Sustainable Value$_{CO2}$ Creation by Pulp & Paper Companies

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Foreword

Purpose and scope of this study

This study assesses the carbon performance of 25 global pulp & paper companies using the Sustainable Value approach. The Sustainable Value approach extends the concept of opportunity costs that is well established on financial markets to include environmental and social aspects. This allows for the fact that companies not only require economic capital for their business activities, but also environmental and social resources. To create positive Sustainable Value, a company must use its economic, environmental and social resources more efficiently than its market peers. In this study, we concentrate on the creation of Sustainable Value with corporate emissions of carbon dioxide (Sustainable Value$_{CO2}$) and therefore align corporate contributions to climate change with the valuation methodology applied to investment and financial market decisions.

The Purpose of this study is twofold: First, the results create transparency by demonstrating how efficiently 25 different pulp & paper companies use carbon emissions compared to their industry peers in the years 2005 to 2009. Secondly, the study reveals the potential that still exists for a more efficient use of carbon dioxide within the pulp & paper industry by comparing industry laggards to industry leaders. The Sustainable Value approach can be extended to other resources and it could cover the entire life-cycle of pulp & paper products. However, for this study, we decided to focus on the climate change impact of activities within the production process of the respective companies. There are two main reasons for this. Firstly, this pays tribute to the importance of climate change for this sector and society. Secondly, it allows us to cover more companies as the inclusion of additional indicators drives down the number of companies that can be considered. By concentrating on the production process we follow the example of the financial markets that concentrate their performance assessment on the use of economic capital by the company rather than by the entire life-cycle. The results of this study thus show how effectively a company balances profit-seeking with its climate related environmental responsibility in production activities.

Funding from MISTRA

The Swedish Foundation for Strategic Environmental Research (MISTRA) funded this study via the research project “Sustainable Investment Research Platform” (SIRP), subproject “Value-based environmental sustainability analysis of Nordic companies”. At the same time it must be stressed that the researchers at the University of Leeds, Euromed Management Marseille, and the Institute for Futures Studies and Technology Assessment take full and sole responsibility for this study and its conclusions.

Executive Summary

This study reports the findings of a research project that analysed the carbon performance of 25 global pulp & paper companies using the Sustainable Value approach. The research was conducted by researchers working at the University of Leeds, Euromed Management Marseille, and IZT – Institute for Futures Studies and Technology Assessment. The Sustainable Value approach is the first method that allows assessing corporate sustainability performance based on the value created with the resources used. By extending a traditional valuation method applied in financial analysis, it assesses not just the use of economic capital but also environmental and social resources. In this study we calculate Sustainable Value$_{CO2}$ as a special case of Sustainable Value, which assesses a company's carbon performance in a value-based way.

A pulp & paper company thus creates positive (or negative) Sustainable Value$_{CO2}$ when it earns a higher (or lower) return than its peers with the carbon emissions emitted. An analysis based on the Sustainable Value$_{CO2}$ approach establishes whether a company is successfully using its carbon emissions to create value in comparison to its industry peers. In doing so, the Sustainable Value$_{CO2}$ approach measures corporate climate change performance in monetary terms. It establishes a link between corporate contributions to climate change and the value-based approach that is traditionally used in management practice and financial analysis.

This study assesses the carbon performance of 25 pulp & paper companies over a five-year period from 2005 to 2009. Two assessments were carried out in the process of this research: The first assessment focuses on the creation of absolute Sustainable Value$_{CO2}$. The second assessment takes into account company size and is a measure of the relative carbon performance of companies. To compare the carbon performance of companies of different sizes, this study looks at the Sustainable Value$_{CO2}$ of a company in relation to its sales. In both of these assessments, two different return figures for the calculation of Sustainable Value$_{CO2}$ are applied to illustrate the explanatory power of the assessment for different stakeholders. The return figures used are Earnings before Interest and Tax (EBIT) and Net Value Added (NVA) to determine the Sustainable Value$_{CO2}$ of the companies under analysis.

The results of the calculation of absolute Sustainable Value$_{CO2}$ creation show considerable differences in sustainability performance between the companies assessed. In the EBIT based scenario, the majority of the companies assessed show both positive and negative Sustainable Value$_{CO2}$ results. Four companies (Metsäliitto, Myllykoski, Nippon and Norske Skog) were identified as consistently generating negative, and five companies (DS Smith, International Paper, Kimberly-Clark, Södra and Sveaskog) as creating positive Sustainable Value$_{CO2}$ over the entire period assessed. Kimberly Clark by far generates the highest Sustainable Value$_{CO2}$ for all years assessed, with its best result in 2009, creating about € 1.5 billion more EBIT than the industry peers had generated with the company's CO_2 emissions and overall following a positive trend. At the other end of the spectrum, Domtar (2005 and 2006), Nippon (2007) and Weyerhaeuser (2008 and 2009), lag far behind their peers in terms

of Sustainable Value$_{CO2}$ creation. While in its best year (2005), Weyerhaeuser ranked second and created nearly € 1.2 billion Sustainable Value$_{CO2}$, in its worst year (2008) the company destroyed a devastating € 1.9 billion of Sustainable Value$_{CO2}$. The results look different when company size is taken into account; here, Sveaskog emerges as best performer in three of the five years assessed (2006, 2007, 2009), creating the highest Sustainable Value$_{CO2}$ in relation to its sales. In 2007 Sveaskog yielded a SVM of 17.12%, that is, the company created € 17.12 Sustainable Value$_{CO2}$ per € 100 of sales. Striking are also the differences Grupo Ence shows: While being in the midfield in terms of absolute Sustainable Value$_{CO2}$ with rather unremarkable results, the company now ranks first in 2005 and last in 2009. Similar differences can be observed with Domtar and Metsäliitto. When results are adjusted to sales, the SVM$_{CO2}$ curves of both companies show much higher amplitude, i.e. the results display rather extreme positions, putting them closer to the worst performance shown by Weyerhaeuser in 2008.

Due to the limited data availability, the NVA based scenario considered 17 companies only. Since the benchmark composition changed accordingly, a meaningful comparison with the EBIT scenario is limited. Particularly some of the companies showing rather extreme EBIT based results (e.g. Domtar, Kimberly Clark and Weyerhaeuser) could not be included. Nevertheless, the analysis reveals interesting results. Clear frontrunner now is SCA, creating between € 0.98 billion (2005) and € 1.55 billion (2009) more Net Value Added than the benchmark had created with SCA's CO_2 emissions. In the EBIT scenario the company in contrast even destroyed Sustainable Value$_{CO2}$ in the years 2005 and 2007. SCA is closely followed by Smurfit Kappa for the years data were available (2007 to 2009).

Despite the fact that the company follows a clear negative trend, in its worst year it still creates considerably more NVA with its CO_2 emissions than the industry peers had generated (2007: SV$_{CO2}$ € 1 billion; 2009: SV$_{CO2}$ € 0.67 billion). Metsäliitto started off as second best performer, but – following a negative trend - ends up in the red in 2008 and 2009. Ahlstrom, Billerud, Corticeira, DS Smith, Grupo Ence, Holmen, PaperlinX, Sodra and UPM form the midfield of the assessment. Lagging behind comparably far, the bottom of the ranking is shared by Mondi, Myllykoski, Norske Skog and Stora. The latter, however, manages to improve significantly over the period reviewed. In 2005, Stora still shows the worst performance among the NVA based Sustainable Value$_{CO2}$ results, generating € 1.25 billion less NVA than if its CO_2 was emitted by the average pulp and paper company assessed in this study. Although still destroying Sustainable Value$_{CO2}$ in 2009 (€ -0.07 billion), the company then managed to climb up to rank 11 of 17.

Again, the picture changes when results are corrected for company size. Now Corticeira clearly shows the most value creating use of CO_2 emissions with a SVM$_{CO2}$ between 20.82% (2008) and 23.89% (2005). Second best performer is Sveaskog, only showing a drop in 2008. Myllykoski, in contrast, destroys devastating € 73.5 Sustainable Value$_{CO2}$ per € 100 of sales (SVM$_{CO2}$ -73.5%) and ploughs a lonely furrow now at the bottom of the ranking. That is, Mondi, Norske Skog and Stora could gain some ground compared to Myllykoski, when company size is accounted for. They still, however, destroy Sustainable Value$_{CO2}$ with each sale they make and form the lower quarter of the ranking.

The differences in carbon performance between the companies identified in this study can be partially attributed to differences in their product portfolios or the energy mix in the countries the companies operate in, as well as to financial and structural effects. However, the individual results also reflect the effects of good carbon management practices.

It should be noted that the Sustainable Value approach does not attempt to express a company's entire commitment to sustainability in a single ratio. Along these lines, the Sustainable Value$_{CO2}$ applied in this study does not attempt to press a company's entire commitment to carbon management in a single ratio. For example, the study does not take into account biogenic carbon dioxide emissions. Furthermore, the Sustainable Value approach only takes into account impacts that can be quantified in a meaningful way. Qualitative sustainability aspects should be managed with qualitative instruments.

The Sustainable Value approach provides a link between sustainability and the value-oriented approach that is common in management practice. Taken as a whole, the results of this study provide a transparent and meaningful overview of carbon performance trends among the pulp & paper companies assessed. More generally speaking, this study illustrates the extra value that has been created by the most carbon-efficient companies within the pulp & paper sector; and, in turn, the value that has been destroyed by the most carbon-inefficient pulp & paper companies when compared to their peers. The study also shows that Sustainable Value$_{CO2}$ is a practical tool for producing an in-depth assessment of corporate carbon performance.

1 Introduction

Measuring corporate sustainability performance is a complex undertaking. This is not only due to the fact that economic, environmental and social information need to be considered simultaneously, but also due to problems concerning the quality and availability of the necessary data. Nevertheless, measuring corporate sustainability performance is extremely important: unless it can be measured, it cannot be managed. Traditional instruments are not capable of combining the environmental, social and economic parameters of sustainability and reporting them in a standardised form that is readily understood throughout an organisation.

The Sustainable Value approach was developed specifically to solve this problem (see for example Figge, 2001a; Figge & Hahn, 2004b, 2005). Sustainable Value measures the efficient use of economic, environmental and social resources and expresses the result in a single integrated monetary figure. Sustainable Value measures the use of environmental and social resources exactly in the same way as companies currently assess the return on capital employed: In the value-oriented approach to management, it is assumed that the use of capital creates value when it earns a higher return than if the capital had been employed elsewhere. The Sustainable Value approach therefore moves away from the traditional logic burden-oriented impact assessments are based on and instead treats environmental and social assets as scarce resources that have to be used in a value-creating way.

The Sustainable Value approach was developed by researchers who now work at Euromed Management School Marseille. It was subsequently tested in a series of research projects and case studies (Figge & Hahn, 2004a; Hahn, Figge, & Barkemeyer, 2007, 2008; Hahn, Liesen, Figge, & Barkemeyer, 2007). This report represents the first comprehensive study of the pulp & paper sector based on the Sustainable Value approach. It focuses on the creation of Sustainable Value with corporate emissions of carbon dioxide (Sustainable Value$_{CO2}$) on account of the importance of climate change for society in general and this sector in specific. For example, the pulp & paper sector was responsible for 1.1% of global CO_2-emissions in 2005 (WRI, 2009) and is one of the top 5 emitters of greenhouse gases among U.S. manufacturing industries (Green Press Initiative, 2007). While significant efficiency gains have been made in recent years, the European pulp and paper sector emitted more than 37,000,000 tons of CO_2 at installations included in the European Emission Trading Scheme in 2008 (CEPI, 2009).

The remainder of this study is structured as follows: In the next chapter we present the logic of the Sustainable Value approach and explain how it was applied for the purposes of the assessment of corporate carbon performance in this study. The third chapter describes the scope of the assessment in this study. We then take a look at the aggregated results (chapter 4). A discussion follows in chapter five. The sixth chapter presents our conclusions.

2 Method for Calculating Sustainable Value

2.1 *The Sustainable Value Approach in Brief*

Companies not only use economic capital but also environmental and social resources to create value. To determine a company's sustainability performance comprehensively, a set of different resources used must be taken into consideration. The Sustainable Value approach measures corporate sustainability performance in monetary terms and ascertains whether a bundle of economic, environmental and social resources has been used in a value-creating way by a company (Figge, 2001b; Figge & Hahn, 2004b, 2005). In this sense the approach is based on a fundamental principle of financial economics: companies create value whenever they use a resource more efficiently than their peers. In the financial market, this valuation methodology has long been practised under the banner of opportunity costs.

The example illustrated below (Figure 1) explains the underlying notion of opportunity costs. Let's assume an investment, such as a share, yields an annual return of 8%. To assess whether this was a good performance, we need to compare it with a benchmark – generally the market average. Assuming that the market (e.g. the shares represented by the Swedish OMX index) has only produced an annual return of 5%, the investment has outperformed this index by 3%. This is also known as the value spread. To determine how much value has been generated by the investment, this value spread simply needs to be multiplied by the capital employed. Assuming an investment of € 100, we arrive at a value contribution of € 3 (see Figure 1).

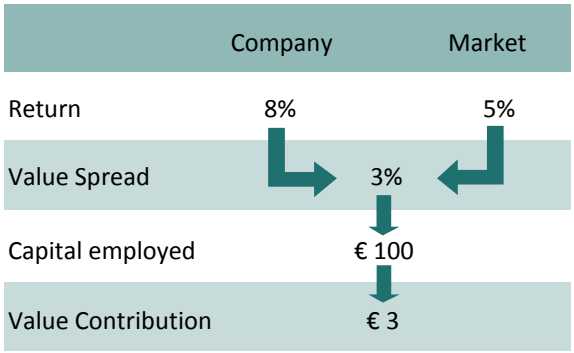

Figure 1: Value-oriented analysis of resource use

The Sustainable Value approach extends this methodology, which is firmly established in financial markets and company valuation practices, to the use of environmental and social resources by companies.

It is the first approach to use opportunity cost thinking to assess corporate sustainability performance. In this study, we use the Sustainable Value approach to value the use of CO_2 by pulp & paper companies. Because it is based on the same underlying method generally used for performance assessments in financial markets the Sustainable Value$_{CO2}$ is compatible with the decision-making and valuation tools used by investors and managers.

2.2 *The Valuation Logic of Sustainable Value$_{CO2}$*

From a sustainability perspective, the valuation of the company's performance must not only take into consideration the use of economic resources, but also environmental and social resources. In this context, the following rule of thumb usually applies when assessing resource use: a resource should only be used if the return generated is higher than the costs incurred. The costs of resource use therefore need to be determined.

Unfortunately, this is not a straightforward task, be it for economic capital or for environmental or social resources. In traditional financial economics, this problem is resolved for economic capital by using the opportunity costs approach (Bastiat, 1870; Green, 1894; Haney, 1912). Since their capital is limited, investors cannot exploit all the investment opportunities available to them at the same time. The earnings foregone from these investment alternatives are costs as far as the investor is concerned, and are referred to as opportunity costs. An investment is successful when the return of the actual investment exceeds its opportunity costs. Opportunity costs therefore represent the cost of using economic assets, such as capital.

As already mentioned, on financial markets it is generally assumed that an investment creates value whenever it is more profitable than the average rate of return available on the market. In practice in financial analysis, a stock index is commonly used as benchmark. In other words, an investment creates value whenever its return is higher than the stock index used as a benchmark. The success of investment funds is for example typically assessed like this. A fund that fails to beat the typical return of the market does not cover its cost of capital and therefore does not create, but rather destroys value.

As already emphasised, companies do not use economic capital alone, but also consume environmental and social resources. In the context of this study, we do however not assess corporate sustainability as a whole, but focus on corporate contributions to climate change. We thus perform a carbon performance assessment in strong analogy to the assessment of economic capital on financial markets. For this purpose, we use the Sustainable Value approach to assess the use the environmental resource CO_2 based on the tried and tested concept of opportunity costs. The resulting Sustainable Value$_{CO2}$ ascertains whether a company's carbon use is value-creating, i.e. more efficient than the average carbon use in the market. It is interesting to note that prior to the Sustainable Value approach, no other method had attempted to assess the use of environmental and social resources by applying the opportunity costs approach (Figge, 2001a; Figge & Hahn, 2004a, 2004b), even though this had first been suggested in principle more than 100 years ago (Green, 1894).

To determine the Sustainable Value$_{CO2}$ performance of companies, the costs occurring through the use CO_2 have to be deducted from the return earned by the company. This approach has already been followed for some time, also with respect to economic, social and other environmental resources (Atkinson, 2000; Huizing & Dekker, 1992). However, the costs have traditionally been determined using methods that focus primarily on burdens (Figge & Hahn, 2004c). The key assumption here is that the costs of a resource depend on the burden that arises through the use of the resource. Despite a plethora of different approaches, putting a monetary value on these burdens is still extremely difficult (Carlsson

Reich, 2005; Sonnemann, Schuhmacher, & Castells, 2000; Westman, 1977) and tends to produce not just inconsistent, but even conflicting results (Tol, 2005).

The Sustainable Value approach is the first value-based method for assessing corporate sustainability performance. Applied to the special case of carbon performance this means that the costs of the use of CO_2 are not determined on the basis of the potential damage inflicted by CO_2 emissions, but on the contribution CO_2 makes to creating value. The costs of CO_2 are determined using opportunity cost thinking, i.e. the return that could have been generated from an alternative use of the CO_2.

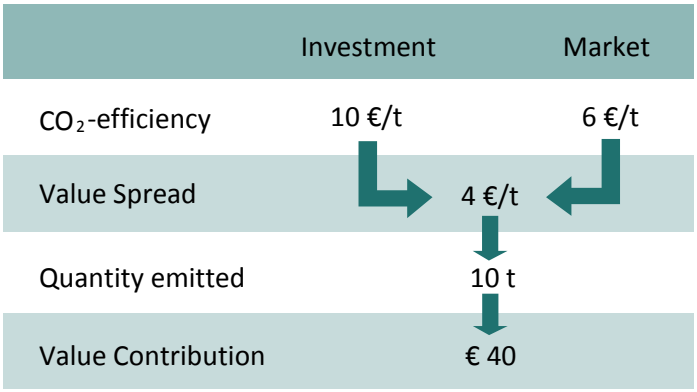

Figure 2: Value-oriented analysis of resource use – CO_2 case

Analogously to the standard assessment of economic value described above, where the efficiency of capital use is determined, Sustainable Value$_{CO2}$ assesses the efficiency of CO_2-use in a market context. Sustainable Value$_{CO2}$ is created whenever a company uses its CO_2 more efficiently than the benchmark, i.e. the market on average. To calculate Sustainable Value$_{CO2}$, a company's CO_2-efficiency is compared with that of the benchmark. A company which emits 10 t of CO_2 in order to generate a return of € 100, has a CO_2-efficiency of € 10 per ton of CO_2. If the sector average for other companies is only € 6 return per ton of CO_2, for example, the company earns € 4 more return per ton of CO_2 than the benchmark (i.e. its industry peers). With a total emission of 10 tons of CO_2, a company therefore generates a value contribution of € 40 (see Figure 2).

The Sustainable Value$_{CO2}$ approach thus applies the opportunity cost logic used in financial management to CO_2. This value-oriented approach makes it far simpler to determine the costs of carbon use. When companies consider the opportunity costs of their resource use we may expect that resources are used ever more efficiently over time. This is what the experience with the opportunity cost approach in financial markets suggests. Applied to the use of CO_2 we may hope that the analogous conclusion applies. When the efficiency of the use of CO_2 increases it will become easier to reconcile our economic desires with our ecological necessities.

2.3 *Calculating Sustainable Value$_{CO2}$*

Sustainable Value$_{CO2}$ represents the value that a company creates through the use of CO_2. Sustainable Value$_{CO2}$ is calculated in four steps, described in detail in this section. It becomes

clear that the assessment of corporate carbon performance using the opportunity costs method is straightforward and does not involve complex mathematics.

The following four steps are necessary to calculate Sustainable Value$_{CO2}$. Each step provides the answer to a specific question that is relevant for the assessment of a company's climate related sustainability performance.

(1) How efficiently does a company use CO_2?
In this step, the efficiency of the use of CO_2 in the company is calculated.

(2) How efficiently does the benchmark use CO_2?
In this step the benchmark is established and the efficiency of its CO_2 use is assessed.

(3) Does the company use CO_2 more efficiently than the benchmark?
In this step the CO_2-efficiency of the company is compared with that of the benchmark.

(4) How much Sustainable Value$_{CO2}$ does a company create?
In this final step, the task is to assess whether the company used CO_2 to create value.

These four steps are now explained using the example of the CO_2 performance of SCA in 2009.

Step 1: How efficiently does a company use CO_2?

The purpose of the first step is to establish how efficiently the company uses CO_2. To this end, the quantity of CO_2 used is compared with the return generated by the company. First, we need to establish which parameter to use for measuring the company's return. To determine the carbon performance of the pulp & paper companies under analysis, this study uses two different return figures, namely Earnings Before Interest and Tax (EBIT) as well as Net Value Added (NVA). This exemplary calculation refers to EBIT only - the calculation based on NVA is carried out analogously. The CO_2-efficiency is given by the ratio between the return generated by the company and the amount of CO_2 emitted. To this end, the EBIT is divided by the quantity of CO_2 used. In 2009, SCA generated about € 845 million EBIT while emitting 4.35 million metric tons of CO_2. Consequently, SCA showed a CO_2-efficiency of € 194 EBIT per ton of CO_2 emitted. When calculating the company's CO_2-efficiency, it has to be ensured that the data on CO_2 use are based on the same scope of consolidation as the earnings figures. SCA makes a profit through its production. The CO_2-emissions must therefore also relate to SCA's production. Including the CO_2-emissions of SCA's suppliers would overstate the burden and leaving out part of SCA's operations would understate them.

Step 2: How efficiently does the benchmark use CO_2?

The second step of the analysis calculates how efficiently the benchmark uses CO_2. First of all the benchmark has to be defined. The benchmark for this study is constructed from the average EBIT (NVA respectively) per ton of CO_2 of all companies assessed in this survey.[1]

[1] See 3.1 for a list of companies examined in this study.

Since figures on average industry efficiency are generally not published or reported, they have to be determined based on the data reported and published by the individual companies within the sector. There are basically two ways to calculate peer group efficiency: on the one hand, it can be determined as an unweighted average. To this end, the mean value of the CO_2-efficiency is determined for all the pulp & paper companies studied. But this approach fails to take into consideration the difference between large companies, which use far greater amounts of CO_2, and small companies. Alternatively, a weighted average can be calculated to obtain the benchmark efficiency. To do this, the total EBIT (NVA respectively) generated by all companies studied is divided by the total amount of CO_2 they have emitted. This approach takes into account the size differential between the companies, and is intended to replicate the peer group performance as accurately as possible. Bigger companies that also consume more CO_2 therefore have a heavier weighting in the benchmark. This study on the Sustainable Value$_{CO2}$ of companies in the pulp & paper sector uses the second approach, i.e. a weighted peer group average. Another question is whether the valuation of the average industry efficiency should exclude the company actually being assessed. When determining the Sustainable Value$_{CO2}$ of SCA, for example, it might be more appropriate to use the average efficiency of the industry *excluding* SCA as a benchmark. The logic here is that if SCA's CO_2 is used elsewhere, this CO_2 should not be counted again at SCA. Put differently, SCA cannot be its own opportunity cost. In this study, this would have resulted in 25 different benchmarks for each of the companies assessed for every year. Therefore, in order to keep things simple we have not excluded the companies assessed from the benchmark. This follows common practice in the financial markets.

The benchmark in this study is therefore the weighted average CO_2-efficiency of all the pulp & paper companies assessed in this survey. As Table 1 shows, for this example the average CO_2-efficiency of the peer group amounts to € 94 EBIT per ton of CO_2-emissions in 2009.

CO_2-efficiency of the benchmark	2005	2006	2007	2008	2009
EBIT scenario	€ 79 per t	€ 98 per t	€ 91 per t	€ 52 per t	€ 94 per t
NVA scenario	€ 255 per t	€ 320 per t	€ 332 per t	€ 362 per t	€ 348 per t

Table 1: Benchmark efficiencies 2005 - 2009

Step 3: Does the company use CO_2 more efficiently than the benchmark?

This step compares the efficiency of the company to the efficiency of the peer group (benchmark). To this end, the peer group efficiency is deducted from the company efficiency. This results in the so-called value spread and describes how much more (or less) return per ton of CO_2 the company produces compared to the peer group. This establishes whether the company uses its CO_2 more efficiently than the peer group. The concept of opportunity costs therefore plays a pivotal role here.

The comparison of the CO_2-efficiency of SCA with the benchmark shows that in 2009 SCA uses this resource more efficiently than the peer group on average. SCA has a positive value spread of roughly € 100 per t of CO_2-emission (€194/t – €94/t = €100/t). That is, SCA exceeds

the opportunity costs of its CO_2-emissions by € 100 per ton. In other words, SCA generates € 100 more EBIT per ton of CO_2 emitted than the peer group on average (see Figure 3).

Step 4: How much Sustainable Value$_{CO2}$ does a company create? ?

In this step the Sustainable Value$_{CO2}$ is determined. The value spread calculated in the previous step identifies how much more (or less) return *per unit of CO_2* the company generates compared to the benchmark. In this fourth step, the value generated by *the overall CO_2 use* of the company is calculated. To this end, the relevant amount of CO_2 emitted is multiplied with the value spread. The result shows how much excess return the company creates with the amount of CO_2 emitted compared to the benchmark. In 2009, for example, SCA emitted 4.35 million tons of CO_2. Having calculated the value spread in step three, we know that SCA creates roughly € 100 more EBIT per t of CO_2 than the peer group on average. If we multiply the value spread with the total amount of CO_2 emitted by SCA, the resulting Sustainable Value$_{CO2}$ comes to approximately € 435 million. This Sustainable Value$_{CO2}$ represents the excess return that is created due to that fact that SCA is emitting this quantity of CO_2 instead of the average of the other pulp & paper companies, i.e. the industry peers (see Figure 3).

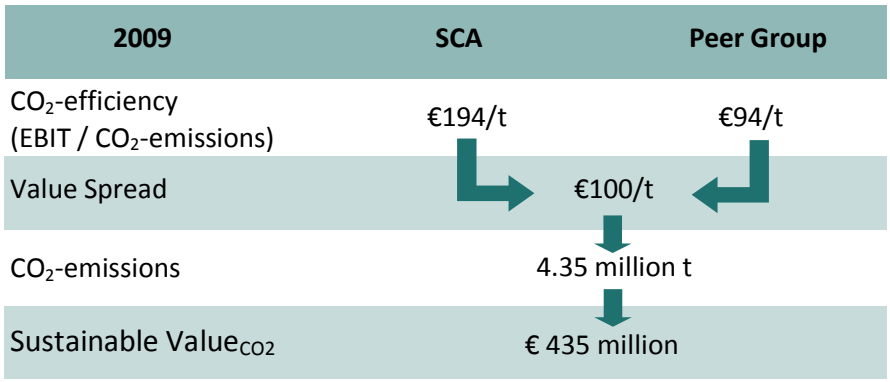

Figure 3: Calculation of the Sustainable Value$_{CO2}$ of SCA in 2009

This completes the calculations as we are only looking at a single resource in this study.

2.4 *Making Allowances for Company Size*

In financial analysis, larger companies are generally expected to generate higher profits and higher sales. This size effect complicates matters when attempting to compare the performance of different companies. Financial analysis compares performance parameters, such as profit, with other indicators that reflect the size of the company. Profit, for example, is frequently assessed in relation to capital employed or sales. Meaningful analysis of companies is possible using key ratios such as return on capital or net profit margin.

The Sustainable Value$_{CO2}$ shows, in absolute terms, how much excess return is created by a company using its CO_2 more efficiently than the benchmark. The same problem arises when attempting to compare different companies: Bigger companies generally use greater quantities of CO_2 and therefore tend to create a bigger (positive or negative) Sustainable

Value$_{CO2}$. As with the financial analysis method, allowances for the company's size therefore need to be made when comparing the Sustainable Value$_{CO2}$ of different companies. To this end, this study looks at the Sustainable Value$_{CO2}$ of a company in relation to its sales. This relative ratio expresses how much Sustainable Value$_{CO2}$ a company generates for every Euro of sales, and is defined as the Sustainable Value$_{CO2}$ Margin (SVM$_{CO2}$). This ratio allows meaningful comparisons to be made of the carbon performance of those companies studied. In 2009 SCA created 4.05 € Sustainable Value$_{CO2}$ per 100 € of sales, i.e. the SVM$_{CO2}$ came to 4.05 %.

2.5 *Explanatory Power of Sustainable Value$_{CO2}$*

The Sustainable Value$_{CO2}$ shows how effectively a company balances profit-seeking with its climate related environmental responsibility in production activities. It measures how much excess return is created by a company by using CO_2 more (or less) efficiently than the benchmark. The explanatory power of the analysis depends on the choice of the benchmark. In this study, the companies assessed constitute the benchmark. The Sustainable Value$_{CO2}$ therefore shows which of the companies within the set of pulp & paper companies under analysis creates the most value with the amount of CO_2 emitted. It provides a monetary measure of how CO_2-efficient an individual company does business compared with its peer group. The study consequently provides an analysis of selected companies within the pulp & paper sector (best in class). It does not provide any conclusions about the efficient use of CO_2 in the pulp & paper sector compared with other industries. Therefore, the results do not allow any conclusions on whether the industry as a whole makes a contribution to an efficient use of CO_2.

Sustainable Value$_{CO2}$ provides an indication of whether CO_2 is used within a company in a value-creating way or not. This study does not deal with aspects outside the company. The calculation of Sustainable Value$_{CO2}$ therefore does not take into consideration factors such as the performance of suppliers or product features. The Sustainable Value approach provides a link between the reduction of CO_2 emissions in production processes and the value-oriented approach that is common in management practice. The most notable advantage of Sustainable Value$_{CO2}$ is therefore that it allows assessing the use of CO_2 in the same way as the use of economic resources. Company valuation and financial analysis, as well as management thinking, have traditionally focused exclusively on optimising the use of economic capital. The Sustainable Value$_{CO2}$ provides a complementary analysis by applying the value-oriented approach to the assessment of the use of CO_2. Sustainable Value$_{CO2}$ is therefore a practical tool for measuring – and ultimately managing – a company's CO_2 performance in the same way as its economic performance.

3 Scope of the Study

This chapter describes the scope of the study. In addition to the companies analysed and the indicator assessed, we describe the two return figures applied in the assessment of Sustainable Value$_{CO2}$ and briefly illustrate the review period. In the remainder of the chapter the data sources used for this study, data coverage and the processes for treatment of missing data are presented. In addition, a commentary on the state of data quality is provided. The chapter concludes with a brief discussion of two aspects that need to be taken into account when interpreting the results of the analysis, namely the role of biogenic emissions and scope 2 emissions in the context of the pulp & paper sector.

3.1 Companies Studied

This study analyses the carbon performance of 25 global pulp & paper companies. These companies are Ahlstrom Oyj (Ahlstrom), Billerud AB (Billerud), Corticeira Amorim S.G.P.S., S.A (Corticeira), Domtar Corporation (Domtar), DS Smith Plc (DS Smith), Grupo ENCE S.A. (Grupo ENCE), Holmen AB (Holmen), International Paper Company (International Paper), Kimberly-Clark Corporation (Kimberly-Clark), Korsnäs AB (Korsnäs), MeadWestvaco Corporation (MeadWestvaco), Metsäliitto Group (Metsäliitto), Mondi Group (Mondi), Myllykoski Corporation (Myllykoski), Nippon Paper Group, Inc. (Nippon), Norbord Inc. (Nordbord), Norske Skogindustrier ASA (Norske Skog), PaperlinX Limited (PaperlinX), Södra Skogsägarna (Södra), Smurfit Kappa Group plc (Smurfit Kappa), Stora Enso Oyj (Stora Enso), Sveaskog AB (Sveaskog), Svenska Cellulosa Aktiebolaget (SCA), UPM-Kymmene Oyj (UPM) and Weyerhaeuser Company (Weyerhaeuser).

The companies analysed in this study are summarized in Table 2, together with their country of origin and industry affiliation. Industry affiliation was derived from the primary Standard Industrial Classification codes (SIC) of the companies under analysis.

Company	Country	Industry Affiliation
Ahlstrom	Finland	Paper mills
Billerud	Sweden	Paper mills
Corticeira	Portugal	Wood products
Domtar	Canada	Paper mills
DS Smith	Great Britain	Packaging paper and plastics film, coated and laminated
Grupo ENCE	Spain	Pulp mills
Holmen	Sweden	Paper mills
International Paper	USA	Paper mills
Kimberly-Clark	USA	Sanitary paper products
Korsnäs	Sweden	Wood products
MeadWestvaco	USA	Corrugated and solid fiber boxes
Metsäliitto	Finland	Paper mills
Mondi	Great Britain/South Africa	Pulp mills
Myllykoski	Finland	Paper mills
Nippon	Japan	Pulp mills
Norbord	Canada	Pulp mills
Norske Skog	Norway	Paper mills
PaperlinX	Australia	Paper mills
Södra	Sweden	Wood products
Smurfit Kappa	Ireland	Packaging paper and plastics film, coated and laminated
Stora Enso	Finland	Paper mills
Sveaskog	Sweden	Paperboard mills
SCA	Sweden	Converted paper and paperboard products
UPM	Finland	Paper mills
Weyerhaeuser	USA	Sawmills and planing mills, general

Table 2: Overview of companies

Table 3 shows the distribution of companies included in this study by country. The countries of origin predominant in this study are Sweden, Finland and USA. Six companies have their country of origin in Sweden, five in Finland and four in the USA.

Country	Number of Companies
Sweden	6
Finland	5
USA	4
Canada	2
Australia	1
Great Britain	1
Great Britain/South Africa	1
Ireland	1
Japan	1
Norway	1
Portugal	1
Spain	1
Total	**25**

Table 3: Overview of countries of origin

Table 4 shows the distribution of companies in the study by industry affiliation. Industry affiliation is derived from a company's primary US SIC code, which classifies companies according to its core industry. Eleven companies are classified as belonging to the paper mills industry, while four and three companies belong to the pulp mills and wood products industry respectively.

Industry Affiliation	Number of Companies
Paper mills	11
Pulp mills	4
Wood products	3
Packaging paper and plastics film, coated and laminated	2
Converted paper and paperboard products	1
Corrugated and solid fiber boxes	1
Paperboard mills	1
Sanitary paper products	1
Sawmills and planing mills, general	1
Total	**25**

Table 4: Overview of industry affiliation

On a superordinate category level all companies in the survey are classified by their SIC code as belonging to the manufacturing industry. The major industry group of four companies in the study is classified as "Lumber and Wood Products, except Furniture", while the remaining 21 companies are officially classified in the "Paper and Allied Products" major industry group.

3.2 *Indicators Assessed*

Carbon performance indicator. In this survey, we look at the direct and indirect CO_2-emissions of the companies under analysis, i.e. we look at CO_2-emissions that occur within the

production processes and at those from the combustion of fossil fuels for the production of the electricity that is consumed during the production processes. In doing so, we assess the impact on climate change that can be directly linked to the activities of a particular company. It is possible to argue that indirect emissions occur during the production of electricity and not directly during the production processes of the respective company under analysis. For the purposes of this study, however, we decided to include indirect emissions in order to avoid any bias regarding own generation or purchase of electricity. CO_2-emissions from transportation were considered where possible on the grounds of data availability. In line with the IPCC (Intergovernmental Panel on Climate Change) guidelines for National Greenhouse Gas inventories (IPCC, 2006), biogenic CO_2 emissions are not considered in this analysis (for a discussion see chapter 3.6.1). CO_2-emission figures are measured in metric tons.

Return figures: EBIT and Net Value Added. Different return figures can be used to calculate Sustainable Value. The choice of the return figure impacts the explanatory power of the results of the assessment. This study uses two different return figures, namely EBIT and Net Value Added, to account for the different explanatory powers of results for different stakeholders. The first return figure, which is applied in the assessment of all companies in this study, is EBIT from ordinary business activities. The results in this first assessment consequently show how much value is created with the emissions used for the providers of capital. Only ordinary business activities are looked at to correct for extraordinary events that are not linked to the normal operations and therefore resource use of a company.

The second return figure applied in this study for the assessment of corporate carbon performance is the Net Value Added (NVA). The Net Value Added can be approximated by summing up EBIT and personnel expenses of a company. The results of this assessment consequently show how much value is created with the emissions used for the owners, external lenders of capital, the state taxes are paid to and the employees of the firm. This perspective is thus mainly interesting to these four key stakeholders. They benefit directly from the creation of NVA that takes place in a company. Net Value Added is of particular interest from a sustainability perspective as it represents a company's contribution to the Net National Product of the country it is operating in. The sample of companies included in the assessment of Sustainable Value$_{CO2}$ with Net Value Added as a return figure is determined by the data availability concerning personnel expenses. 17 companies published data on personnel expenses and were consequently included in this assessment.

In summary, EBIT from ordinary business activities and Net Value Added are used to calculate the Sustainable Value$_{CO2}$ in this study. The financial performance data necessary for this assessment have been mainly extracted from the data base "Bureau van Dijk". Data have been cross-checked with annual reports to make sure financial figures do not include returns from extraordinary business activities. Foreign currency figures were converted into Euros on the basis of the average annual exchange rate of the underlying financial year using www.oanda.com. Information on companies' Standard Industrial Classification (SIC) codes were also mainly extracted from "Bureau van Dijk".

3.3 Review Period

This study looks at the Sustainable Value$_{CO2}$ of 25 global pulp & paper companies over a five year period from 2005 to 2009.

3.4 CO_2-Data Sources and Data Collection

The data used to assess the utilization of the different resources examined in the study were taken from the reports published by the individual companies. These included environmental, sustainability, CSR and integrated reports. We also referred to publications available on the companies' websites and to the website of the Carbon Disclosure Project. Financial performance data were taken from the Bureau van Dijk data base and verified by examining the companies' annual reports to exclude exceptional business activities.

These data sources were used to assess the performance of the 25 global pulp & paper companies over the review period. We checked and where necessary adjusted the collected data to ensure its quality, integrity and comparability (see chapter 3.5). All companies were also contacted directly and asked for their CO_2 data. These data sets were then used to calculate the Sustainable Value of the respective companies. At the same time, these data were used to calculate the average efficiency of resource use in the peer group as a whole, which then served as a benchmark for the assessment (see step 2 in chapter 2.3).

3.5 Data Coverage, Treatment of Missing Data and Data Problems

Despite intense data collection efforts, we were unable to prepare a full data set for all companies for every year of the review period. One general point that comes to light here is that the area of environmental and social reporting, unlike traditional accounting, is still a long way from being standardised when it comes to the scope and quality of data. This section looks at data coverage for the different resource indicators (3.5.1). We then give some examples how data gaps and data problems were dealt with for the purpose of this study (3.5.2). The following section takes a more general look at data quality in the pulp & paper sector (3.5.3).

3.5.1 Data Coverage

The following Table 5 provides an overview on the data coverage for the 25 companies for the EBIT return figure over the entire assessment period of this survey based on. Data coverage increases over time. This is on the one hand due to an increased uptake of sustainability reporting by companies. On the other hand there are individual aspects like changes in the ownership structure that result in companies not providing data over the entire reporting period.

	2005	2006	2007	2008	2009
Ahlstrom	x	x	x	x	x
Billerud			x	x	x
Corticeira		x	x	x	x
Domtar	x	x	x	x	x
DS Smith	x	x	x	x	x
Grupo ENCE	x	x	x	x	x
Holmen		x	x	x	x
International Paper	x	x	x	x	x
Kimberly Clark	x	x	x	x	x
Korsnas				x	x
MeadWestVaco	x	x	x	x	x
Metsäliitto	x	x	x	x	x
Mondi	x	x	x	x	x
Myllykoski	x	x	x	x	x
Nippon	x	x	x	x	x
Norbord		x	x	x	
Norske Skog	x	x	x	x	x
Paperlinx		x	x	x	x
Sodra	x	x	x	x	x
Smurfit Kappa			x	x	x
Stora	x	x	x	x	x
Sveaskog	x	x	x	x	x
SCA	x	x	x	x	x
UPM		x	x	x	x
Weyerhaeuser	x	x	x	x	x
COVERAGE	*17/25*	*22/25*	*24/25*	*25/25*	*24/25*

Table 5: Data coverage – EBIT based analysis

Table 6 shows that data coverage for the NVA scenario is lower. This is due to the financial figures. To estimate the net value added of a company we require personnel expenses (cf. chapter 0). It has not been possible to ascertain the personnel expenses of all companies.

	2005	2006	2007	2008	2009
Ahlstrom	x	x	x	x	x
Billerud			x	x	x
Corticeira		x	x	x	x
Domtar					
DS Smith	x	x	x	x	x
Grupo ENCE	x	x	x	x	x
Holmen		x	x	x	x
International Paper					
Kimberly Clark					
Korsnas					
MeadWestVaco					
Metsäliitto	x	x	x	x	x
Mondi	x	x	x	x	x
Myllykoski		x	x	x	x
Nippon					
Norbord					
Norske Skog	x	x	x	x	x
Paperlinx		x	x	x	x
Sodra		x	x	x	x
Smurfit Kappa			x	x	x
Stora	x	x	x	x	x
Sveaskog	x	x	x	x	x
SCA	x	x	x	x	x
UPM		x	x	x	x
Weyerhaeuser					
COVERAGE	*9/25*	*15/25*	*17/25*	*17/25*	*17/25*

Table 6: Data coverage – NVA based analysis

3.5.2 Calculating and Estimating Performance Data

Different scopes of data. One important step in determining Sustainable Value is the comparison of corporate resource efficiency with the benchmark efficiency (see step 3 in chapter 2.3). The calculation of these efficiencies therefore plays a central role. They are obtained by dividing the company's cash flow by the quantity of the respective resources used. In order to produce meaningful results, it is vitally important that the same system boundaries (scope) apply to the return figures and the data on resource use (United Nations Conference on Trade and Development, 2003). No meaningful comparison can be made, for example, between a cash flow figure that applies to the entire group and a figure for CO_2-emissions that only covers part of the company (e.g. a specific division or region). Unfortunately in some cases, the environmental and social data reported by companies have different system boundaries than the published financial figures.

In such cases it is necessary to match up the scope for the figures available on corporate cash flow and resource use e.g. by extrapolating CO_2-data accordingly. To do so, however, we have to assume that those divisions for which no data are available use resources with the same efficiency as those divisions for which data are reported. When compiling the study, extrapolations were undertaken on the basis of different allocation keys. One possibility is to extrapolate with the help of the company's production or sales figures. For example, Corticeira does not report the CO_2-emissions of its global operations; however, the company specifies the extent to which its reported emissions cover its global operations based on sales and/or the number of employees. Based on this information, the existing dataset could be extrapolated to 100% of global operations for the years 2006-2009.

Calculation and estimation of data. Companies that have not reported any carbon performance data could obviously not be included in the assessment. However, if a company discloses data on scope 1 emissions and also provides information on purchased electricity use, it can be possible to approximate total emissions.

The amount of indirect CO_2 emissions a company is responsible for is therefore derived, not only by how much energy is purchased, but by the fuel mix used to produce this energy (see chapter 3.6.2). As this fuel mix differs on a country-by-country basis, indirect emissions consequently also have to be calculated on a country-by-country basis. This also means that indirect emissions can only be calculated for companies for which country-level electricity use can be obtained or approximated. For Billerud, Metsaliitto, Myllykoski, indirect emissions could be calculated based on their purchased electricity data and their geographic employee spread.

In some cases, missing data for individual years could be approximated based on existing data for other years. In the case of UPM-Kymmene, indirect emissions for the year 2006 could be approximated based on the CO_2-intensity of purchased electricity in subsequent years; accordingly, indirect emissions of Sodra were calculated on the basis of available data for 2006, and indirect emissions data for Smurfit Kappa was approximated based on existing 2008 and 2009 data.

In cases in which a company's financial year does not match a calendar year, generally data was used for those calendar years that have the largest overlap with a calendar year. For example, data for a financial year ranging from April 2008 to March 2009 was used for the calendar year 2008. However, it needs to be kept in mind that if a company does not report its financial performance in Euros, this impacts the exchange rate that can used for the conversion of financial data into Euros. For example, this applies to DS Smith and Nippon Paper.

Dealing with data corrections. In many cases, companies have corrected or updated figures in their subsequent environmental or sustainability reports. Where new data have been provided to correct erroneous data in previous reports, they were adopted. For example, this applies to Metsaliitto, as the company restated its CO_2-emissions for the year 2008 in its most recent report. In the case of MeadWestVaco (2005) and Sveaskog (2005-2008), it was necessary to recalculate total emissions based on information that was provided in

subsequent reports. In a large number of cases, revised data obtained through direct contact with the companies was used for the analysis rather than published data.

In other cases carbon performance data were adjusted in subsequent years in response to a change in the scope of consolidation, to ensure that the data could still be compared despite the restructuring of the company. Since this change in the scope of consolidation is also reflected in the financial figures published by the group, and for methodological reasons financial figures must match the scope of the corresponding environmental and social data, here the originally reported data is used.

3.5.3 Data Quality

When interpreting the results presented in this analysis, it should also be kept in mind that a substantial number of pulp & paper companies could not be included in this study. This is significant because the reason why these companies could not be included points to wider implications for the current state of corporate sustainability reporting. As described in chapters 3.2 and 3.4, publicly available corporate sustainability reports form one of the key information sources for this study. Hence, all of the companies included in this study can to a certain extent be considered as best practice reporters as they publish data that is of sufficient quality for the analysis at hand. However, only 7 of the 25 companies under analysis provided carbon performance information in their sustainability reports that met the necessary requirements to be used directly in this study. For another 18 companies, it was possible to include them in this study after data treatment as described in chapter 3.5.2 and/or clarifications with the company involved.

Overall, carbon reporting appears to be relatively widespread among pulp & paper companies. In terms of total sales, 67% of all European pulp & paper companies (the equivalent of 38% of pulp & paper companies worldwide) could be included in this study. However, significant number of companies could not be included because either no environmental performance data was available – or the data that was available did not allow for any meaningful analysis. Some of these cases are discussed below.

No data available. Generally, data availability could be restricted both in terms of financial and environmental data. In the case of complex ownership structures (e.g. *M-real*) or pulp & paper operations owned by large diversified conglomerates (e.g. *Procter & Gamble*), it was not possible to identify corresponding financial data for readily available emissions data. More importantly, a notable number of companies do not publish a sustainability report, or do not report any CO_2 performance data in their sustainability reports. Among others, this includes *Heinzel Holding*, *Lecta Group*, *Lee & Man Paper Manufacturing*, *Reno de Medici*, *Sino Forest Corporation*, *Timber West* and *West Fraser*. *Timber West* and *West Fraser* are interesting cases as both companies participated in several waves of the Carbon Disclosure Project but opted not to publicly disclose their performance data.

Flawed data/exotic indicator definitions. In some cases, CO_2 performance data was reported but could not be used as companies chose to disclose data in ways that do not allow comparison with other companies. This includes companies only reporting relative performance data (e.g. *Groupe Gascogne*, *Oji Paper*), or companies including emissions from

biofuels in an aggregate emissions figure (e.g. *Canfor*, *Louisiana Paper*, and again *Oji Paper*). In some cases, publicly available data simply proved to be erroneous. This included contradictory information from different company reports or other data sources. One of the more colourful examples in this context is *Pfleiderer*, for which CDP data for the year 2006 appeared to be misstated by factor of 1,000.

Incomplete data/scope problems. As pointed out above in chapter 2.3, it is of utmost importance that the scope of environmental data matches the scope of the company's financial data (EBIT and Net Value Added). If this precondition is not met, it is not possible to conduct a meaningful Sustainable Value assessment – or any eco-efficiency calculations in general. Problems regarding the scope of the reported data were the most significant problem we encountered during the data mining phase. In some cases, information on the scope of data is not readily available from the sustainability reports (e.g. *Oji Paper*). In those cases in which the scope is specified, deviations from the scope used for financial reporting unfortunately appear to be the general rule rather than the exception. A number of companies could not be included in the analysis as they only report on operations which are included in the EU Emissions Trading Scheme (EU-ETS) (e.g. *Portucel*, *Sonae Industria*); thus omitting those parts of their operations that are not covered by the EU-ETS. Likewise, other companies only report on selected operations: *Exacompta Clairefontaine* provides data for three French paper sites, but does not provide information about how these three sites relate to the company's overall operations.

The above problems are surprising given the perceived level of maturity of carbon reporting: in recent years, large-scale efforts such as the Global Reporting Initiative (GRI) Guidelines, the Greenhouse Gas Protocol Initiative, or the Carbon Disclosure Project have played key roles in increased standardization and professionalization of carbon reporting. Whilst the state of carbon reporting is arguably more mature today compared to previous years – or compared to other environmental indicators such as waste generation or water use – the above examples show that it is still a long way from sufficient. The problem today is arguably not the lack of a commonly acknowledged reporting regime: on paper, the GRI Guidelines and, more specifically, the Greenhouse Gas Protocol alongside the UNEP conversion coefficients for emissions from electricity generation have clearly filled this gap. Instead, the problem appears to be linked to how environmental information is processed in the market. Put differently, if carbon performance data was used in the market by SRI professionals, rating agencies and/or other companies, would large and highly visible companies in a highly energy-intensive sector such as pulp & paper be able to come up with company-specific definitions of their Greenhouse Gas performance, or would flawed or contradictory environmental performance data go unnoticed for a number of years?

Unfortunately, there appears to be a widespread lack of awareness of data quality issues of those providing the market with corporate CO_2 performance data. For the purposes of this study, we have developed an online data collection tool in order to make sure that all relevant information regarding the scope of the carbon performance data is known. The tool is available via the website www.SustainableValue.com.

3.6 *Emissions from Biofuels and Electricity Generation*

Two aspects that are inextricably linked to the analysis at hand also need to be taken into account when interpreting the results. Firstly, an analysis of the carbon efficiency of pulp & paper companies needs to keep in mind specific characteristics of this sector. Whilst the pulp & paper sector is one of the most energy intensive industries, a significant (and increasing) proportion of its energy needs is commonly covered by biomass fuels, which in turn has important implications for this analysis. This aspect is discussed in chapter 3.6.1. Secondly, given the diversity of electricity generation in the Nordic countries, it is of vital importance *where*, i.e. in which country, the electricity that has been consumed by the companies has been generated; this aspect is discussed in chapter 3.6.2.

3.6.1 Biogenic Carbon Dioxide

The pulp and paper industry is one of the most energy intensive industrial groups. This sector alone accounts for approximately 45% of industrial utilisation of fuels and electricity in Sweden (K. Möllersten, Yan, & Westermark, 2003, p. 3679). Paper and pulp mills generate approximately two thirds of their energy needs from biomass fuels (NCASI, 2005) which are recovered from waste and process streams during the harvesting and manufacturing process.

Under the IPCC (Intergovernmental Panel on Climate Change) guidelines for National Greenhouse Gas inventories (IPCC, 2006), biogenic CO_2 is treated under the land use sector rather than the energy sector. Net carbon stock changes in the biomass carbon pool brought about by forest harvesting activities, fuel wood removal or losses from disturbances by fire, insects or disease are reported in the land use, land use change and forestry activities (LULUCF) sector for the country where the stock change occurred (IPCC, 2006; Kenneth Möllersten & Grönkvist, 2007). This is therefore an indirect measure of the CO_2 impact on the atmosphere. As biogenic CO_2 stocks are accounted for in this way emissions to atmosphere from combustion of biomass, from paper and pulp activities for instance, are not included in greenhouse gas emission totals to avoid any double counting. Furthermore, this biogenic carbon is considered as “carbon neutral” since it is essentially atmospheric carbon, which has been sequestered by trees during their growth, and subsequently transformed into organic carbon substances. Thus as the carbon cycle is a closed loop, releasing this carbon back into the atmosphere from such combustion processes is not considered to add new carbon to the loop unlike the burning of fossil fuels (NCASI, 2005). However, although sectoral and national GHG Emissions as reported under the GHG Protocol do not include biogenic carbon in emission totals it does require that biomass derived CO_2 be reported separately as additional information.

The above convention for biogenic CO_2 accounting has been widely adopted and accepted. However, there is some debate about whether exempting emissions from bio-energy is improper for greenhouse gas accounting under the Kyoto Protocol (Searchinger, et al., 2009). Searchinger et al (2009) point out that the Kyoto Protocol caps CO_2 emissions of developed countries but applies no limits to land use. Therefore, it is argued that the CO_2 biomass stock accounting system and consideration of all biogenic CO_2 as carbon neutral

cannot automatically be transferred to climate regulation. By valuing carbon from fossil fuel sources only this could create strong incentives for land use change and conversion of existing forest and agricultural land to bio-energy crops (Melillo, et al., 2009; Wise, et al., 2009). With current GHG regulation encouraging such an undesirable effect there is some call for reform around biogenic CO_2 accounting mechanisms (Searchinger, et al., 2009).

Furthermore, all CO_2 in the atmosphere must be considered equal and will have the same radiative effects whether the source is fossil or biomass (Kenneth Möllersten & Grönkvist, 2007) and as CO_2 from biomass combustion will not be immediately re-absorbed by a carbon sink it will undoubtedly have an effect on climate change with this effect not being represented in current GHG emission totals. In this survey on the pulp and paper sector, direct and indirect CO_2 emissions reported cover nevertheless only emissions from fossil fuel sources as biogenic CO_2 information was not available in all cases. However, as the sector generates a significant amount of energy from biomass combustion, the importance of the CO_2 associated with such emissions is not represented in the report.

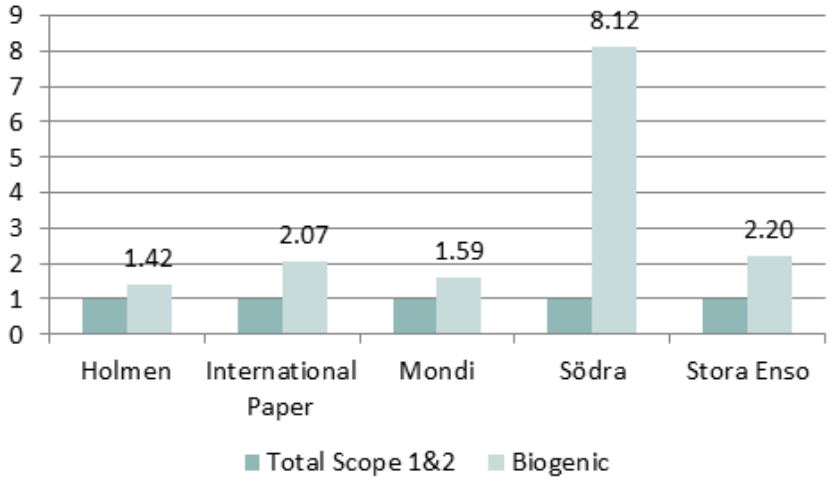

Figure 4: Biogenic emissions as multiples of total scope 1&2 emissions in 2008 (various companies)

Figure 4 above illustrates the significance of biogenic CO_2 emissions in the pulp & paper sector. In the case of the five companies covered in this example, the amount of biogenic emissions ranges between 1.42 times (Holmen) and 8.12 times (Södra) the total amount of CO_2 from fossil sources emitted by the company. Södra, the company with the highest relative amount of biogenic emissions, is explicitly aiming to achieve "fossil-free production", by relying on the increased use of wood pellets and lignin as biogenic energy carriers (Södra, 2009).

3.6.2 Indirect CO_2 emissions or electricity usage

Indirect, or scope 2, CO_2 emissions are those derived from the consumption of secondary energy, i.e. purchased electricity, steam or heat (GHG Protocol, 2011). The amount of indirect CO_2 emissions a company is responsible for is therefore derived, not only by how much energy is purchased, but by the fuel mix used to produce this energy.

In the case of electricity the primary energy mix used to produce electricity varies greatly between the different Nordic countries. At 70% of total electricity production, Denmark is the most reliant on fossil fuels (International Energy Agency, 2011a), this is followed by Finland at 34% (International Energy Agency, 2011b), Sweden with 2% (International Energy Agency, 2011d) and finally Norway where only 0.4% of electricity is fossil fuel dependent. In both Sweden and Finland the majority of the remaining electricity production comes from a mix of nuclear and hydro-electricity (International Energy Agency, 2011b, 2011d). In Norway 98% of all electricity comes from hydro (International Energy Agency, 2011c). As shown in Table 7 this leads to a large variation in the CO_2 emitted per unit of electricity produced.

Country	Emission Factor (t CO_2/ KWh)
Denmark	0.000639
Finland	0.000259
Sweden	0.000045
Norway	0.000002

Table 7: Electricity-derived CO_2-Emission Factors for Nordic Countries (Sturm, Müller, & Upasena, 2003: 69)

The differences between these emission factors means that the indirect CO_2 emissions, and subsequently the total CO_2 emissions of companies based either in Sweden or Norway can be vastly lower than for companies based in Finland and Denmark who either use a similar or much lower quantity of electricity. This can be illustrated taking the example of Holmen's total emissions in 2009 (Figure 5). Holmen is based in Sweden but operate production facilities in six European countries (Holmen, 2008). If all of Holmen's electricity use in 2009 had occurred in Finland, its total (direct and indirect) CO_2 emissions would have been four times the amount the company actually emitted based on its actual spread of operations throughout Europe; if all of the company's operations had instead been based in Norway – and hence virtually all of the electricity used by the company had been generated through hydro power – the company would have been able to cut its total CO_2 emissions by 55%.

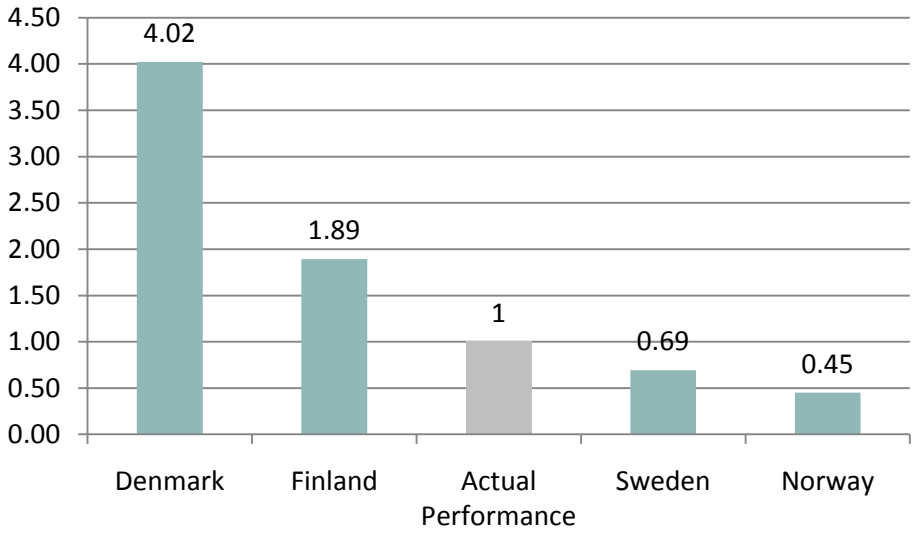

Figure 5: Hypothetical CO_2 Performance of Holmen in 2009 in the four Nordic Countries

The example illustrates the major impact the energy mix in a given context can have on a company's overall CO_2 performance. Therefore it is important to analyse the electricity consumption of a company alongside indirect CO_2 emissions in order to establish whether low indirect emissions are an accident of location or the result of a determined effort to reduce electricity use. Whilst the situation sketched out above describes an extreme case – as all of the companies analysed in this study operate in more than one country – it clearly shows that the primary energy mix to generate electricity is a potentially crucial factor.

4 Results: Overview

In this chapter we present the results of the Sustainable Value$_{CO2}$ assessment of 25 pulp & paper companies over the period from 2005 to 2009. Chapter 4.1 starts with the results based on EBIT as return figure, providing an overview on the Sustainable Value$_{CO2}$ and the SVM$_{CO2}$ of the companies assessed. In chapter 4.2 we present the Sustainable Value$_{CO2}$ created and the SVM$_{CO2}$ of the companies using Net Value Added as return figure.

4.1 EBIT-based assessment results

4.1.1 Absolute Sustainable Value$_{CO2}$ (EBIT scenario)

Table 8 provides an overview of the absolute Sustainable Value$_{CO2}$ created by the 25 pulp & paper companies during the period from 2005 to 2009, as well as the rank of each company in each year. The Sustainable Value$_{CO2}$ produced by these companies ranges from -€ 1.9bn (Weyerhaeuser in the year 2008) to € 1.5bn (Kimberly-Clark in the year 2009). One salient feature is that five companies managed to consistently produce a positive Sustainable Value$_{CO2}$ over the entire review period (DS Smith, International Paper, Kimberly-Clark, Södra and Sveaskog).

	2005	*Rank*	2006	*Rank*	2007	*Rank*	2008	*Rank*	2009	*Rank*
Ahlstrom	€ 20,007	*7/17*	-€ 14,588	*14/22*	-€ 73,638	*15/24*	-€ 40,052	*18/25*	-€ 97,957	*14/24*
Billerud	N/A	*N/A*	N/A	*N/A*	€ 45,214	*9/24*	€ 20,348	*17/25*	€ 12,445	*12/24*
Corticeira	N/A	*N/A*	€ 27,992	*11/22*	€ 31,540	*12/24*	€ 22,504	*16/25*	€ 13,358	*11/24*
Domtar	-€ 697,036	*17/17*	-€ 692,875	*22/22*	-€ 201,805	*19/24*	-€ 523,240	*24/25*	€ 85,594	*6/24*
DS Smith	€ 15,196	*8/17*	€ 35,037	*10/22*	€ 75,157	*7/24*	€ 63,749	*9/25*	€ 20,217	*9/24*
Grupo ENCE	€ 61,691	*4/17*	€ 18,466	*12/22*	€ 37,441	*11/24*	€ 31,993	*14/25*	-€ 122,545	*16/24*
Holmen	N/A	*N/A*	€ 140,696	*5/22*	€ 157,216	*5/24*	€ 78,163	*7/25*	€ 97,460	*5/24*
International Paper	€ 360,431	*3/17*	€ 197,053	*4/22*	€ 190,715	*4/24*	€ 125,831	*6/25*	€ 344,008	*3/24*
Kimberly-Clark	€ 1,362,069	*1/17*	€ 1,060,360	*1/22*	€ 1,340,261	*1/24*	€ 1,422,580	*1/25*	€ 1,500,688	*1/24*
Korsnäs	N/A	*N/A*	N/A	*N/A*	N/A	*N/A*	€ 45,345	*12/25*	€ 66,424	*8/24*
MeadWestvaco	-€ 20,274	*9/17*	-€ 148,519	*15/22*	€ 72,887	*8/24*	€ 50,313	*11/25*	€ 141,509	*4/24*
Metsäliitto	-€ 240,958	*12/17*	-€ 410,915	*20/22*	-€ 322,167	*22/24*	-€ 135,414	*20/25*	-€ 371,820	*23/24*
Mondi	-€ 337,198	*13/17*	-€ 292,514	*18/22*	-€ 115,252	*17/24*	€ 135,567	*5/25*	-€ 269,400	*20/24*
Myllykoski	-€ 170,947	*11/17*	-€ 235,556	*17/22*	-€ 289,888	*21/24*	-€ 165,831	*22/25*	-€ 242,707	*19/24*
Nippon	-€ 347,629	*14/17*	-€ 522,515	*21/22*	-€ 564,071	*24/24*	-€ 259,893	*23/25*	-€ 343,694	*22/24*
Norbord	N/A	*N/A*	€ 60,447	*8/22*	-€ 90,540	*16/24*	-€ 113,428	*19/25*	N/A	*N/A*
Norske Skog	-€ 161,827	*10/17*	-€ 206,521	*16/22*	-€ 242,846	*20/24*	-€ 150,834	*21/25*	-€ 319,048	*21/24*
PaperlinX	N/A	*N/A*	€ 9,250	*13/22*	€ 41,814	*10/24*	€ 29,353	*15/25*	-€ 116,226	*15/24*
Södra	€ 41,880	*6/17*	€ 77,881	*6/22*	€ 226,425	*3/24*	€ 36,064	*13/25*	€ 13,859	*10/24*
Smurfit Kappa	N/A	*N/A*	N/A	*N/A*	€ 275,115	*2/24*	€ 347,224	*3/25*	-€ 9,736	*13/24*
Stora Enso	-€ 602,306	*16/17*	-€ 300,432	*19/22*	-€ 194,750	*18/24*	€ 73,976	*8/25*	-€ 147,794	*17/24*
Sveaskog	€ 59,598	*5/17*	€ 70,700	*7/22*	€ 134,455	*6/24*	€ 59,391	*10/25*	€ 75,581	*7/24*
SCA	-€ 540,045	*15/17*	€ 349,641	*3/22*	-€ 58,345	*14/24*	€ 581,364	*2/25*	€ 438,265	*2/24*
UPM	N/A	*N/A*	€ 36,990	*9/22*	€ 4,754	*13/24*	€ 178,301	*4/25*	-€ 202,608	*18/24*
Weyerhaeuser	€ 1,197,348	*2/17*	€ 739,920	*2/22*	-€ 479,690	*23/24*	-€ 1,913,375	*25/25*	-€ 565,871	*24/24*

Table 8: Absolute Sustainable Value$_{CO2}$ and ranking of pulp & paper companies in the EBIT-based assessment (in € 1,000)

In the cases of Billerud, Corticeira, Holmen and Korsnäs no complete time series are available, but these companies generated a consistently positive Sustainable Value$_{CO2}$ for the

years where data is available. In addition, four companies were identified as generating negative Sustainable Value$_{CO2}$ over the entire review period (Metsäliitto, Myllykoski, Nippon and Norske Skog). The twelve remaining companies show both positive and negative Sustainable Value$_{CO2}$ figures.

During the review period, a clearly positive trend in creating Sustainable Value$_{CO2}$ was reported for SCA, being last but two in 2005 and second in class in 2009 (2005: -€ 0.54bn; 2009: € 0.44bn). A positive trend over time is also shown by Stora Enso (2005: -€ 0.6bn; 2009: -€ 0.15bn), Domtar (2005: -€ 0.7bn; 2009: € 0.09bn) and MeadVestvaco (2005: -€ 0.02bn; 2009: € 0.14bn). Stora Enso, however, remains in the red and ranked within the lower third after creating a positive Sustainable Value$_{CO2}$ in 2008 only. The highest Sustainable Value$_{CO2}$ creation is reported for Kimberly-Clark, which follows a slight but almost continuous positive trend too (2005: € 1.36bn; 2009: € 1.5bn) and leads the ranking for each year reported.

The strongest negative trend was reported for Weyerhaeuser, dropping from rank 2 in 2005 (€ 1.2bn) to last in 2009 (-€ 0.57bn). Thereby, particularly in 2008, the negative performance of Weyerhaeuser (-€ 1.91bn) significantly influences the results of the other companies due to a dampening effect on the benchmark efficiency. Whereas in the years before and after 2008 about 41% to 53% (2005: 9/17; 2006: 9/22; 2007: 11/24; 2009: 12/24) showed a negative Sustainable Value$_{CO2}$, in 2008 just 32% (8/25) of the companies assessed were in the red. This is due to the influence of large companies on the benchmark. A single large company with a poor performance can influence the benchmark enough to result in a positive performance of several small companies. If the CO_2 emitted by Weyerhaeuser in 2008 was instead emitted by the average of the industry peers, nearly € 2bn more EBIT would have been created. Other companies, albeit smaller, showing a strong negative trend in their Sustainable Value$_{CO2}$ over time include Smurfit Kappa (2007: € 0.28bn; 2009: -€ 0.01bn), UPM (2006: € 0.04bn; 2009: -€ 0.2bn), Grupo ENCE (2005: € 0.06bn; 2009: -€ 0.12bn), Norbord (2006: € 0.06bn; 2008: -€ 0.11bn) and Norske Skog (2005: -€ 0.16bn; 2009: -€ 0.32bn).

The graphic representation of the Sustainable Value$_{CO2}$ clearly illustrates the developments outlined above (Figure 6 & Figure 7). Particularly striking are the graphs of Kimberly-Clark and Weyerhaeuser. Despite a small downward development from 2005 to 2006, both were leading the ranking in those years. Kimberly-Clark in 2007 nearly catches up with its Sustainable Value$_{CO2}$ created in 2005 again and continues improving. Showing the highest fluctuation, Weyerhaeuser in contrast drops significantly, destroying Sustainable Value$_{CO2}$ of -€ 0.48bn in 2007 and continues this trend in 2008. Figure 6 also shows the positive trend SCA and Domtar follow over time, despite their relatively strong fluctuation. Being among the worst performers in 2005 (SCA: 15/17; Domtar: 17/17), both show significant improvements towards the end of the review period, ranking second (SCA) and sixth (Domtar) in 2009, with Domtar creating Sustainable Value$_{CO2}$ for the first time of the period under review. Further companies that are at least partially standing out either positively or negatively from the crowd are Smurfit Kappa, International Paper, Nippon and Metsäliitto. International Paper ranks third in 2005 (€ 0.36bn), loses Sustainable Value$_{CO2}$ the following

three years with its low in 2008 (€ 0.13bn) and gains back its position in 2009, creating a Sustainable Value$_{CO2}$ of € 0.34bn. Smurfit Kappa in contrast starts second in class in 2007 and increases its Sustainable Value$_{CO2}$ in 2008, but falls into the red in 2009, then ranking 13th out of 24 assessed companies only. Metsäliitto and Nippon, in 2005 both destroying Sustainable Value$_{CO2}$ and ranking within the bottom third (12/17 and 14/17 respectively), recorded their best performance in 2008 but slightly dropped again in 2009, then being last but two and last but three, respectively.

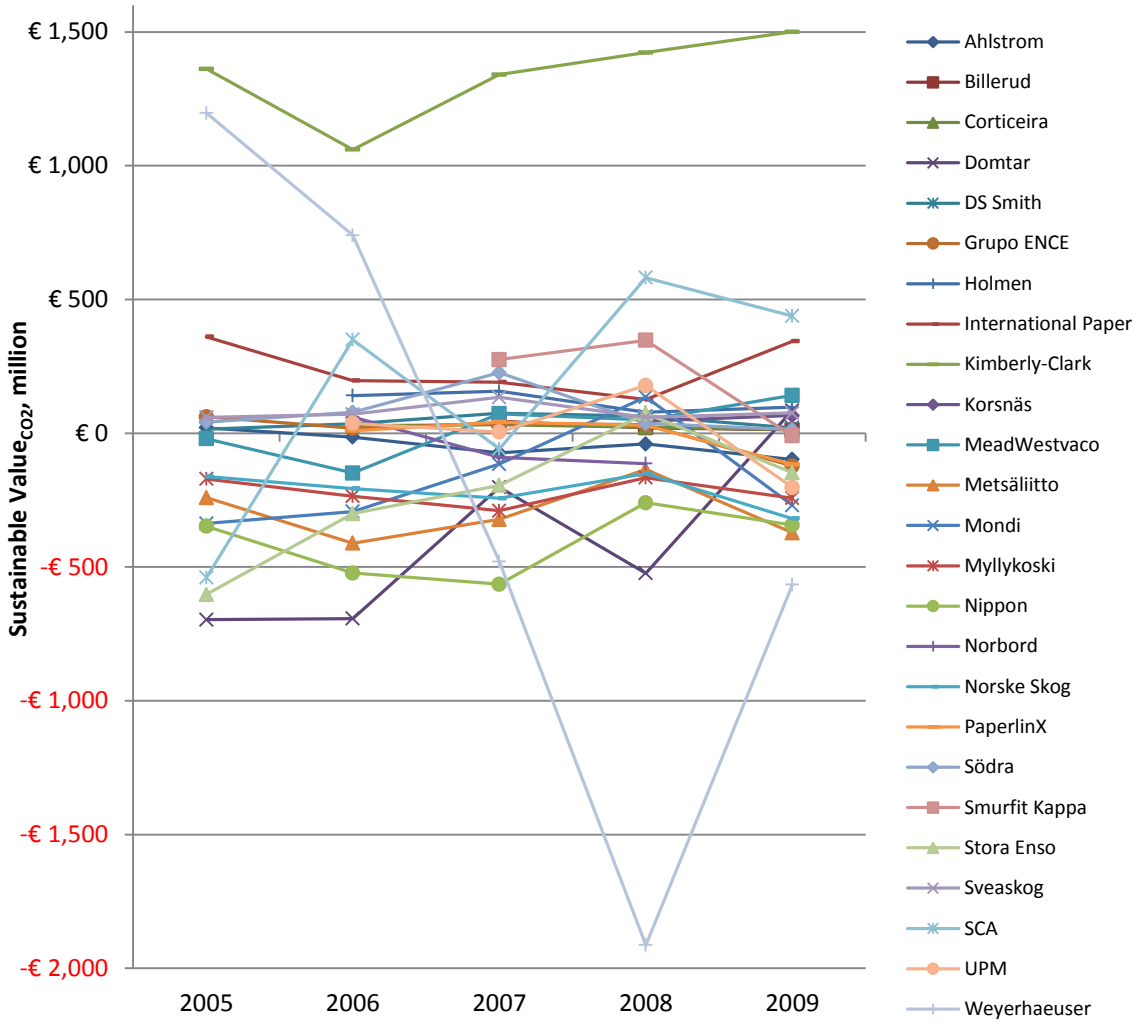

Figure 6: Absolute Sustainable Value$_{CO2}$ of pulp & paper companies in the EBIT-based assessment

Figure 7 allows for a closer look on the development of the other companies. Particularly striking is the graph representing the Sustainable Value$_{CO2}$ of Mondi. It shows significant improvements the first three years, reaching its peak with a positive Sustainable Value$_{CO2}$ in 2008, before dropping into the red again in 2009. The figure also shows clearly that Ahlstrom, UPM, Norske Skog and Myllykoski overall follow a negative trend except for 2008 (cf. the effect of Weyerhaeuser's performance drop in 2008). For Korsnäs data were available only for two years (2008 and 2009). In those years the company generated positive Sustainable Value$_{CO2}$ and moved up its rank from 12/25 (2008) to 8/24 (2009). Grupo ENCE and PaperlinX show a very similar curve shape, alternating their ranking position year by

year and eventually falling into the red in 2009. Billerud, Corticeira, Holmen and Sveaskog perform slightly better than the industry average for the years data was available but show comparably small changes over time only.

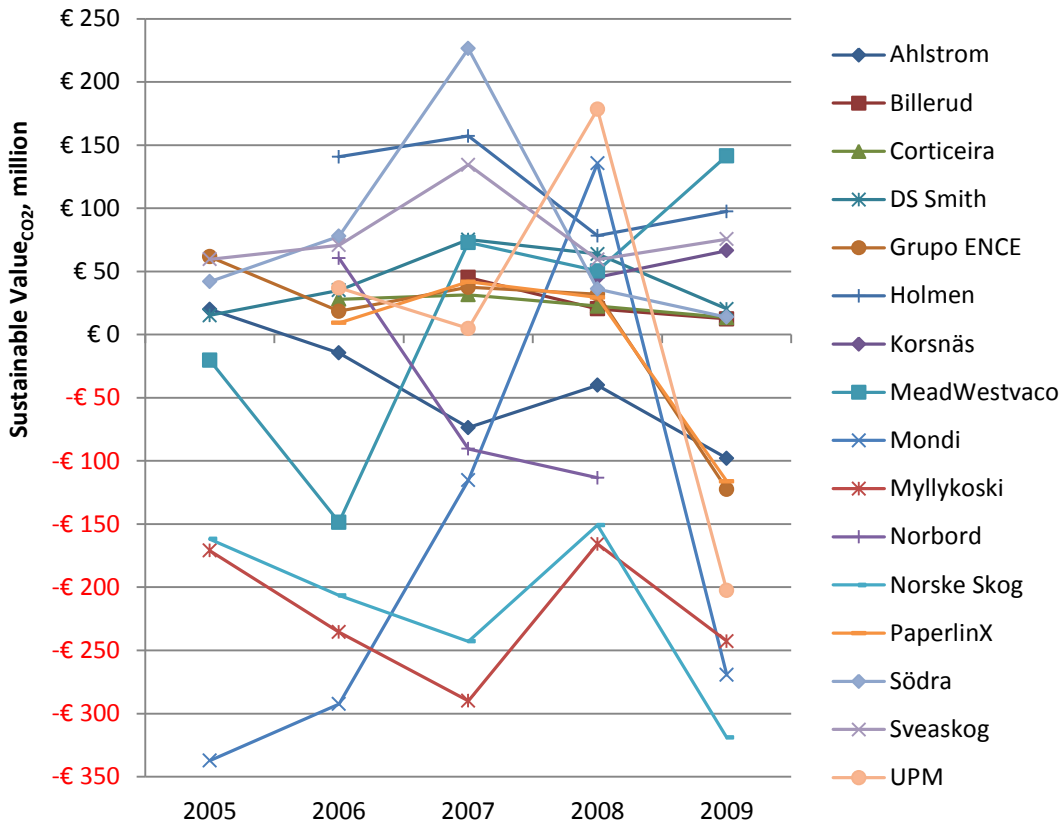

Figure 7: Absolute Sustainable Value$_{CO2}$ of selected pulp & paper companies in the EBIT-based assessment

(clipping of Figure 6)

4.1.2 Sustainable Value$_{CO2}$ Margin (EBIT scenario)

So far our analysis of the Sustainable Value$_{CO2}$ data has focused on the absolute Sustainable Value$_{CO2}$ of the individual pulp & paper companies. As already explained in chapter 2.4, the absolute Sustainable Value$_{CO2}$ created is directly linked to the size of the company in question. The Sustainable Value$_{CO2}$ Margin (SVM$_{CO2}$) is a relative ratio that takes into consideration the size of the company by means of dividing Sustainable Value$_{CO2}$ figures by sales figures. Table 9 shows the SVM$_{CO2}$, i.e. the ratio of Sustainable Value$_{CO2}$ to sales, for each company.

Adjusting the results to company size allows a meaningful comparison of the performance of the individual companies and reveals a different picture of the performance of the individual companies assessed (Table 9). A comparison with the absolute Sustainable Value$_{CO2}$ data of pulp & paper companies (Table 8) shows that the negative/positive signs are identical in each case: a company that uses its CO_2 more efficiently than the industry average over the review period and subsequently creates positive absolute Sustainable Value$_{CO2}$, by definition achieves a positive SVM$_{CO2}$ as well. As with our analysis of the absolute Sustainable Value$_{CO2}$, only DS Smith, International Paper, Kimberly-Clark, Södra, and Sveaskog have a consistently

positive SVM$_{CO2}$; Metsäliitto, Myllykoski, Nippon and Norske Skog always fall below the industry average in every year studied.

	2005	*Rank*	2006	*Rank*	2007	*Rank*	2008	*Rank*	2009	*Rank*
Ahlstrom	1.29%	*7/17*	-0.91%	*14/22*	-4.18%	*17/24*	-2.22%	*19/25*	-6.14%	*19/24*
Billerud	N/A	*N/A*	N/A	*N/A*	5.39%	*7/24*	2.51%	*10/25*	1.64%	*10/24*
Corticeira	N/A	*N/A*	6.33%	*5/22*	6.95%	*5/24*	4.81%	*6/25*	3.22%	*7/24*
Domtar	-25.17%	*17/17*	-27.60%	*22/22*	-4.64%	*19/24*	-11.98%	*23/25*	2.18%	*8/24*
DS Smith	0.63%	*8/17*	1.47%	*10/22*	2.90%	*9/24*	2.56%	*9/25*	0.86%	*11/24*
Grupo ENCE	10.80%	*1/17*	2.96%	*9/22*	5.88%	*6/24*	4.73%	*7/25*	-22.88%	*24/24*
Holmen	N/A	*N/A*	6.84%	*4/22*	7.59%	*4/24*	3.88%	*8/25*	5.53%	*4/24*
International Paper	1.96%	*6/17*	1.18%	*11/22*	1.28%	*11/24*	0.71%	*15/25*	2.12%	*9/24*
Kimberly Clark	10.10%	*2/17*	8.34%	*2/22*	10.80%	*2/24*	10.20%	*1/25*	11.31%	*2/24*
Korsnas	N/A	*N/A*	N/A	*N/A*	N/A	*N/A*	5.89%	*3/25*	8.77%	*3/24*
MeadWestVaco	-0.41%	*9/17*	-2.85%	*16/22*	1.44%	*10/24*	1.11%	*14/25*	3.25%	*6/24*
Metsäliitto	-2.79%	*10/17*	-4.43%	*17/22*	-4.20%	*18/24*	-2.10%	*18/25*	-7.69%	*20/24*
Mondi	-6.29%	*15/17*	-5.09%	*18/22*	-1.84%	*16/24*	2.14%	*12/25*	-5.12%	*18/24*
Myllykoski	-11.76%	*16/17*	-15.37%	*21/22*	-20.06%	*24/24*	-11.27%	*22/25*	-20.03%	*23/24*
Nippon	-4.29%	*11/17*	-6.97%	*20/22*	-7.37%	*22/24*	-2.86%	*20/25*	-3.94%	*17/24*
Norbord	N/A	*N/A*	6.06%	*6/22*	-11.22%	*23/24*	-17.60%	*24/25*	N/A	*N/A*
Norske Skog	-5.04%	*13/17*	-5.76%	*19/22*	-7.18%	*21/24*	-4.68%	*21/25*	-13.05%	*21/24*
Paperlinx	N/A	*N/A*	0.20%	*13/22*	0.89%	*12/24*	0.64%	*17/25*	-3.29%	*16/24*
Sodra	2.47%	*5/17*	2.97%	*8/22*	8.40%	*3/24*	2.33%	*11/25*	0.85%	*12/24*
Smurfit Kappa	N/A	*N/A*	N/A	*N/A*	3.78%	*8/24*	4.92%	*5/25*	-0.16%	*13/24*
Stora	-4.57%	*12/17*	-2.06%	*15/22*	-1.46%	*15/24*	0.67%	*16/25*	-1.65%	*14/24*
Sveaskog	8.99%	*3/17*	10.85%	*1/22*	17.12%	*1/24*	7.88%	*2/25*	13.29%	*1/24*
SCA	-5.20%	*14/17*	3.19%	*7/22*	-0.51%	*14/24*	5.06%	*4/25*	4.05%	*5/24*
UPM	N/A	*N/A*	0.36%	*12/22*	0.05%	*13/24*	1.88%	*13/25*	-2.62%	*15/24*
Weyerhaeuser	7.50%	*4/17*	7.23%	*3/22*	-6.46%	*20/24*	-32.87%	*25/25*	-14.75%	*22/24*

Table 9: Sustainable Value$_{CO2}$ Margin of pulp & paper companies in the EBIT-based assessment

It seems that particularly the outstanding position of Kimberly-Clark in the analysis of the absolute Sustainable Value$_{CO2}$ can at least partly be attributed to the size of the company. The difference to the other companies studied is not as pronounced as in the analysis of absolute Sustainable Value$_{CO2}$. By contrast, Sveaskog and Domtar have rather extreme positions when it comes to the analysis of SVM$_{CO2}$, although their (positive or negative) absolute Sustainable Value$_{CO2}$ is relatively modest as far as absolute amounts are concerned. Relative to company sales, Sveaskog beats the previous leader Kimberly-Clark in three of the five years studied, while the performance of Domtar in 2005 and 2006 puts it closer to the worst performance shown by Weyerhaeuser in 2008. The graph of the latter, however, still remains relatively isolated in 2008, allowing the assumption that the company size in this case only partly explains the extreme absolute Sustainable Value$_{CO2}$ performance. Grupo ENCE now shows a very different curve shape than PaperlinX and a stronger fluctuation over time compared to its absolute Sustainable Value$_{CO2}$ performance. While in 2005 the company ranked 4/17 with respect to the absolute Sustainable Value$_{CO2}$, in terms of SVM$_{CO2}$ Grupo ENCE leads the ranking in that year with a SVM$_{CO2}$ of 10.8%. That is, the company creates a Sustainable Value$_{CO2}$ of € 10.80 per € 100 of sales. In 2009, in contrast, Grupo ENCE ranks last with a SVM$_{CO2}$ of -22.88%. Significant changes in the performance when taking company size into account can also be observed for Korsnäs. In terms of SVM$_{CO2}$ the

company could gain some ground and moved up compared to the absolute Sustainable Value$_{CO2}$ ranking, in 2008 from 12/25 to 3/25 (CVM: 5.89%) and in 2009 from 8/24 to 3/24 (CVM: 8.77%). Similar differences between absolute Sustainable Value$_{CO2}$ performance and SVM$_{CO2}$ can be observed for Corticeira, moving up in ranking significantly for each of the years assessed.

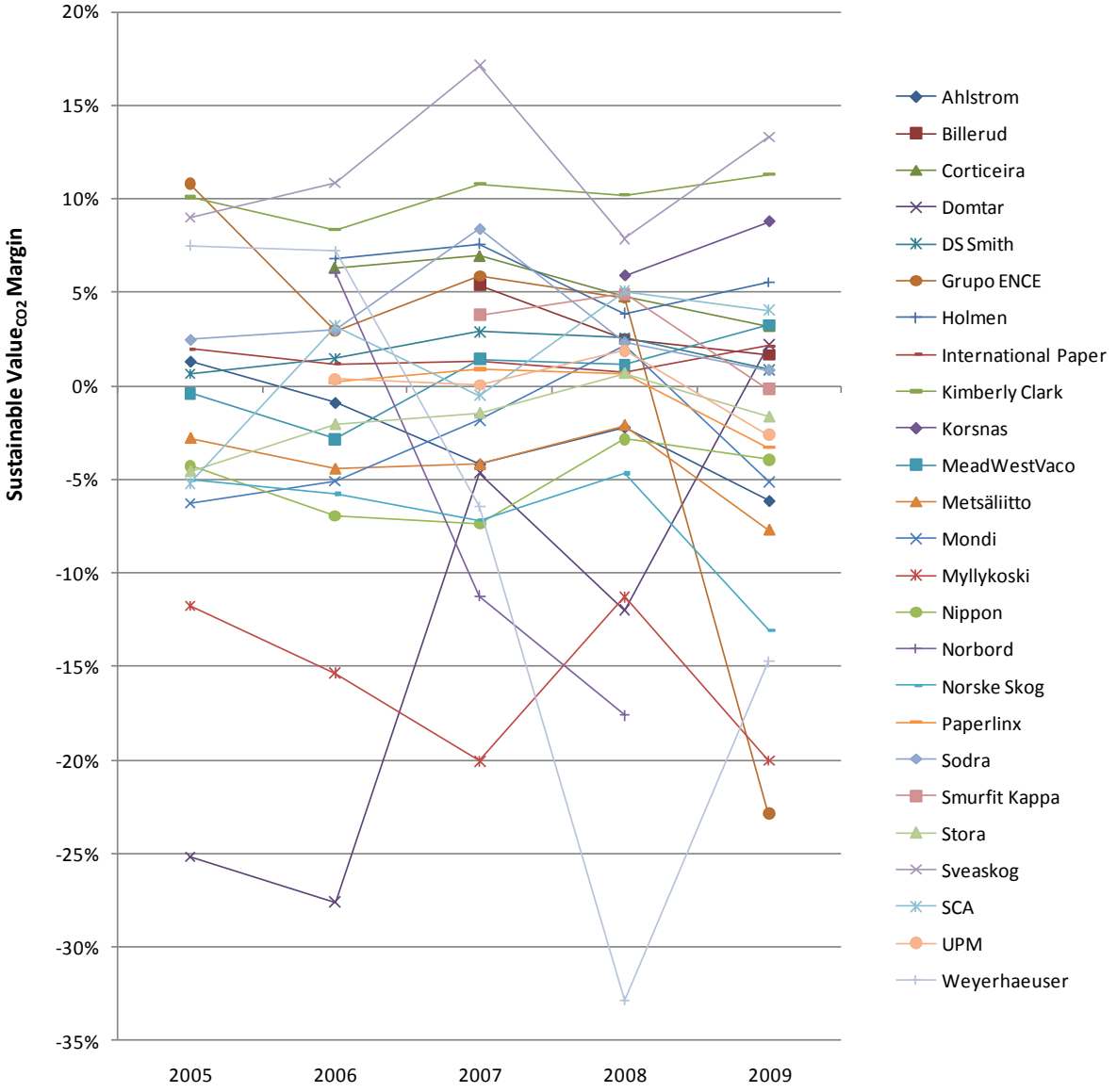

Figure 8: Sustainable Value$_{CO2}$ Margin of pulp & paper companies in the EBIT-based assessment

4.2 *NVA-based assessment results*

In this section, we describe the results of the carbon assessment of the 17 pulp & paper companies, for which information on personnel expenses was available, when Net Value Added is used as a return figure. As already mentioned above, there are two main differences in comparison to the EBIT-based assessment. First, Net Value Added represents a broader return figure as it does not only cover the value that accrues to capital providers and the state (as with EBIT). Net Value Added also includes the value that accrues to employees in form of salaries and other personnel expenses (see also the discussion in section 3.2.1). Second, in the NVA-based assessment only 17 companies could be assessed

because usually US-based and Japanese firms do not report and publish figures on personnel expenses.

4.2.1 Absolute Sustainable Value$_{CO2}$ (NVA scenario)

Table 10 shows the results and respective ranks for the absolute Sustainable Value$_{CO2}$ of the 17 pulp & paper companies that could be analysed in the NVA-based carbon assessment. The highest Sustainable Value$_{CO2}$ in the period between 2005 and 2009 was achieved by sector heavy-weight SCA in 2009 with a Sustainable Value$_{CO2}$ of € 1.55bn. At the other extreme resides Sweden's Stora Enso with a negative Sustainable Value$_{CO2}$ of -€ 1.25bn in 2005. DS Smith, Sveaskog and SCA achieve positive Sustainable Value$_{CO2}$ throughout all five years and another four companies do so for the years where data is available (Billerud, Corticeira, Holmen and Södra). Mondi, Norske Skog and Stora Enso produced negative Sustainable Value$_{CO2}$ throughout the entire period, similarly to Myllykoski who remains in the red for all years where data is available. The remaining five pulp & paper companies show mixed results during the period under review.

	2005	*Rank*	2006	*Rank*	2007	*Rank*	2008	*Rank*	2009	*Rank*
Ahlstrom	€ 158,882	*4/9*	€ 75,471	*9/15*	€ 35,782	*10/17*	-€ 845	*10/17*	€ 15,767	*9/17*
Billerud	N/A	*N/A*	N/A	*N/A*	€ 134,352	*8/17*	€ 98,050	*6/17*	€ 101,351	*5/17*
Corticeira	N/A	*N/A*	€ 105,741	*7/15*	€ 105,002	*9/17*	€ 97,510	*7/17*	€ 89,910	*7/17*
DS Smith	€ 337,651	*3/9*	€ 333,087	*2/15*	€ 326,248	*4/17*	€ 214,141	*3/17*	€ 214,125	*3/17*
Grupo ENCE	€ 41,272	*6/9*	-€ 91	*11/15*	€ 23,596	*12/17*	-€ 63,287	*11/17*	-€ 168,468	*13/17*
Holmen	N/A	*N/A*	€ 199,410	*4/15*	€ 233,849	*5/17*	€ 154,584	*5/17*	€ 211,695	*4/17*
Metsäliitto	€ 538,042	*2/9*	€ 163,909	*5/15*	€ 26,430	*11/17*	-€ 68,776	*12/17*	-€ 125,984	*12/17*
Mondi	-€ 587,344	*8/9*	-€ 926,847	*15/15*	-€ 817,957	*15/17*	-€ 734,202	*15/17*	-€ 938,436	*17/17*
Myllykoski	N/A	*N/A*	-€ 689,871	*14/15*	-€ 862,418	*16/17*	-€ 1,081,157	*17/17*	-€ 790,239	*16/17*
Norske Skog	-€ 304,532	*7/9*	-€ 624,554	*12/15*	-€ 789,814	*14/17*	-€ 783,882	*16/17*	-€ 726,735	*15/17*
Paperlinx	N/A	*N/A*	€ 152,452	*6/15*	€ 212,020	*6/17*	€ 168,623	*4/17*	-€ 4,910	*10/17*
Sodra	N/A	*N/A*	€ 201,355	*3/15*	€ 353,182	*3/17*	€ 36,462	*9/17*	€ 80,445	*8/17*
Smurfit Kappa	N/A	*N/A*	N/A	*N/A*	€ 1,022,885	*2/17*	€ 849,459	*2/17*	€ 665,620	*2/17*
Stora	-€ 1,250,761	*9/9*	-€ 642,155	*13/15*	-€ 1,091,924	*17/17*	-€ 147,762	*14/17*	-€ 70,783	*11/17*
Sveaskog	€ 85,372	*5/9*	€ 97,880	*8/15*	€ 155,250	*7/17*	€ 72,282	*8/17*	€ 95,202	*6/17*
SCA	€ 981,419	*1/9*	€ 1,494,026	*1/15*	€ 1,092,857	*1/17*	€ 1,316,585	*1/17*	€ 1,550,157	*1/17*
UPM	N/A	*N/A*	€ 60,185	*10/15*	-€ 159,341	*13/17*	-€ 127,784	*13/17*	-€ 198,720	*14/17*

Table 10: Absolute Sustainable Value$_{CO2}$ and ranking of pulp & paper companies in the NVA-based assessment (in € 1,000)

SCA is clearly the frontrunner in terms of absolute Sustainable Value$_{CO2}$ creation in the NVA-based assessment over the five years. Residing consistently at the top of the ranking, SCA also displays a positive performance trend with strongest results in 2006 and 2009 (€ 1.49bn and € 1.55bn, respectively). While remaining negative over all years, overall Stora Enso's Sustainable Value$_{CO2}$ shows a strong upward trend. Starting with a loss of Sustainable Value$_{CO2}$ of -€ 1.25bn in 2005, the company manages to reduce these losses considerably in 2008 and especially 2009, in the latter year, Stora Enso comes in with a Sustainable Value$_{CO2}$ of -€ 70m. This is also reflected in the rankings where Stora Enso brings up the rear of the table in 2005 and 2007, only to climb to the lower midfield in 2009. There is no other company with a clear upward performance trend. A number of companies display relatively stable Sustainable Value$_{CO2}$ results and ranks such as Corticeira, Holmen and Myllykoski (however in negative territory).

However, there are a number of companies with a downward trend in Sustainable Value$_{CO2}$. These companies include Finish Metsäliitto with a constant decline of Sustainable Value$_{CO2}$ from € 538m in 2005 to -€ 125m in 2009. This downward trend also translates into the rankings where Metsäliitto plunges from the second position in 2005 to 12th in 2009. While defending the second place in the ranking for all the years Smurfit Kappa could be included in the analysis (2007 to 2009) the Sustainable Value$_{CO2}$ of this company constantly drops over these three years from some € 1.02bn in 2007 to € 0.67bn in 2009. Other companies with a downward trend in Sustainable Value$_{CO2}$ include UPM, dropping from € 60m in 2006 to -€ 199m in 2009 (ranking: 10/15 in 2006 vs. 14/17 in 2009) and Norske Skog who loses territory especially in 2005 and 2006 with Sustainable Value$_{CO2}$ dropping from -€ 304m in 2005 to -€ 625m in 2006 to reach its lowest value of -€ 790m in 2007 a level from which Norske Skog hardly recovered in the subsequent years. An overall negative performance trend can also be found for Mondi – already deep in negative territory – with a Sustainable Value$_{CO2}$ of -€ 587m in 2005 plunging to -€ 938m in 2009.

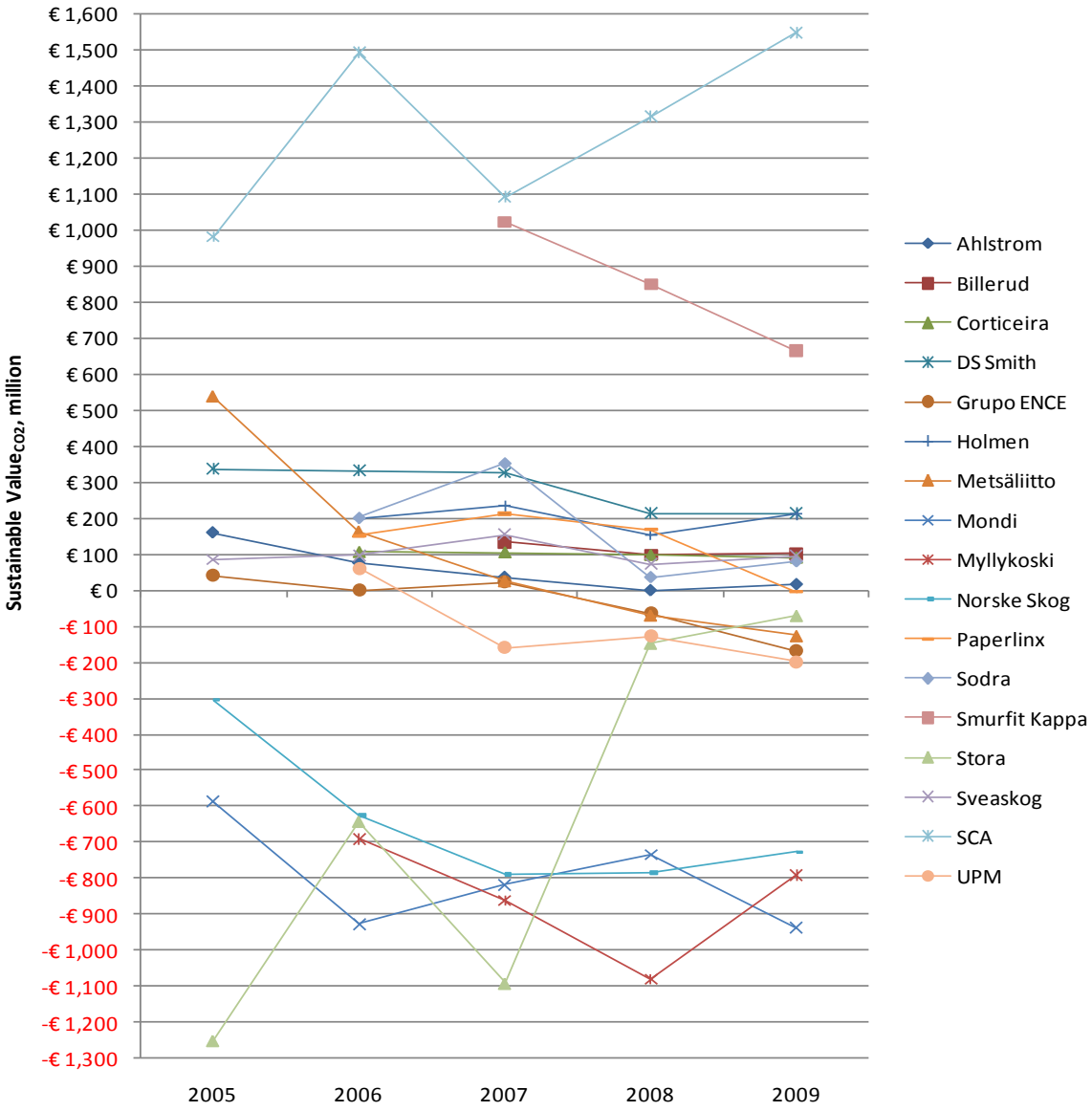

Figure 9: Absolute Sustainable Value$_{CO2}$ of pulp & paper companies in the NVA-based assessment

Figure 9 illustrates the different performance trends of absolute Sustainable Value$_{CO2}$ in the NVA-based assessment. The graphs clearly show the dominance of SCA and – despite its downward trend – Smurfit Kappa. At the lower end, the four companies Norske Skog, Mondi, Myllykoski and Stora Enso considerably lag behind the other pulp & paper companies in terms of absolute Sustainable Value$_{CO2}$ in the NVA-based assessment. Only in the years 2008 and 2009 Stora Enso catches up with the group of companies in the midfield and ranks 11th in 2009 with an only slightly negative Sustainable Value$_{CO2}$. The companies of the midfield group display a Sustainable Value$_{CO2}$ ranging roughly in the area between € 400m and -€ 200m. While there is no company within this group with a strong and clear upward performance trend, a number of companies such as Corticeira, Holmen or Sveaskog produce relatively stable absolute Sustainable Value$_{CO2}$ figures over the period of 2005 to 2009. Other companies in this group lose considerable ground over the five years under analysis. For instance, Ahlstrom, PaperlinX and Metsäliitto all fall into negative terrain in either 2008 or 2009 while having solid positive Sustainable Value$_{CO2}$ in the earlier years of 2005 or 2006. Group ENCE shows a particularly negative trend among the companies in the midfield with a drop from € 49m Sustainable Value$_{CO2}$ in 2005 to -€ 169m in 2009.

4.2.2 Sustainable Value$_{CO2}$ Margin (NVA scenario)

As with the EBIT-based assessment we next look at the Sustainable Value$_{CO2}$ Margin (SVM$_{CO2}$) in order to take into account company size when comparing carbon performance. As explained above, the SVM$_{CO2}$ corrects for firm size by dividing the absolute Sustainable Value$_{CO2}$ created by a company by its sales figure. Table 11 shows how much Sustainable Value$_{CO2}$ per sales the 17 pulp & paper companies in the NVA-based assessment have created.

	2005	*Rank*	2006	*Rank*	2007	*Rank*	2008	*Rank*	2009	*Rank*
Ahlstrom	10.23%	*3/9*	4.72%	*7/15*	2.03%	*11/17*	-0.05%	*10/17*	0.99%	*9/17*
Billerud	N/A	*N/A*	N/A	*N/A*	16.01%	*3/17*	12.08%	*2/17*	13.39%	*4/17*
Corticeira	N/A	*N/A*	23.89%	*1/15*	23.14%	*1/17*	20.82%	*1/17*	21.65%	*1/17*
DS Smith	14.08%	*1/9*	13.97%	*3/15*	12.60%	*6/17*	8.60%	*6/17*	9.10%	*7/17*
Grupo ENCE	7.23%	*5/9*	-0.01%	*11/15*	3.70%	*10/17*	-9.36%	*14/17*	-31.46%	*16/17*
Holmen	N/A	*N/A*	9.70%	*5/15*	11.29%	*7/17*	7.68%	*7/17*	12.01%	*5/17*
Metsäliitto	6.23%	*6/9*	1.77%	*9/15*	0.34%	*12/17*	-1.07%	*11/17*	-2.60%	*13/17*
Mondi	-10.95%	*9/9*	-16.12%	*13/15*	-13.05%	*15/17*	-11.57%	*15/17*	-17.85%	*14/17*
Myllykoski	N/A	*N/A*	-45.00%	*15/15*	-59.68%	*17/17*	-73.50%	*17/17*	-65.20%	*17/17*
Norske Skog	-9.48%	*7/9*	-17.43%	*14/15*	-23.34%	*16/17*	-24.30%	*16/17*	-29.72%	*15/17*
Paperlinx	N/A	*N/A*	3.36%	*8/15*	4.51%	*9/17*	3.69%	*8/17*	-0.14%	*10/17*
Sodra	N/A	*N/A*	7.69%	*6/15*	13.11%	*5/17*	2.35%	*9/17*	4.94%	*8/17*
Smurfit Kappa	N/A	*N/A*	N/A	*N/A*	14.07%	*4/17*	12.03%	*3/17*	10.99%	*6/17*
Stora	-9.48%	*8/9*	-4.40%	*12/15*	-8.16%	*14/17*	-1.34%	*12/17*	-0.79%	*11/17*
Sveaskog	12.87%	*2/9*	15.02%	*2/15*	19.77%	*2/17*	9.59%	*5/17*	16.74%	*2/17*
SCA	9.45%	*4/9*	13.63%	*4/15*	9.54%	*8/17*	11.45%	*4/17*	14.34%	*3/17*
UPM	N/A	*N/A*	0.59%	*10/15*	-1.54%	*13/17*	-1.35%	*13/17*	-2.57%	*12/17*

Table 11: Sustainable Value$_{CO2}$ Margin of pulp & paper companies in the NVA-based assessment

As already explained above, the sign of the SVM$_{CO2}$ remains the same as with the absolute Sustainable Value$_{CO2}$. However, the ranking can considerably differ from the absolute Sustainable Value$_{CO2}$ case as bigger companies tend to produce bigger (positive and

negative) numbers. This size effect can be seen with several companies. For instance, Portuguese Corticeira who maintained a stable midfield position in the absolute Sustainable Value$_{CO2}$ assessment now ranks first with a stable SVM$_{CO2}$ between about 21% and 24%. Sveaskog represents a similar case and comes out second over the entire assessment period except 2008. The leader of the ranking for the absolute Sustainable Value$_{CO2}$, SCA, still solidly ventures in positive territory. However, taking firm size into account it becomes clear that SCA is not the most carbon-efficient company in the sample. With a SVM$_{CO2}$ between 9.5% and about 14% SCA creates € 9.50 to € 14 of Sustainable Value$_{CO2}$ per € 100 of sales. Another company among the leading group is Billerud yielding between € 12 of Sustainable Value$_{CO2}$ per € 100 of sales (in 2008) and € 16 of Sustainable Value$_{CO2}$ per € 100 of sales (in 2008) which translates into ranks between 2nd and 4th.

At the lower end of the ranking it becomes evident that the strongly negative absolute figures of Stora Enso in the earlier years of the assessment period result from its size in combination with a low SVM$_{CO2}$: A big company using a lot of CO_2 with an underperforming CO_2-efficiency in comparison to the benchmark yields rather strongly negative absolute Sustainable Value$_{CO2}$ results. The company with by far the most negative performance is Myllykoski lagging behind strongly behind all other pulp & paper companies analyzed. Already in their "best" year 2006, Myllykoski lost € 45 of Sustainable Value$_{CO2}$ per € 100 of sales. This performance further drops to reach a devastating SVM$_{CO2}$ of -73.5% in 2008. Norske Skog displays a constant downward trend with its SVM$_{CO2}$ dropping from -9.5% in 2005 to -29.7% in 2009. Grupo ENCE's SVM$_{CO2}$ also plunges heavily over the assessment period. While still venturing in positive terrain on a midfield position (5/9) with a SVM$_{CO2}$ of 7.2% in 2005, Grupo ENCE ends up at the penultimate position of the ranking with a SVM$_{CO2}$ of -31.5% in 2009. Mondi is the fourth company with a consistently negative performance that meanders around a SVM$_{CO2}$ of about -15% over the entire review period.

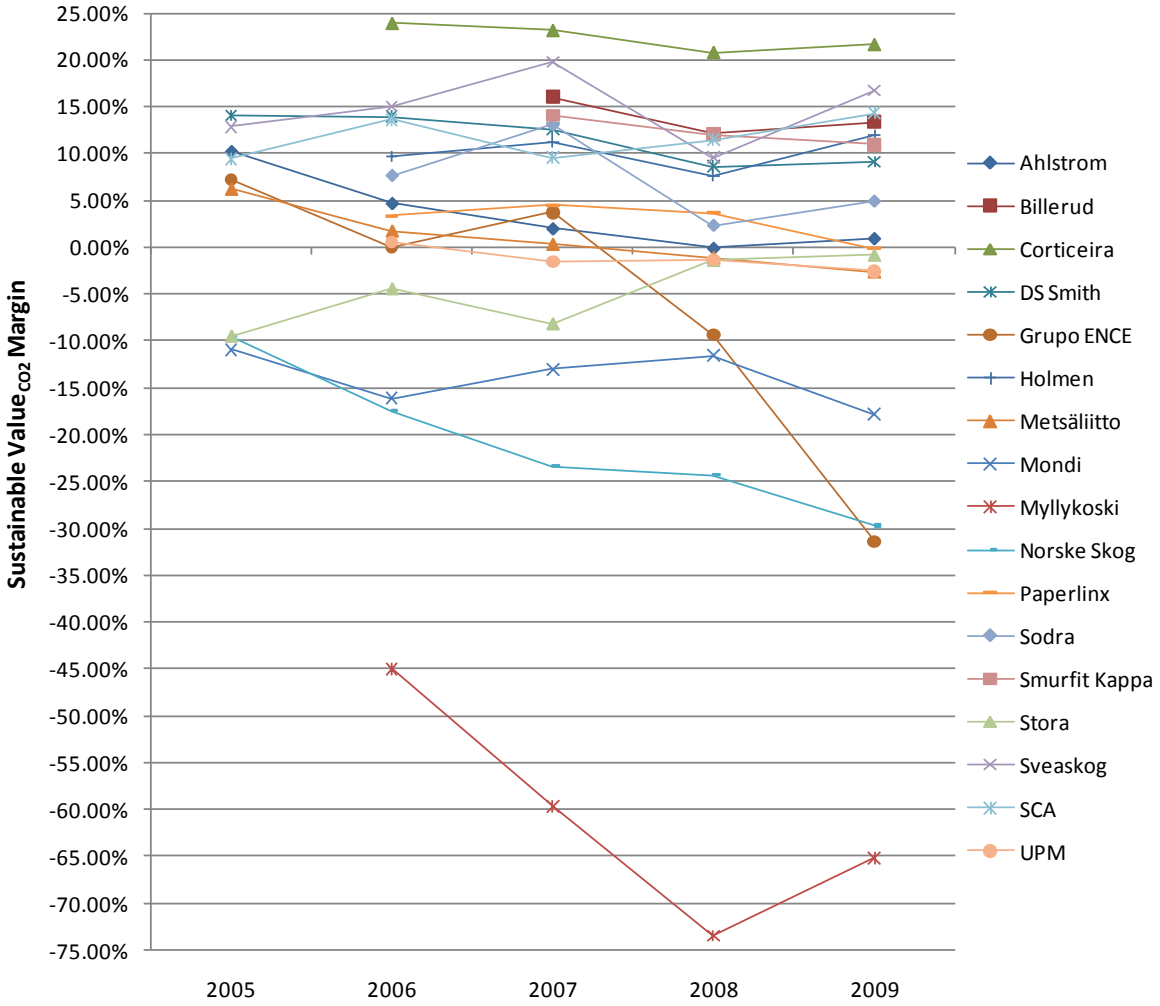

Figure 10: Sustainable Value$_{CO2}$ Margin of pulp & paper companies in the NVA-based assessment

Figure 10 illustrates the trends of the SVM$_{CO2}$ performance of the pulp & paper companies under review. While only facing relatively modest decline of their SVM$_{CO2}$ from 14% in 2005 to 9.1% in 2009, DS Smith loses considerable ground in the ranking from first in 2005 to only seventh in 2009. In contrast, competitors such as Holmen have gained ground with an improved SVM$_{CO2}$ from 9.7% in 2005 to 12% in 2009. Companies that fail to maintain their initially quite positive performance levels include Ahlstrom (SVM$_{CO2}$ of 10.1% in 2005 against 1% in 2009), PaperlinX (3.4% in 2006 against -0.1% in 2009), Metsäliitto (6.2% in 2005 against -2.6% in 2009) and – most drastically as seen above – Norske Skog and Grupo ENCE.

5 Discussion

The Sustainable Value$_{CO2}$ assessment of the 25 globally operating companies in the pulp and paper sector shows how much more or less value the companies generate with their CO_2 emissions in comparison to their peers. It should be kept in mind, however, that it does not attempt to provide any conclusion about the absolute carbon performance of the companies assessed. The study reveals considerable differences with respect to the companies' carbon performance as well as between the results of the different scenarios. In the following we exemplarily take a closer look at selected assessment results and discuss potential reasons for performance differences between the companies assessed as well as between the different scenarios established.

5.1 Benchmark development

It is worthwhile having a look at first at the development of the CO_2 efficiency of the benchmark, since it also is subject to considerable fluctuations and has a significant impact on the assessment results of the individual companies. It is important to note that the composition of the benchmark changes over time and that therefore a change of the benchmark does not necessarily represent a change of the sector.

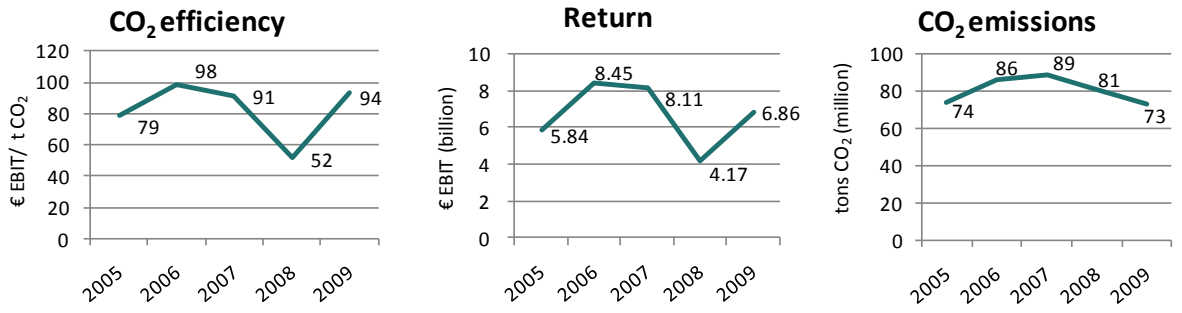

Figure 11: Benchmark CO_2 efficiency, accumulated return and accumulated CO_2 emissions 2005 - 2009 (EBIT scenario)

To this end, Figure 11 visualizes the development of the average CO_2 efficiency as well as the accumulated EBIT and CO_2 emissions of the pulp and paper companies assessed in this study (benchmark) over the years 2005 to 2009. It becomes evident that, despite an increase of the CO_2 emissions of the companies considered in the benchmark, the CO_2 efficiency of the benchmark increased by about 24% from 2005 to 2006 due to a disproportionately higher increase in accumulated EBIT. The increase in EBIT thereby is a result of two effects. Firstly, the number of companies with data available and therefore considered for the assessment was higher in 2006 than in 2005 (see Table 5). Secondly, the companies already being considered in 2005 have on average yielded a higher return in 2006. The increase of CO_2 emissions, in contrast, is solely a result of considering five more companies in 2006 to establish the benchmark, while the 17 companies considered in 2005 overall even slightly reduced their CO_2 emissions in 2006. In the following year, the accumulated return

generated by the benchmark dropped from € 8.45bn to € 8.11bn, although another two companies could be considered now for the assessment, bringing in additional EBIT of about € 680m. The reason for the drop assumedly lies in the first effects of the crash of the US real estate market, hitting some of the companies assessed. Particularly Weyerhaeuser, with the housing and building material market being one of their key product segments, had to record a strong decline in return (2006: € 1.12bn; 2007: € -170m). At the same time, the accumulated amount of CO_2 emissions increased, eventually resulting in a lower CO_2 efficiency of the benchmark. Similar effects determined the CO_2 efficiency of the benchmark in 2008, with the difference that overall CO_2 emissions dropped as well, but to a disproportionately lower extent than the overall return. Although one more company has been considered in the benchmark, adding return to the accumulated EBIT, the latter was cut at nearly half the amount of 2007 (-49%). Again, Weyerhaeuser with its specific product segment had to record severe losses, generating EBIT of € -1.75bn. But also most of the other companies now obviously were hit by the recession following the 2007 financial crisis. While in 2007 nine companies recorded a drop in EBIT, now only three of all companies assessed managed to increase their EBIT. The drop in overall CO_2 emissions can assumedly be ascribed to reduced production activities that companies affected by the recession have reacted with (only four companies emitted more CO_2 in 2008 than in 2007). Eventually, the benchmark CO_2 efficiency dropped about nearly 44%. Only in 2009 the companies recovered to an extent that CO_2 efficiency exceeded the 2007 value, being a result of a further reduction of overall CO_2 emissions and at the same time of an increase of accumulated EBIT. Interestingly, International Paper managed to cut its CO_2 emissions to the highest extent in absolute terms (-1.5m tons) while at the same time increasing its EBIT by nearly € 750m (+80%) compared to the previous year. Particularly with respect to the return, also Weyerhaeuser played a key role again, reducing its losses to about € -315m EBIT, while the majority of the companies still lost EBIT in comparison to 2008.

In order to highlight the differences between the EBIT and the NVA scenario from benchmark perspective, the following Figure 12 shows the development of the benchmark performance based on NVA as return figure.

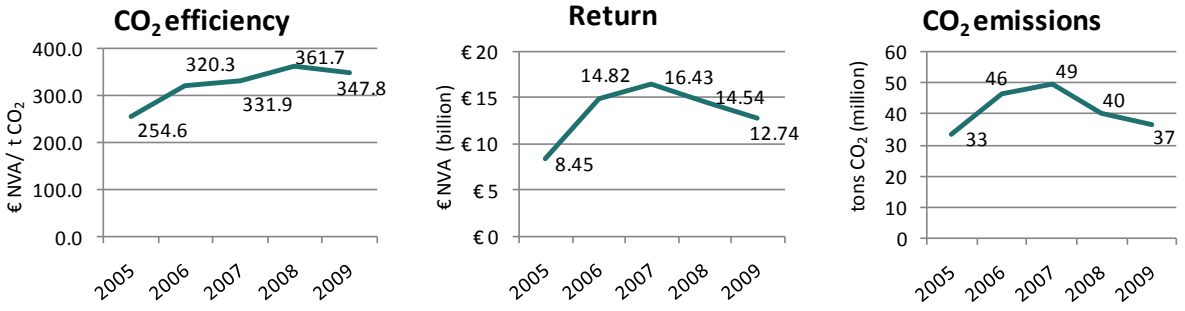

Figure 12: Benchmark CO_2 efficiency, accumulated return and accumulated CO_2 emissions 2005 - 2009 (NVA scenario)

It becomes apparent that, although overall less carbon is emitted, the emissions graph follows a similar curve. The differences can fully be ascribed to the different composition of

the benchmark, taking into account only 9 (2005) to 17 (2007 - 2009) companies due to limited data availability (see Table 6). The curve reflecting the development of the accumulated NVA, in contrast, shows higher values and a clearly different development than the respective EBIT based curve. The return improves until 2007 and drops only in 2008 and 2009 to a comparatively rather small extent. There are several factors influencing these differences. Firstly, here as well the composition of the benchmark plays a role, particularly the exclusion of Weyerhaeuser being the company with the highest drop in return. Secondly, NVA by definition adds personnel expenses to the EBIT, thus ends up in a higher absolute value than EBIT. Thirdly, labour constitutes a key factor of the production of goods and services and must be hold at a certain level required to keep the particular value creation process running. Moreover, companies have an interest to hold their human resource capacities as long as economically reasonable, since downsizing e.g. in recessions and hiring again in booming phases is related to additional costs. Fluctuations of personnel expenses therefore are less erratic than e.g. of EBIT return figures. And lastly, cuts in production capacities, including human resources, with respect to the recession rather have a reactive character and therefore tend to be subject to a time lag compared to changes in EBIT. Considering these characteristics and the development of the accumulated CO_2 emission, the NVA based benchmark CO_2 efficiency consequently shows higher values and a continuous improvement with a slight reduction only in 2009.

5.2 *Development of selected companies*

The development of a company's Sustainable Value$_{CO2}$ performance, and ultimately the Sustainable Value$_{CO2}$ Margin, are determined by different factors. Therefore, we now take a closer look at selected companies with particularly striking assessment results to exemplarily discuss reasons for trends and performance differences within and between individual companies. Thereby, also differences between EBIT based and NVA based assessment results will be highlighted.

To this end, we first take a closer look at the best performer in terms of EBIT based Sustainable Value$_{CO2}$, US based Kimberly Clark. The company, overall following a positive trend with a break in 2006 only, constantly creates positive Sustainable Value. The Sustainable Value$_{CO2}$ performance drop in 2006 on the one hand results from a cut in the company's EBIT by about 10% (compared to 2005). This can mainly be ascribed to a change of the exchange rate between the US-$ and the Euro. As outlined above, on the other hand the benchmark raises the bar, improving the CO_2 efficiency by about 24%. Kimberly Clark's CO_2 emissions, instead, remain nearly on the same level from 2005 to 2007 (6.2m tons). The improvement in 2007, therefore, clearly is a result of an increase in company's EBIT by about 14% and the worse performance of the benchmark. Kimberly Clark's CO_2 emissions for the first time were reduced in absolute terms in 2008 by 4%. However, its CO_2 efficiency in 2008 still falls off by nearly 6% due to a disproportionately higher drop in profits[2] (-9.3%), which

[2] As a side note, it is worthwhile mentioning that among the companies assessed Kimberly Clark is the only one with a drop in return below 10% between 2006 and 2009, i.e. least affected by the recession. This can

assumedly is an effect of the recession that followed the 2007 financial crisis. Despite its decreased CO_2 efficiency, Kimberly Clark still creates € 1.42bn EBIT more with its carbon emissions than the industry peers on average would have generated with these emissions, since the benchmark's performance is affected by the recession to an even greater extent. In 2009, the company recorded its lowest CO_2 emissions and highest return within the review period, leading to an improvement in CO_2 efficiency by about 24%. The latter, however, is not fully reflected by the Sustainable Value$_{CO2}$ since the benchmark performance improved significantly too. Next to International Paper and Weyerhaeuser, Kimberly Clark is among the three biggest companies assessed in this study when it comes to sales. This partly explains its outstanding Sustainable Value$_{CO2}$ performance, since the wide margin the company shows reduces considerably when company size is taken into account. Nevertheless, Kimberly Clark remains among the three best SVM$_{CO2}$ performers.

Showing the highest fluctuation and by far the worst CO_2 performance in the EBIT scenario, it is also worthwhile having a closer look at what happened to US based Weyerhaeuser. In terms of Sustainable Value$_{CO2}$, the company starts off as second best performer with a healthy margin but falls steep from 2006 to 2008 before gaining some ground again in 2009. As outlined above, the company obviously was hit seriously by the financial crisis, its EBIT drastically dropping into the red (2006: € 1.12 billion Euros; 2007: € -0.17 billion; 2008: -1.75 billion). Although Weyerhaeuser managed to continuously reduce its overall CO_2 emissions for each year assessed, the plummeting EBIT causes its Sustainable Value$_{CO2}$ performance to plunge from € 1.2bn in 2005 (rank 2/17) to € -1.9bn in 2008 (rank 25/25). The reduction in CO_2 emissions for these years might be ascribed to an assumedly recession induced drop in sales (2006: € 10.2bn; 2007: € 7.4bn; 2008: € 5.8bn; 2009: € 3.8bn) and a potentially related cut in production. Companies that seem to benefit most obviously from Weyerhaeuser's poor 2008 performance and the related development of the benchmark include Ahlstrom, which constantly follows a negative trend and just records an improvement from 2007 to 2008, as well as Metsäliitto, Mondi, Myllykoski, Nippon, Norske Skog, SCA, Smurfit Kappa, Stora Enso and UPM, all showing their best EBIT based Sustainable Value$_{CO2}$ and SVM$_{CO2}$ results in 2008. When Sustainable Value$_{CO2}$ is corrected for company size it loses its position in ranking in 2005 (4/17) and 2006 (3/22), but still raises 3 ranks in 2007 (20/24) and 2 ranks in 2009 (22/24). That is, with its best performance in 2005 Weyerhaeuser created € 7.50, and in 2008 destroyed devastating € 33 Sustainable Value$_{CO2}$ per € 100 of sales.

A company with particularly interesting results in the NVA scenario is Corticeira, although its development over time seems rather unexciting. The company shows, however, by far the highest CO_2 efficiency, in all years assessed (2006 to 2009) generating more than € 2,000 Net Value Added per ton of CO_2 emitted. This case clearly illustrates the impact company size has on the assessment results. Despite its outstanding CO_2 efficiency, the company only ranks 7 in the years 2006, 2008 and 2009 and even 9 in 2007. SCA, in contrast, is the front runner of the NVA based Sustainable Value$_{CO2}$ ranking over the period assessed, but only

assumedly be ascribed to its product portfolio, offering convenience goods such as health and body care products.

shows a CO_2 efficiency between € 579 and € 704 per ton of CO_2. While Corticeira creates a Sustainable Value$_{CO2}$ of € 89m, SCA yields € 1.55bn (see also Figure 9). Putting these absolute values into relation to the respective sales, however, Corticeira now ranks first over the entire assessment period, showing its best performance in 2006 when creating nearly € 24 Sustainable Value$_{CO2}$ per € 100 of sales (SVM$_{CO2}$ 23.9%). SCA in the same year creates a comparatively low Sustainable Value$_{CO2}$ of about € 14 per € 100 of sales (SVM$_{CO2}$ 13.6%) and reaches its best ranking position (3/17) in 2009 with a SVM$_{CO2}$ of 14.3%. That is, although in absolute terms SCA has a higher contribution to value creation, Corticeira in relative terms produces € 10 more Sustainable Value$_{CO2}$ per € 100 of sales than SCA and therefore shows from a sustainability perspective a better performance when it comes to CO_2 emissions used to create value. The outperformance thereby might, however, to a certain extent also be linked to the output, i.e. the product portfolio of Corticeira (cork), assumedly allowing for higher margins than the product groups of the benchmark.

Myllykoski is, in contrast to Corticeira, rather lagging behind in terms of both NVA based Sustainable Value$_{CO2}$ and SVM$_{CO2}$ results, but constitutes an interesting case to illustrate differences between EBIT based results and NVA based results also with respect to the benchmark composition. In the EBIT scenario, the Sustainable Value$_{CO2}$ of Myllykoski shows, comparatively, no significant developments, ranging from € -165m (2008) to € -290m (2007). Myllykoski's Sustainable Value$_{CO2}$ curve in the NVA scenario, in contrast, shows stronger differences between the years assessed, ranging from € -624m in 2006 to € -1.081bn in 2008, then being last among the companies assessed and just improving again in 2009 (€ -790m). The different degree and direction of fluctuation, particularly in 2008, foremost seems to be an effect of the differences in the benchmark development. As explained in 5.1, the benchmark in that year shows significant performance differences between the EBIT and NVA scenario (see also Figure 11 & Figure 12). Thus, while in the EBIT scenario Myllykoski managed to improve its performance from 2007 to 2008, in the NVA scenario 2008 constitutes the year with the company's worst Sustainable Value$_{CO2}$ performance. Interestingly, the company even improved its CO_2 efficiency in that period in both scenarios - despite an increase in CO_2 emissions. As a side note it is worth mentioning that, in relative terms, the CO_2 efficiency improved to a higher extent in the EBIT scenario than in the NVA scenario, additionally contributing to the differences between the EBIT based and the NVA based curves: Seemingly being hit by the recession, in 2007 Myllykoski generated losses in EBIT of € -11m. In 2008, EBIT increased to € 13m. Personnel expenses, in contrast, slightly reduced from € 162m in 2007 to € 160m in 2008. Thus, in relative terms personnel expenses change to a smaller extent than EBIT. As NVA is approximated as the sum of EBIT and personnel expenses, this translates into a smaller change of the NVA based CO_2 efficiency and eventually influences the Sustainable Value$_{CO2}$ development. Having a look at the differences in SVM$_{CO2}$, Myllykoski ranks last in the NVA scenario and is being left far behind the other companies assessed, with € -73.50 in 2008 destroying nearly three times as much Sustainable Value$_{CO2}$ per € 100 of sales than in the EBIT scenario. Thereby the better performance in the EBIT scenario also is a result of the benchmark: Except for Grupo Ence, all companies showing worse SVM$_{CO2}$ results than Myllykoski are not included in the NVA scenario. With the NVA reflecting the corporate contribution to a country's net national

product, this result is particularly devastating from a sustainability perspective. However, the underperformance of Myllykoski might to a certain extent also be linked to the type of output produced, assumedly allowing a smaller margin than the products of the benchmark.

Another interesting case highlighting differences between the EBIT and the NVA scenario is SCA. In both scenarios SCA shows a rather similar but strong erratic development, overall following a positive trend. However, there are considerable differences in the amounts of Sustainable Value$_{CO2}$ creation. With respect to the EBIT based results, in 2006, 2008 and 2009 SCA ranks among the first three in terms of Sustainable Value$_{CO2}$ (2006: € 350m; 2008: € 581m; 2009: € 438m). In the other two years, however, SCA destroys Sustainable Value$_{CO2}$ (2005: € -540m; 2007: € -58m). Thus, apart from the positive result, SCA shows, from a purely micro economic perspective, a rather poor performance. In the NVA assessment, in contrast, SCA creates a positive Sustainable Value$_{CO2}$ over the entire review period. Moreover, SCA generates the highest Sustainable Value$_{CO2}$ in all of the years of the assessment, leaving the majority of the other companies far behind. Thus, from a macroeconomic perspective, SCA shows an outstanding performance. These differences are, next to the benchmark composition, also rooted in the value creation process of the company. SCA on average creates the highest net value added among the companies assessed in the NVA scenario, which in turn is significantly influencing the CO_2 efficiency and thus the Sustainable Value$_{CO2}$ results. When SCA's Sustainable Value$_{CO2}$ is adjusted to company size, it loses part of its earlier advantage. However, while in the EBIT scenario the SCA meanders around the average, in the NVA scenario SCA still creates comparatively high Sustainable Value$_{CO2}$ per € 100 of sales (between € 9.45 in 2005 and € 14.35 in 2009).

Lastly, an interesting effect related to the depth of value creation can be observed for example with Sveaskog. A closer look at the performance of this company reveals that in special cases there seems to be a mismatch between a company's CO_2 efficiency and the ranking in the NVA based SVM$_{CO2}$. Although Sveaskog's NVA based CO_2 efficiency in 2008 (€ 934.06/ t CO_2) is way above the CO_2 efficiency of Billerud (€ 880.72/ t CO_2), Smurfit Kappa (€ 589.23/ t CO_2) and SCA (€ 653.6/ t CO_2), the company only follows behind them on rank five when comparing NVA based SVM$_{CO2}$ results (see Table 11). This disparity is due to the fact that the company's scope of value creation in terms of net value added is relatively small compared to its sales and being reflected in the SVM$_{CO2}$. That is, it may very well be that a company with a lower CO_2 efficiency can create more Sustainable Value$_{CO2}$ per sales than a company with a higher CO_2 efficiency.

5.3 *Conversion factors and biogenic emissions*

As pointed out in Chapter 3.5.3, for the majority of companies it was not possible to collect reliable data for total energy use or biogenic emissions. However, the selected cases described below can serve to illustrate their pivotal importance for an in-depth evaluation of the environmental performance of these companies. A comparison of CO_2-efficiencies and energy-efficiencies for these companies for the year 2008 (NVA scenario) highlights the role of conversion factors for indirect emissions and in particular the role of biogenic emissions. This can be illustrated taking the example of Billerud, Södra and Norske Skog: whilst the

three companies achieved very different Sustainable Value$_{CO2}$ Margins with Billerud ranked 2nd, Södra 9th and Norske Skog 2nd to last in the year 2008, Figure 13 below shows that in terms of energy efficiency, the performance of all three companies was virtually identical in this year with around 17 €/MWh.

Both Billerud and Södra cover more than 90% of their total energy demand through biogenic energy carriers. Therefore, both companies clearly benefit from the current carbon accounting regime, i.e. the convention not to account for biogenic emissions.

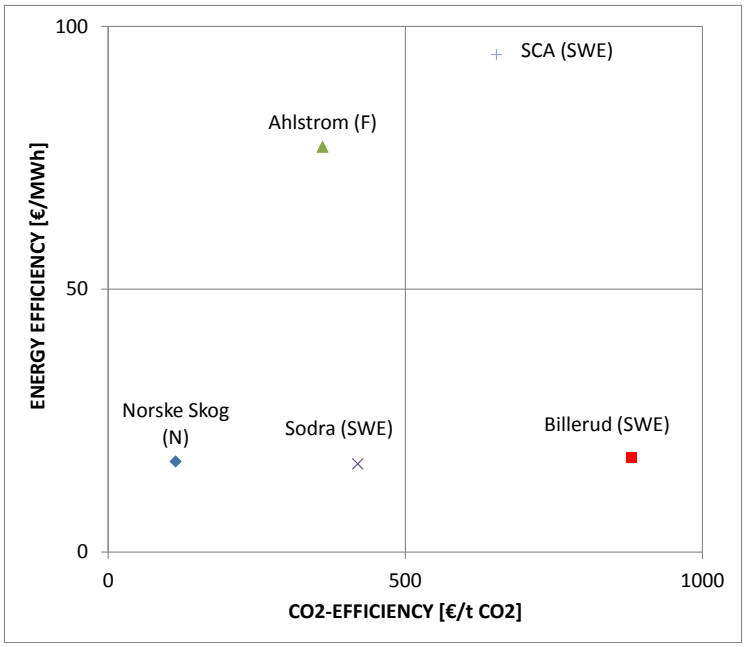

Figure 13: Comparison of energy-efficiency and CO2-efficiency (NVA scenario; selected companies in the year 2008)

Furthermore, from an energy-efficiency perspective, the exclusion of biogenic emissions therefore puts companies such as Ahlstrom and SCA – using only a limited amount of biogenic emissions – at a disadvantage if the analysis is purely based on scope 1 and 2 emissions according to the GHG Protocol. Both Ahlstrom and SCA, although showing the highest energy-efficiencies among the five companies, are positioned behind Billerud in the SVM ranking (see 4.2.2).

An additional factor that puts Ahlstrom at a disadvantage is the fact that the vast majority of the electricity consumed by the company is generated in Finland. As described in Chapter 3.6.2, Finland has a relatively high electricity CO_2 emission factor compared to Sweden or Norway.

Likewise, the CO_2-efficiency of Norske Skog benefits from the Norwegian energy mix; had the electricity consumed by the company been purchased in Denmark for example, its total (direct and indirect) CO_2 emissions would have been nearly three times the amount the company actually emitted based on its actual spread of operations throughout the world. However, Norske Skog's performance is mediated by the company's significant share of international operations, resulting in an average emission coefficient of 0.229 t CO_2/MWh in 2008. In contrast, Billerud, a company with only a small share of international operations,

arrives at an average emission coefficient of 0.079 t CO_2/MWh in the same year, although Sweden's energy mix would generally be less favourable compared to Norway.

When comparing the results with respect to the origin of the companies, no clear patterns can be identified. One of the main reasons therefore is that all companies assessed operate in more than one country, each location having a country specific CO_2 emission factor for purchased electricity that influences the companies' CO_2 performance. This points to a limited significance of the official home country of a company for its real CO_2-perfomance.

6 Conclusions and Outlook

In this study, we have assessed the Sustainable Value$_{CO2}$ creation of 25 globally operating pulp & paper companies. Following a number of successful applications, this study was the first study that focused on the corporate contributions to climate change and the pulp & paper sector. The study underlines the practicability of the Sustainable Value approach for assessing corporate carbon performance. A major advantage of this approach is given by the combination of corporate carbon assessment with traditionally value-based financial performance analysis. Here lies the major difference to other methods measuring corporate sustainability. Other approaches usually evaluate resource consumption in a burden-based way. Sustainable Value, in contrast, measures the value generated with the resources used, including economic, environmental as well as social resources. Sustainable Value is expressed as a monetary measure and is based on opportunity cost thinking. This means that the cost of using resources is determined by the return that would have been created with the same type and amount of resources had they been used in an alternative way. A pulp & paper company thus creates positive (or negative) Sustainable Value$_{CO2}$ if it earns a higher (or lower) return than its industry peers with its carbon emissions used.

In this study, the use of carbon emissions of 25 pulp & paper companies has been rated over the five-year period from 2005 to 2009 based on two different scenarios: the first scenario used EBIT from ordinary business activities as return figure. This scenario shows the corporate carbon performance rather from a business perspective, being primarily of interest to the owners and providers of capital. The second scenario was based on the Net Value Added (NVA), which is approximated as sum of EBIT and personnel expenses and represents a company's contribution to the Net National Product of the country it is operating in. Consequently, the findings of this scenario are of particular interest from a sustainability perspective. The specific results show considerable differences in the carbon performance among the companies assessed as well as between the different scenarios established.

In the EBIT based scenario, the majority of the companies assessed show both positive and negative Sustainable Value$_{CO2}$ results. Four companies (Metsäliitto, Myllykoski, Nippon and Norske Skog) were identified as consistently generating negative, and five companies (DS Smith, International Paper, Kimberly-Clark, Södra and Sveaskog) as creating positive Sustainable Value$_{CO2}$ over the entire period assessed. Kimberly Clark by far generates the highest Sustainable Value$_{CO2}$ for all years assessed, with its best result in 2009, creating about € 1.5 billion more EBIT than the industry peers had generated with the company's CO_2 emissions and overall following a positive trend. The rear is brought up by Domtar (2005 and 2006), Nippon (2007) and, lagging far behind, Weyerhaeuser (2008 and 2009). While in its best year (2005) the latter ranked second and created nearly € 1.2 billion Sustainable Value$_{CO2}$, in its worst year (2008) Weyerhaeuser destroys a devastating € 1.9 billion of Sustainable Value$_{CO2}$. The results look different when taking company size into account and reveal Sveaskog as best performer in three of the five years assessed (2006, 2007, 2009), creating the highest Sustainable Value$_{CO2}$ in relation to its sales. In 2007 Sveaskog yielded a

SVM of 17.12%, that is, the company created € 17.12 Sustainable Value$_{CO2}$ per € 100 of sales. Striking are also the differences Grupo Ence shows: While being in the midfield in terms of absolute Sustainable Value$_{CO2}$ with rather unremarkable results, the company now ranks first in 2005 and last in 2009. Similar differences can be observed with Domtar and Metsäliitto. When results are adjusted to sales, the SVM$_{CO2}$ curves of both companies show much higher amplitude, i.e. the results display rather extreme positions, putting them closer to the worst performance shown by Weyerhaeuser in 2008.

Due to the limited data availability, the NVA based scenario considered 17 companies only. Since the benchmark composition changed accordingly, a meaningful comparison with the EBIT scenario is limited. Particularly some of the companies showing rather extreme EBIT based results (e.g. Domtar, Kimberly Clark and Weyerhaeuser) could not be included. Nevertheless, the analysis reveals interesting results. Clear frontrunner now is SCA, creating between € 0.98 billion (2005) and € 1.55 billion (2009) more Net Value Added than the benchmark had created with SCA's CO_2 emissions. In the EBIT scenario the company in contrast even destroyed Sustainable Value$_{CO2}$ in the years 2005 and 2007. SCA is closely followed by Smurfit Kappa for the years data were available (2007 to 2009). Despite the fact that the company follows a clear negative trend, in its worst year it still creates considerably more NVA with its CO_2 emissions than the industry peers had generated (2007: SV$_{CO2}$ € 1 billion; 2009: SV$_{CO2}$ € 0.67 billion). Metsäliitto started off as second best performer, but – following a negative trend - ends up in the red in 2008 and 2009. Ahlstrom, Billerud, Corticeira, DS Smith, Grupo Ence, Holmen, PaperlinX, Sodra and UPM form the midfield of the assessment. Lagging behind comparably far, the bottom of the ranking is shared by Mondi, Myllykoski, Norske Skog and Stora. The latter, however, manages to improve significantly over the period reviewed. In 2005, Stora still shows the worst performance among the NVA based Sustainable Value$_{CO2}$ results, generating € 1.25 billion less NVA than if its CO_2 was emitted by the average pulp and paper company assessed in this study. Although still destroying Sustainable Value$_{CO2}$ in 2009 (€ -0.07 billion), the company then managed to climb up to rank 11 of 17. Again, the picture changes when results are corrected for company size. Now Corticeira clearly shows the most value creating use of CO_2 emissions with a SVM$_{CO2}$ between 20.82% (2008) and 23.89% (2005). Second best performer is Sveaskog, only showing a drop in 2008. Myllykoski, in contrast, destroys devastating € 73.5 Sustainable Value$_{CO2}$ per € 100 of sales (SVM$_{CO2}$ -73.5%) and ploughs a lonely furrow now at the bottom of the ranking. That is, Mondi, Norske Skog and Stora could gain some ground compared to Myllykoski, when company size is accounted for. They still, however, destroy Sustainable Value$_{CO2}$ with each sale they make and form the lower quarter of the ranking.

The study reveals another interesting aspect if one compares the results with other initiatives rating the sustainability performance of the pulp and paper sector. In 2009, the Dow Jones Sustainability Index ranked Stora Enso as the best sustainability performer among European forestry and paper companies. The company received a top industry score for climate strategy. Closely behind, UPM was also included in the Dow Jones World Sustainability Index as "sustainability leader". In a similar vein, Norske Skog was named 'best in class' by the Carbon Disclosure Project's (CDP) 2009 Nordic report, which ranked companies based on their climate change strategy and reporting of greenhouse gas

emissions. CDP also named SCA as the best Swedish company for carbon dioxide reporting in 2010. In the same year, all four companies found themselves listed among the 10 best Nordic companies of the Carbon Disclosure Leadership Index (CDLI). The results of the study, however, show that with regard to actual CO_2 emissions, these four sustainability leaders perform very differently in terms of Sustainable Value$_{CO2}$ creation. Whilst SCA indeed turns out to be one of the best performers in the industry, its three peers Norske Skog, Stora Enso and UPM consistently occupy places in the bottom half of the ranking in the EBIT based scenario. At the top of the ranking we now find a Scandinavian company that has not managed to claim any of the prestigious sustainability awards: Sveaskog consistently outperforms its Scandinavian peers in terms of absolute Sustainable Value$_{CO2}$ – and tops the ranking in 2009. Whilst qualitative aspects such as strategy formulation or disclosure undoubtedly have an important role to play in corporate sustainability, the Sustainable Value approach serves to identify those companies that actually manage to make the best use of scarce resources. In a nutshell, what is the value of carbon disclosure that is not reflected in the reduction of carbon emissions?

At this point, it should be highlighted that data availability and data consistency are playing a crucial role with respect to a comprehensive and verifiable comparison of the companies' carbon performance. The analysis performed in this study is based on publicly available data and information provided by the companies themselves. In this regard, the biggest challenge in applying the Sustainable Value approach in this study consisted in the differences in data availability and data quality between the companies assessed. Firstly, although carbon reporting is quite advanced and wide spread, the number of companies to be considered in this assessment was limited due to either non-publicly available data or insufficient quality of the data provided. Secondly, only a small number of the companies assessed published figures that were suitable for a direct comparison with other companies. Most of the corporate data published had to be subsequently corrected. It is common knowledge from financial reporting that adjustments occasionally need to be made to published data in order to ensure comparability. Nevertheless, sustainability reporting has some catching up to do with financial reporting. Although particularly in carbon reporting widely acknowledged standards such as GRI Guidelines do exist, its application in practice still lacks consistency. This refers particularly to a harmonised and transparent presentation of data in order to ensure comparability and comprehensive coverage of the companies' global activities. The minimum objective here should be to consistently report on the different scopes of GHG emissions as well as to guarantee the same scope of coverage for financial and emissions data.

Nevertheless, the Sustainable Value approach proved to be a robust and meaningful analysis tool providing informative and comparative results on the sustainability performance of companies. Here too, the basic principle is: the better the data base, the more meaningful and robust the results of the analysis. As the results of this study have shown, companies vary not just in respect of their carbon performance, but also in terms of scope and quality of their carbon reporting.

This assessment has generated valuable results, particularly as it creates transparency regarding the carbon efficiency of different companies in the pulp & paper sector. In addition, the results can be used as a starting point for environmental management, for example for strategic target setting or sustainable investment analysis. And despite the fact that the differences in the performance of the companies assessed partially stem from differences in the product portfolio and in the fuel mix of the countries they operate in, the effect of an efficient use of carbon emissions can clearly be seen in the results.

The Sustainable Value approach applies the logic of financial management to sustainability management. Financial management theory states that the use of capital must cover its opportunity costs. In many instances the need to maximise shareholder value is a common conclusion. This is justified by the fact that an economic benefit ought to be produced. But companies obviously do not only need economic capital, but environmental and social resources as well. Because these resources are scarce, it makes sense to use them efficiently not just in order to protect the natural environment, but also to optimise the economic benefit.

If we follow the logic of financial management, companies that do not create shareholder value could see their existence threatened. From a market economy viewpoint, this micro-economic threat helps to avoid macroeconomic harm, namely the inefficient use of the valuable resource economic capital. From a sustainability viewpoint, a perspective that only focuses on economic capital has its shortcomings. The inefficient use of environmental and social resources by companies also has the potential to produce macroeconomic damage. For the use of carbon emissions, as focused on in this study, such macroeconomic damages particularly refer to the potential anthropogenic climate change and its resulting costs e.g. for adaptation to a changing natural environment. Additionally, the emissions trading scheme, which is already effective to the European pulp and paper industries, should encourage an efficient use of carbon emissions. Applying market economy thinking, a low Sustainable Value therefore also poses a potential threat to a company's existence. Companies wishing to counter this threat need to create Sustainable Value. In doing so, they encourage an allocation of resources that is not only in their self-interest, but benefits the economy as a whole.

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