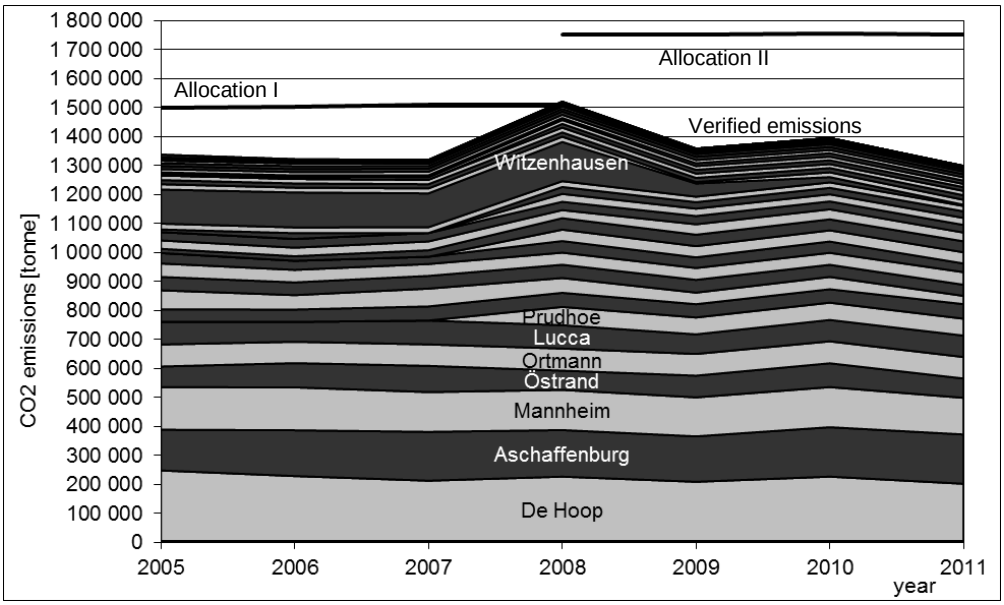

Fig. 1. Allocations and CO_2 emissions for SCA's 41 installations under EU ETS. Source: Sandbag (2012)

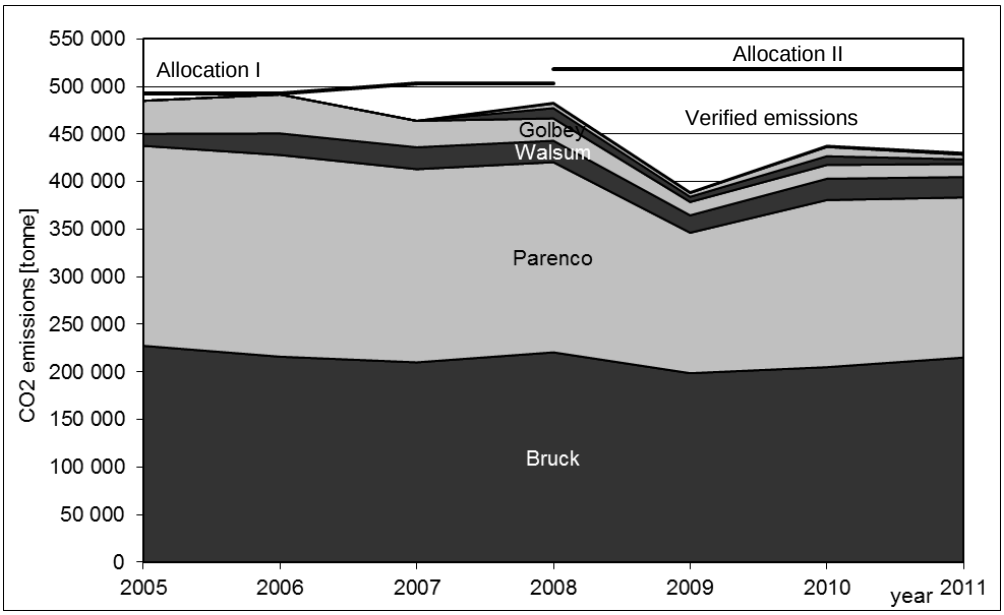

Fig. 2. Allocations and CO_2 emissions for Norske Skog's 7 installations under EU ETS. Source: Sandbag (2012)

Turning to Norske Skog, Figure 2 shows CO_2 emissions and EUA allocations for the seven installations covered by the EU ETS. From an initial emission-to-cap ratio close to 100%, the allocation of EUAs increased as the Norwegian mills joined the EU ETS in the second trading period. Over the period 2005–2011 Norske Skog's direct CO_2 emissions decreased by about 10%, due partly to low production output in recent years (Norske Skog 2006, 2011). In 2011, Norske Skog had a total EUA surplus of 90,000 tons CO_2 and an emission-to-cap ratio of 83% (Sandbag 2012). Almost 90% of the CO_2 emissions from its European mills stem from Parenco (Netherlands) and Bruck (Austria) – where electricity for the production processes is not purchased but produced on-site from natural gas (co-generation of heat and power). Under the EU ETS, CO_2 emissions from the production of electricity are allocated to these mills, not to the power companies. The CO_2 emissions from Norske Skog's three Norwegian mills are very low compared to mills elsewhere in the PPI, and this relates to energy and fuel mix. The Norwegian mills

account for more than 30% of the company's total production capacity, but their direct emissions (onsite fossil fuels) and indirect emissions (those arising from purchased energy) are less than 5%. These mills get most of their electricity from hydropower, and cover only around 1% of their energy demand by fossil fuels.

Norske Skog is likely to receive a group-wide surplus of EUAs in the third trading period, partly because of the low emission levels of its Norwegian mills. Table 1 shows direct and indirect emissions from purchased energy for Norske Skog's European mills in tons of CO_2 equivalents per ton of paper.[9] Only direct emissions are reported under the EU ETS. As the product benchmarks for these mills will be close to 0.3 allowances per ton of paper in the third trading period (DG CLIMA 2011; EC 2011), two mills – Bruck and Parenco – will have to purchase emission allowances; the other mills will receive a surplus of free allowances (Carlberg, interview 2011).

Table 1: Direct and indirect emissions from Norske Skog's European mills in 2010, measured as tons CO_2 equivalents/tons of paper. Source Norske Skog (2011).

Mill	Bruck (AT)	Follum (NO)	Golbey (FR)	Parenco (NL)	Saugbrugs (NO)	Skogn (NO)	Walsum (DE)
CO_2-e direct	0.55	0.01	0.04	0.72	0.02	0.02	0.06
CO_2-e indirect	0.05	0.02	0.12	0.07	0.02	0.02	1.29

Somewhat paradoxically, the mill with the biggest carbon footprint – Walsum – will have a considerable surplus of emission allowances in the third phase of the EU ETS. This mill has a large carbon footprint because it purchases electricity from a coal-fired power station, but emissions from producing this electricity are accounted for by the power-plant under the EU ETS, not by the mill (see Table 1). In sum, Norske Skog appears well-positioned for the third trading period, when a considerable surplus of free allowances can be expected.

3.4 Actions for abatement

In its external communication SCA reports on several recent and on-going CO_2-lean investment projects and some innovative abatement actions. The company strategy is to maintain and improve its installations with the most suitable technology in terms of fuel usage and energy performance (Strandqvist, interview 2011). A group-wide programme, ESAVE, has been established to provide a structured approach to identifying and implementing energy-efficiency improvement actions. Since 2003 this programme has resulted in 1700 smaller-scale projects with an estimated annual reduction of 120,000 tonnes of CO_2 (SCA 2012). In 2010, responding to the demand for biofuels and renewable electricity, SCA formed the new business unit SCA Energy to coordinate activities like fuel from logging residues, refined biofuels and wind-power (Fält, interview 2011). Larger projects include investments in new or retrofitted energy installations with the potential to generate significant CO_2 emissions reductions:

- In 2006 the Östrand chemical pulp mill (Sweden) made a €160 million investment in a recovery boiler and a back-pressure turbine which doubled the capacity for biofuel based auto-produced electricity and made the mill a net provider of electricity and heat (SCA 2009). In 2011, after a €50 million investment, Östrand installed a new lime kiln which will be fuelled with crushed sawdust pellets and will reduce oil consumption by 17,000 m^3 per year, and fossil CO_2 emissions by 80% or 50,000 tons per year (Fält, interview 2011).
- At the Witzenhausen mill (Germany), an external partner has invested €127 million in a combined heat and power (CHP) plant for incineration of industrial by-products and refuse-derived fuel (Isaksson, interview 2011). The mill has phased out its old gas installations and outsourced electricity and heat production to the operator of the CHP plant, thereby reducing direct CO_2 emissions by 90% or 100,000 tons per year (Sandbag 2012).
- The joint venture Statkraft SCA Vind AB has been formed to implement wind-power installations of up to 1200 MW in SCA's Swedish forest holdings (Vindkraft Norr 2011). SCA grants the land area while the Norwegian power company Statkraft undertakes the €1.6 billion investment. Through the wind-power installations partly underway, SCA will be ensured affordable and long-term electricity supply for its electricity-intensive Ortviken mill (SCA 2011).

Norske Skog reports that climate-change issues are integrated into its business strategy in various ways – including management and projection of operational costs; identification of investment options; relations with employees, customers and other stakeholders; and its engagement with governments and regulators (CDP 2011). The focus is on short- and long-term abatement plans in order to achieve its emissions-reduction target. As examples of abatement actions, the company has highlighted:

- Participation in a consortium investigating the possibilities to develop and produce second-generation biofuel.[10]
- Several mills are conducting feasibility studies into greater use of biofuel, as investments in new assets or upgrades of existing assets.
- Reduced energy use and GHG emissions by increasing the capacity of the company's Skogn mill in Norway to incorporate clay fillers in its paper products (CDP 2011). The clay can substitute virgin pulp and reduce process energy demand for pulp production in an integrated mill.

4. Effects of EU ETS on corporate climate strategies

4.1 The cost-benefit perspective

The EU ETS may influence company cost-benefit assessments by increasing the benefits of cutting CO_2 emissions and by adding costs to not doing so. Companies will rank the available abatement alternatives, phasing in the lowest-cost options first. Low EUA prices should not be expected to trigger offensive strategies involving new investment practices and engagement in long-term R&D to drive large-scale and high upfront-cost solutions.[11]

Both SCA and Norske Skog recognize that EUAs represent potential costs or revenues in every investment decision. New staff categories, like project departments responsible for major process changes at the mills, are now involved in CO_2 accounting, as the price of emissions must be integrated in investment appraisals. However, the companies do not perceive the role of the EU ETS as a particularly important impetus for investments (interviews, Isaksson 2011 and Carlberg 2011). The CO_2 price-tag on fossil-fuel use represents one of several factors that can underpin industrial investment decisions (Fält, interview 2011). Rising electricity prices are seen as a stronger influence from the EU ETS. Access to abundant and affordable electricity is essential to the PPI; thus, the EU ETS has made it increasingly important to make projections about future electricity prices and account for this in investment and business plans. This 'indirect' effect of EU ETS overshadows the more 'direct' effect of establishing a price-tag on CO_2 emissions from internal fossil fuel use. Interest in electricity generation from wind-power and industrial CHP has grown, and greater efforts are being made to establish secure and affordable electricity supplies. This is demonstrated by SCA's abatement actions, organizational restructuring (e.g. the establishment of SCA Energy) and search for alternatives to the electricity spot market.

Rising electricity prices are also a driving force for process changes to reduce specific electricity use. Both SCA and Norske Skog claim that they continuously maintain and replace equipment to improve their energy performance and reduce CO_2 emissions. Primarily SCA has implemented large high upfront-cost investments expected to generate significant future CO_2 emissions reductions. These investment decisions have been announced at various points in time over the EU ETS periods (2005–2012), without apparent association with the EUA market price or expectations as to future prices. Hence, the variable but generally low EUA price level does not appear to have been important in motivating companies to adopt more offensive investments.

The impact of the EU ETS on investments is expected to increase in the third trading period. The newly installed lime kiln at SCA's Östrand mill has shown that the EU ETS can contribute positively to a large CO_2-lean investment. The estimated emissions reduction of 50,000 tons CO_2 per year represents revenues of €0.5–1.5 million per year from selling EUAs, depending on the future price level (here assigned a

range of €10–30). For the €0.5 billion investment, this revenue stream will constitute a considerable share of the depreciation value.

4.2 Regulation, innovation and competitiveness

As applied to the EU ETS, the Porter Hypothesis rests on the following logic: companies (board, management and staff) in the trading sector will have to deal with the introduction and implications of EU ETS; the EUA cap-and-price signal will raise awareness of the business advantages of achieving CO_2 emissions reductions; early adopters of CO_2-lean products and process innovations will gain a first-mover advantage over their competitors.

With current emissions-to-cap ratios of 75–85%, both SCA and Norske Skog have some operating space in relation to their caps. In a group-wide perspective, neither company risks having to purchase EUAs. In terms of the size of the cap, the regulation of CO_2 emissions cannot be considered stringent. Neither do today's low price levels (€5–10), due partly to generous allocations, send a clear signal to companies to develop offensive strategies and invest in innovative solutions. For Norske Skog the situation was somewhat different in the first trading period, when its emissions-to-cap ratio was close to 100% and the EUA market price was around €20–30. The allocation increased after the Norwegian mills were included in the second period, which established Norske Skog's long position. It can be argued, as held by Norske Skog, that the company was disadvantaged in being partly excluded from the EU ETS and the framework conditions faced by its competitors (Norske Skog 2005). In relation to other PPI companies, Norske Skog's cap appears to have exerted some pressure on the company in the first trading period (Sandbag 2012). However, it is primarily market factors like newsprint overcapacity that have led Norske Skog to reduce its CO_2 emissions since 2005. The Parenco mill in the Netherlands has reduced its CO_2 emissions by 20% in absolute figures since 2005 as a result of a paper machine shutdown in 2009 which decreased annual production by 40% (Norske Skog 2010). The CO_2 intensity of this mill's production has thus increased by 30%.

A common standpoint among industry representatives is that energy and climate policies need to provide long-term stable conditions to facilitate investments. Perceived uncertainties may lead to dropping or postponing investments due to lack of decision support (Fält, interview 2011). SCA has to a greater extent than Norske Skog undertaken large projects and investments over the EU ETS period. We find no instances where the EU ETS as such has led SCA to refrain from making investments, but neither is the system perceived as a major force behind business-driven investments (Isaksson, interview 2011). In expectation of the third period, with allocation based on performance benchmarks, SCA is content with the long-term horizon provided by the scheme. In addition to the phase-out of expensive fuel oil, the lime kiln investment at the Östrand mill will generate annual revenues from EUAs, at least until 2020. This may give the mill a first-mover advantage, as lime kilns are often considered a fossil-fuel-dependent production process (Ecofys 2009). In their roadmap to a low-carbon bioeconomy, the Confederation of European Paper Industries (CEPI 2011) categorize biofuel lime kilns as one of the long-term solutions up to 2050. The project is innovative with regard to the large volumes of fuel-oil replacement and the advanced requirements of the biofuel combustion process (Fält, interview 2011). If successful, this could pave the way for further installations in the PPI. To coordinate its business activities in renewable energy, SCA established SCA Energy. The intention is to scale up existing segments (like supply of wood pellets) and develop new innovative segments (like automotive fuels) – both likely to influence SCA's R&D strategies.

4.3 Internalization of norms and rules

Drawing on neo-institutional theory, we proposed that companies may internalize norms and rules about appropriate conduct through their participation in schemes like the EU ETS. Whereas companies are likely to seek the least costly adaptation to the ETS in the short term, they may internalize norms and rules for appropriate conduct as socially responsible companies in the longer term. Our interviews confirmed that the EU ETS has raised awareness of the climate-change issue among company staff and management alike. Media coverage and public debate have made the ETS a reality that both SCA and Norske Skog must take into account. The scheme also requires companies to monitor and report CO_2

emissions and integrate the cost of emissions in their financial procedures. As noted, while SCA and Norske Skog had monitored and reported emissions data before the introduction EU ETS, the scheme has resulted in slightly more resources being put into site-level administration and reporting of GHG emissions data. Project departments have also become involved in integrating CO_2 prices in investment appraisals.

Although commitments on emissions reductions had been made earlier, it was only in 2007/2008, after the introduction of the EU ETS, that the companies formulated and communicated quantified CO_2 emission reduction targets. Political targets associated with the ETS, like the EU's GHG emissions target of at least 20% reduction by 2020 compared to 1990, spur companies to formulate their own targets with timeframes and ambition levels that appear both reasonable and socially responsible (Isaksson, interview 2011). SCA has stressed the importance of adapting its group-wide climate mitigation target to the circumstances of various EU member states and other regions of the world. In each country, operations experience differing conditions, such as variable feedstock, energy supply, and policy contexts. Consequently, opportunities for reducing CO_2 emissions vary significantly from country to country.

Norm-driven company behaviour may certainly be triggered by mixed motivations, including the desire to 'do the right thing' while also reaping reputational benefits and building credibility in the marketplace. However, we have found little evidence of norm-driven behaviour in the PPI and the companies studied. Rather, our analysis of the influence of the EU ETS on corporate climate strategies shows that some activities, like energy-efficiency improvement actions, can be attributed to other policy programmes or an autonomous development. In this kind of action-oriented perspective, the EU ETS can be seen as one factor among others, but one which has as yet had rather little influence on normative commitments to develop proactive climate strategies.

5. Explaining divergent corporate climate strategies

We have seen that both SCA and Norske Skog recognize the problem of anthropogenic climate change. Apart from aspects perceived to have negative impacts on business (e.g. electricity price increases and the risk of carbon leakage), they have welcomed the EU ETS. The companies have manifested their responsibility for problem-solving with their CO_2 emissions-reduction targets and related monitoring practices, and have made progress towards their respective targets. Compared to pulp and paper companies in other European countries that rely on fossil oil, coal and natural gas for much of their electricity and process heat needs, a relatively large share of production capacity of our two case companies is located in Sweden and Norway, with ready access to renewable electricity and CHP based on biofuels. This helps to explain why Norske Skog and SCA were more positive towards the EU ETS than were pulp and paper companies in other European countries, although it must be noted that only 8 out of 41 SCA installations covered by the ETS are located in Sweden.

On the other hand, there are some divergences that call for further analysis. One evident difference between the company strategies lies in target formulation. Norske Skog's target is formulated as an absolute reduction, whereas SCA has adopted an intensity-based reduction target, following the common practice of reduction related to production level. As noted, Norske Skog's progress towards its target has been facilitated by its closure of some mills in recent years. These restructurings of operations were probably foreseen when targets were formulated, which may explain the rationale for adopting an absolute target.

SCA is more active than Norske Skog in investing and implementing CO_2-lean actions. One explanation and important difference here is access to forest land. As Europe's largest forest owner, SCA can take advantage of its vast forest resources (2.6 million hectares) through activities like biofuel production, electricity generation from biomass sources, and experimentation with large-scale wind-power installations. By contrast, Norske Skog has sold off most of its forests and cannot experiment with innovative activities requiring large tracts of forest land.

The viable options for larger investments and climate-related innovation activities are heavily dependent on the infrastructural and organizational context surrounding the mill. The SCA Östrand mill (Sweden), for example, is located in the vicinity of the company's forest assets. At a site nearby, the business unit SCA BioNorr produces refined biofuels of residuals from sawmilling operations under SCA Timber. This integration creates a supply chain and a logistic solution that ensures reliable and affordable access to fuel pellets, making possible the investment in the biofuel-based lime kiln (Fält, interview 2011). Projects undertaken at the Östrand mill show that production factors (access to natural resources, raw materials, infrastructure etc.) clearly matter for the types of innovative and CO_2-lean investment solutions that can be accomplished. These factor conditions, however, are not entirely inherited or given, but have been exploited and refined by SCA together with other actors (cf. Porter 1990).

SCA has aligned several operations to interplay in something like an industrial cluster in the area around the Östrand mill. In Witzenhausen (Germany), by contrast, SCA has outsourced electricity and heat production and contracted a company to cover the whole 'waste-to-energy' value chain, to ensure the long-term energy supply. More generally, it is easier to use and switch to less carbon-intensive fuels in some countries than in others, and the national situation clearly matters when it comes to electricity supply and the availability of biomass to replace fossil fuels. Mills in some countries can rely on affordable hydropower (as in Norway) or on CHP from biomass fuels (as in Sweden), while elsewhere in Europe mills often rely on fossil natural gas for much of the electricity and process heat required in production.

Production mix and financial situation are other aspects that make possible different actions. As noted, problems of overcapacity and decreased demand for newsprint have put pressure on Norske Skog. In this situation it is probably difficult for Norske Skog to see long-term stability in the segment, which can explain why the company has refrained from investments and instead focused on paying its debts. By contrast, SCA has a more diversified production portfolio, dominated by the hygiene segment (tissue and personal care products), where demand is steadily growing. Between 2005 and 2011, the global production of household and sanitary paper increased by almost 25% (FAO 2012). Besides being less vulnerable to shifts in market demand, a diversified production portfolio requires different types of process equipment, which in turn makes possible a variety of energy supply- and demand-side measures.[12]

The pulp and paper companies of Sweden and neighbouring Finland are known for their long history of product and process innovations (see e.g. Waluszewski 1990; Smith 1997; Laestadius 1998). According to recent rankings of the top 1000 EU companies by level of R&D investment, Stora Enso (Finland), SCA (Sweden) and UPM (Finland) are the three highest-ranked forest industry companies (JRC EC 2011). By comparison, Norske Skog was not a technological frontrunner in the past, nor does it rank among the companies with the highest R&D investments. However, it has been relatively quick to adopt new technology developed in collaboration between equipment manufacturers and the Swedish (and Finnish) PPI. In the 1970s, for example, Norske Skog dealt with air and water pollution with equipment developed and delivered by Swedish companies (Sæther 2000: 190).

To summarize, the effect of EU ETS is conditioned by various factors at the national and regional level, including access to biomass, electricity supply, and policy context. Our case studies have shown that both company-internal and -external factors influence corporate responses to the EU ETS and help to explain why SCA has initiated more innovation activities and CO_2-lean investment projects than Norske Skog.

6. Conclusions

The EU ETS was the first mandatory climate regulation targeting the PPI in Europe. The PPI sector initially opposed the ETS, arguing it would entail competitive disadvantages for European industry. The rational-calculative model of corporate behaviour captures well the opposition to the EU ETS in the PPI and the short-term, cost-minimizing adaptation to the EU ETS by European pulp and paper companies. The pulp and paper industry generally appears to focus on continuous improvements in operations and reductions in energy use, rather than long-term, innovative solutions. Corroborating this observation, our

study has shown that emissions trading has had a rather limited effect on the climate strategies of SCA and Norske Skog. For both firms, company-wide CO_2 emission objectives existed prior to the introduction of the scheme, as did systems for site-specific emissions monitoring. The value of CO_2 emissions is recognized and accounted for by SCA and Norske Skog, but the EUA price-tag is a minor incentive among the many factors that underpin industrial investment decisions.

However, the observation that SCA and to some extent Norske Skog have engaged in low-carbon activities for the longer term does not fit with the model of cost-minimizing, short-term adaptation to the EU ETS. By influencing electricity prices, the scheme has reinforced commitments to improve energy efficiency and reduce CO_2 emissions. Indeed, rising electricity prices are perceived as the strongest influence of the EU ETS and have led to strategic decisions to investigate the alternatives to the wholesale electricity market. Electricity-intensive pulp and paper companies are showing greater interest in investing in power assets, on their own or in various constellations; in making bilateral agreements for long-term power contracts; and engaging in energy-supply contracts.

Compared to Norske Skog, SCA appears more attuned to exploring new opportunities. One explanation is company variation in factors of production that constrain or facilitate specific innovative and CO_2-lean investment solutions. Illustrative is SCA's extended search for new biomass-based energy solutions to reduce emissions. The situation for Norske Skog is different, as the company has less need for CO_2-lean innovation for its mills in Norway, which receive the bulk of their electricity needs from hydropower. Two additional factors seem to explain the greater willingness of SCA than Norske Skog to invest in low-carbon solutions: availability of human and financial resources, and dynamic capabilities. SCA is not only a far bigger company than Norske Skog; it is also one of Europe's largest owners of forests that can be used for innovation and emissions-reduction purposes. SCA also has a long history of product and process innovation and ranks among the top three innovators in the industry.

We must conclude, however, that the EU ETS so far has had little effect in triggering the search for *innovative*, low-carbon solutions. Even a frontrunner like SCA has maintained a low profile with regard to possible long-term abatement technologies like black liquor gasification and CCS. Hence, our study does not lend support to the Porter Hypothesis – i.e. that the EU ETS would alert and educate companies to the benefits of reducing emissions, and raise the likelihood of product and process innovations achieving high environmental performance. In our analysis, the limited effect of the EU ETS on innovation emerges as due primarily to surplus of allowances and a low EUA price.

Finally, the proposition that companies may *internalize* norms and rules about appropriate conduct through their participation in the EU ETS receives limited support in our study. Both SCA and Norske Skog had recognized their responsibility in mitigating GHG emissions before the introduction of the ETS. Moreover, their actions do not appear to be norm-driven but seem motivated primarily by economic motives, taking their social responsibility into account.

As part of the EU 2020 strategy there are high expectations for the EU ETS to become the key policy instrument in delivering cost-effective climate mitigation in energy-intensive industries. The cap for 2020 represents a 21% reduction of emissions compared to 2005, when the EU ETS was first implemented. Thereby the EU ETS, alongside with the effort-sharing decision, is intended to ensure that the EU meets its binding target of 20% reductions of GHG emissions by 2020 compared to 1990. However, this does not imply that EUA prices will be sufficiently high to directly stimulate investments, climate strategies and innovations in the trading sector and more specifically in the PPI. Estimates based on EUA futures indicate that EUA prices will remain low throughout the third period. Although price projections are uncertain, the economic downturn combined with generous allocations during the second trading period is set to create a surplus of EUAs which can be transferred to the third period. Thus, it is possible that access to EUAs will be inflated compared to actual emission levels of the PPI – which would lessen the need for companies to purchase any EUAs over the initial years of the third period, and further delay investment in innovative strategies to reduce GHG emissions. For the system to have greater influence on company investment decisions in the future, the enforcement of a stringent cap and a high EUA market price will be necessary.

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[1] The Follum mill in Norway was sold in March 2012 and the Parenco mill in the Netherlands in August 2012; during the period studied here, Follum and Parenco were fully owned by Norske Skog.

[2] In 2012, SCA announced its decision to divest itself of its main operations in the packaging segment. When implemented, this will significantly alter the company portfolio (SCA 2012).

[3] Data on file with authors. See also Gulbrandsen and Stenqvist (forthcoming).

[4] However, all mills in Norway were excluded from the scheme in the first trading period – a government decision that Norske Skog disagreed with (Norske Skog 2005).

[5] In the first and the second period of EU ETS, the EUAs were allocated to the PPI by means of 'grandfathering' based on recent historical baselines of fossil CO_2 emissions. Due to significant use of biofuels, the industry also has biogenic CO_2 emissions, which are not regulated by EU ETS.

[6] According to economic theory, the power generators will pass on the opportunity costs of their largely freely allocated emission allowances to electricity consumers. The extra costs of fossil-fuel-based power generation thus impact on wholesale electricity prices, in line with the carbon intensity of the marginal production unit (Sijm et al. 2006).

[7] Since 2006, SCA has had the following environmental and social commitments: reducing CO_2 emissions from fossil fuels; not using wood fibre from controversial sources; improved water usage; compliance with the universal Code of Conduct (SCA 2011). In 2011, SCA further extended the number of sustainability targets (SCA 2012).

[8] The starting point for setting performance benchmarks for free allocation of EUAs (2013–2020) was to be the average performance of the 10% most efficient installations in a sector in 2007/2008 (EC 2011).

[9] Norske Skog's mills produce primarily newsprint and coated fine paper.

[10] Financial constraints have halted this project, but Norske Skog reports that the accumulated knowledge base will be valuable for similar projects in the future.

[11] Over the second period (2008–2012) the EUA price has ranged between €27 (in 2008) and low levels of €5–10 (2011–2012). The economic downturn and generous allocation over the second period will generate a transferable surplus which will depress the price in the third period. As of August 2012, estimates based on EUA futures indicated price levels between €8 and €12 over the third period 2013–2020 (EEX 2012).

[12] For instance, SCA Östrand's investments in a new recovery boiler and a back pressure turbine which made the mill a net supplier of renewable electricity could not be have been made by any of Norske Skog's mills, which are all based on the thermo-mechanical pulping process (see Section 3.4 for examples of different measures implemented by SCA).