CHALMERS

Media Coverage, Market Power and Internalization of External Costs

- A Study of Four Swedish Industries

REBECKA LIGANDER DAMBERG
FRIDA RIMARK
School of Business, Economics & Law, University of Gothenburg

CPM – Center for Environmental Assessment of Product and Material Systems
CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden, 2012

CPM Report No. 2012:4

Acknowledgment

Foremost, we would like to express our sincere gratitude to our supervisor Oleg Shchetinin for his guidance, support and useful comments throughout the whole process of the thesis.

Also, we would like to thank Bengt Steen and Sara Palander at CPM for their valuable advice and patience.

Göteborg, May 2012

Frida Rimark & Rebecka Ligander Damberg

Abstract

A negative externality arises when an actor has a negative impact on another actor, and when this cost is not regulated inside the price system of the economy. A negative externality discussed in the literature is emissions from industry production affecting the environment and human health. One way to make polluters pay and achieve market efficiency is to induce a tax that is equal to the damage they inflict on society. This is referred to as internalizing external costs. In order to calculate how much of the external costs that are covered by emission tax a measure called 'degree of internalization' can be used. The aim of this thesis is to analyze the impact of media coverage on the degree of internalization, through government and stakeholder pressure, in four Swedish industries. The focus will be on emissions of carbon dioxide. Starting out with a time series analysis we find that it takes at least two years for media coverage to impact the degree of internalization. By conducting panel data analysis we conclude that media coverage primarily affects the degree of internalization by reducing industry emissions. We also find that market concentration is positively related to industry emissions, which indicates that more competitive industries have greater incentives to reduce emissions.

Table of Contents

1. Introduction

An external cost, or negative externality, arises when the actions of one agent has a negative impact on another agent, and when this cost is not regulated inside the price system of the economy. An example of this is a power station generating emissions as a by-product and causing damage to building materials, environment and human health, thus imposing an external cost. Even though external costs are real costs to the affected members of society or to the environment, they are not incorporated by the owner of the power station in his or her decision-making. This type of external costs is often unintended and results from the absence of property rights or markets for these environmental effects (Hindriks & Myles, 2006; Roos, 2010).

There is a growing consensus among economists as well as politicians and business leaders concerning the importance of putting a monetary value on external cost in order to reduce emissions (Forge & Williams, 2008). In order to put a price on emissions, several valuation methods exist today. The EPS method is one of the more general valuation methods used since it does not depend on location. EPS stands for Environmental Priority Strategies in product design and is based on five safeguard areas such as, human health, biodiversity, ecosystem production capacity, abiotic stock resources and recreational values. In order to put a monetary value on environmental damage and a value on a change in the safeguard subjects, the EPS method use market values or the willingness-to-pay principle in cases where this is not possible (Steen, 2011). Valuation methods make it possible for industries to include environmental costs in their decision-making.

According to the Polluter Pays Principle (PPP), a principle which was adopted by the United Nations in the Rio Declaration in 1992, polluters responsible for damaging the environment should in turn be forced to bear the costs and pay for these damages (Cordato, 2001). One way to make the polluters pay for the damage they inflict and achieve market efficiency is to induce a tax that is equal to the external cost that the emissions evoke on the environment. This process, often referred to as Pigouvian taxation, has been proposed as a simple solution to the problem of negative externalities. If the firm or consumer that imposes the negative externality pays a tax equal to the marginal damage, this makes them take account for the damage they cause. They will then include this tax in their decision of how much to produce or consume, which provides a solution to the problem. This way of taxing activities that have

a negative impact on another actor is usually referred to as internalizing externalities (Hindriks & Myles, 2006).

In reality, the amount of emission taxes paid by firms is far from equal to the total damage costs due to selective tax legislation. At present, Swedish industries pays 21 percent of the total marginal carbon dioxide tax induced by the government. This means that Swedish industries pay approximately 0.21 SEK instead of 1.01 SEK per kilo of carbon dioxide emissions (Swedish Tax Agency, 2010). In order to calculate how much of the external costs that are covered by emission taxes a measure called 'degree of internalization' can be used. The degree of internalization is defined as the ratio between the total amount of emission taxes paid and the total environmental damage cost inflicted on society. In other words, the degree of internalization measures how much of the damage that firms inflict on society by polluting is reimbursed by emission taxes. Ideally the degree of internalization should be equal to 1, which would result in the first-best solution where all external costs are compensated for. The term is more commonly used in reports and policy oriented work done by Swedish authorities in order to measure social efficiency (Swedish Road Administration, 2010; Swedish Transport Administration, 2011).

Firm incentives to engage in environmental protection are broadly discussed in the academic literature. An increasing number of firms tend to adopt environment-friendly behavior in order to attain a pro-environment image, which is the result of environmental regulations and pressure by consumers and investors (Conte Grand & D'Elia, 2005). Konar and Cohen (1997) conclude that shareholders and financial markets provide strong incentives for firms to engage in environmental performance. They show that after experiencing a stock price decline resulting from a public release of information about pollution, firms reduce their emissions more than their competitors. Lefebvre, Lefebvre and Talbot (2003) states that industry environmental performance is positively related to firm innovativeness and may give competitive advantages in some industry markets.

Many authors also emphasize that media attention can exert influence on firm behavior (see Dyck & Zyngales, 2002; Knyazeva, 2007). This raises the question what mechanism force firms to pay attention to the medial debate since the media do not vote in elections and do not set managers' salaries. From the theory perspective, there are at least three ways in which media attention can influence firm behavior, which mainly works though its impact on reputation. First, media attention may lead to an increased pressure on politicians to impose

regulations since they fear that inaction could hurt their future political careers. Second, media coverage could affect the behavior of firm managers by having an impact on reputation in the eyes of their stakeholders, such as shareholders and future employers. Third, media coverage not only impacts the reputation in the eyes of their stakeholders, but also affect firm behavior by having an impact on reputation in the eyes of society at large (Dyck & Zyngales, 2002).

With this in mind, the aim of the thesis is to assess the degree of internalization in four Swedish industries and to examine how it is affected by media coverage of carbon dioxide emissions. This analysis will be conducted using a time series model for each industry. Further, as the degree of internalization is determined by both the total amount of emission taxes paid and the level of emissions, we want to investigate which part of the fraction that is affected by media coverage. The aim is also to investigate whether market concentration impacts the level of emissions and whether industries on less concentrated markets are more sensitive to media coverage. This analysis will be conducted using dynamic panel data model. The industries included in our study are the paper and pulp industry, the chemical industry, the machine industry and the automotive industry. We focus on carbon dioxide emissions as there has been a lot of media attention on this matter during the last 20 years.

The thesis is organized as follows: Section 2 presents the theoretical analysis, where we describe the underlying theory that our model rests upon. In section 3, we present our empirical analysis, and present and discuss our results. In section 4 we present our concluding remarks.

2. Theoretical Analysis

In this section we discuss motives for firms to engage in environmental protection as well as theoretical work which support the claim that media coverage impacts government and stakeholder pressure. Further, based on the theoretical framework of Konar and Cohen (2000), we develop a model of firm behavior. In this model we emphasize how government and stakeholder pressure affects firms' incentives to reduce emissions. Based on the theoretical analysis we state our hypotheses.

Motives for Firm Engagement in Environmental Protection

Nowadays, more and more firms tend to adopt environment-friendly behavior in order to attain a pro-environment image, which originate in environmental regulations and requirements from consumers and investors. This behavior of maintaining a pro-environment image is present even in countries where environmental regulation is absent (Conte Grand & D'Elia, 2005).

Maintaining an environmentally friendly image is important as environmental trends influence customers in what products to buy and which products not to buy. A polluting firm has much to lose by ignoring an unfavorable image as customers could punish the firm by stop buying its products. A more environmental friendly production can thus lead to competitive advantages as consumers may have preferences for sustainable consumption and green products (Conte Grand & D'Elia, 2005; Lefebvre, Lefebvre &Talbot, 2003). Most likely due to this, firms that have the most intense contact with its customers more frequently attend programs of environmental protection. It also follows that environmental programs is likely to attract the largest firms and the heaviest emitters (Arora & Carson, 2001).

A polluting firm will not only attract fewer customers but will also result in a lower interest for the firm among investors. This is because potential investors would take future losses from expected penalties, cleaning costs and adverse consumer behavior into account when making their investment decision. This would increase the incentives for a polluting firm to improve its behavior and reduce its emission levels (Conte Grand & D'Elia, 2005). Shareholders also provide strong incentives for a firm to reduce its emissions. If a firm realizes that negative publicity about emissions affect their shares negatively, they tend to reduce their emission levels to a larger extent than their competitors (Konar & Cohen, 1997).

Another motive for firms to engage in environmental protection is due to pressure from actors inside the supply chain. Supply purchasers that have already engaged in formal activities for environmental protection tend take a step further and secure environmentally cautious behavior among their suppliers. This is done in order to maintain their image of sustainable consumption. There are also motives that are not necessarily connected to a firm's customers. In some communities where firms are connected to a local area, these firms might avoid environmentally unfriendly activities due to the risk of displeasure of the residents in that area (Zhang et al., 2008). Hence, it can be concluded that public recognition is an important factor when firms choose to participate in environmental activities (Arora & Carson, 2001).

Media Coverage and Firm Behavior

The Role of the Media

Media coverage is often considered to be agenda-setting. The power of media can be substantial and is one of the determinants of the public agenda as it focuses public attention on a few key issues. By concentrating the public attention on a few key issues, media coverage can create consciousness among the general public around which the public opinion forms (McCombs, 2003; O'Heffernan, 1991). An increase in media coverage of global warming can consequently increase public awareness of climate change and lead to an increase in the public concern for the issue (Sampei & Aoyagi-Usui, 2009).

Due to this, media coverage has an impact on firm behavior. By playing a key role in determining the reputation of both politicians and firm managers, two channels through which media coverage can influence firm behavior are government and stakeholder pressure.

Government Pressure

One way for media coverage to impact firm behavior is to influence political forces that drive firm regulations. This is based on the politicians' belief that their ignorance would result in a lost future career as political inaction gets public. Politicians care about public opinions since their career paths are directly affected by it and therefore strive to act in the interest of the media (Dyck & Zyngales, 2002). In addition to this, there are certain circumstances under which policy makers are more sensitive to media attention. According to the policy-media interaction model devised by Robinson (2000), media coverage primarily influence policy makers when there exist uncertainty about policy, combined with a large proportion of critical media coverage. In order for media coverage to exert pressure on government

regulations, the media coverage has to be "extensively critically framed". This requires that the news is a headline material and politicians are highly criticized in newspapers and television for their inaction. If there exist an uncertainty in how to handle the situation and no clear policy is undertaken, politicians or policy makers tend to respond to the claims of the media.

Another perspective could be that policy makers, who constantly are under pressure from various forces, should be critical about opinions of others. As policy makers are unable to take in consideration all opinions of different interest group in the society, they are likely to be restrictive in adapting their views of a certain issue. Media coverage is hence likely to concentrate its attention to a problem in society, but is unlikely to affect the core values of the policy maker (Yanovitsky, 2002). However, assuming that policy makers are influenced by the attention of issues in the media, this will drive policy incentives.

Stakeholder Pressure

Through the channel of stakeholder pressure, media coverage has the ability to influence the firm's managers. Assuming that there exist both responsible and irresponsible managers, where the responsible managers want to reduce emissions while the irresponsible ones are not willing to do so. If the cost of being perceived as an irresponsible manager is sufficiently high, then it would be favorable for these managers to reduce emissions. The reason is that the cost of reducing emission would be offset by the cost of bad reputation (Dyck & Zyngales, 2002).

The cost of being unwilling to reduce pollution can be incorporated in the classical model of career concerns (see Harris & Holmstöm, 1982). It can be thought of the disutility of bad reputation in a future political career or just simply the disutility of being singled out as a bad person. If it is assumed that it is not certain whether information about a manager will get publicly revealed but that it will happen with a certain probability, then the frequency of which a manager is covered in the media determines this probability. The more frequently a manager is covered in the media the more likely it is that the public gets informed about the manager being incautious of the environment. If more intense media attention leads to a higher probability of detection of an irresponsible manager, then managers covered in media should act in a more environmentally conscious way (Dyck & Zyngales, 2002).

Firms that are more frequently covered in media also tend to participate more in CSR activities. Mcwillian and Siegel (2001) defines firm CSR as corporate "actions that appear to further some social good, beyond the interest of the firm and that which is required by law" (2001, p. 117). A firm is practicing CSR as it is going beyond the legal requirements and has a forward looking rather than a short term approach into adjusting its business in a socially sustainable way. They do this in order to create a positive view for their stakeholders. These firms are more eager to participate in environmental protection in order to respond to a demand of a sustainable business (Zyglodopoulus et al., 2011).

There is reason to believe that media coverage is associated with an environmentally cautious behavior of the firm as it is closely related to both the firm image and financial performance. As stated by Konar and Cohen (2000, p. 11): "To the extent that environmental reputation matters and stakeholder pressures are important, firms with the "most to lose" from a negative environmental reputation have a greater incentive to improve their environmental performance compared to others - regardless of any legal mandate to do so". As firms realize the cost of a bad reputation, it does not matter whether there are law enforcements that require abatement. There will still be incentives for the firm to engage in environmental protection in order to keep its good name in the eyes of their stakeholders.

A Model of Firm Behavior

Based on the theoretical framework of Konar & Cohen (2000), we develop a model of firm behavior in order to motivate our empirical analysis. With this model of firm behavior we want to emphasize that decisions concerning emissions depend on externally imposed incentives and that these are part of the firm profit maximization problem. In contrast to Konar and Cohen (2000), we assume that both government and stakeholder pressure, due to pressure from the media and competition, affect firm incentives for reducing pollution.

At a competitive stage, the optimal production will occur at a price p equal to the marginal cost. However, if the firm's emissions will bring about an external cost for the firm due to adverse consumer behavior or government regulations, this yields the following profit function:

$$( ) \qquad (\quad) \quad [(\quad) \quad ( ) \;] \quad [\quad ( ) \;]$$

where:

( ) is the degree of pollution abatement.

( ) is the amount of pollutant generated and is a function of output *y*.

[( ) ( )] is externally imposed incentives to reduce emissions brought about by government and stakeholder pressure. It depends on the emission level ( ) ( ) and firm specific characteristics , which affects firm's incentives to reduce emissions.

is a vector in which represents pressure from the media and represents pressure due to competition. We assume .

[( )] is cost of pollution abatement. It depends on the abatement level ( ) and firm specific characteristics , which affect the firm's ability to reduce its emissions.

is firm technology that facilitates pollution abatement. We assume .

We assume that *D* and *A* are convex functions. The derivative of *D* with respect to its first argument increase in emission levels. The derivative of *A* with respect to its first argument increase in abatement. The external cost is higher the more the firm pollutes and the abatement cost is higher the more it abates.

[( ) ( )]

[( )]

The second order conditions are assumed to increase in emission levels and abatement cost with an increasing rate. As for *D*, a firm is expected to receive more publicity and pressure to reduce its emissions the more the firm pollutes.

[( ) ( )]

[( )]

The firm chooses output *y* and as well as abatement *a* in order to maximize profits.

— [( ) ( )] (( )) [( )] (( ))

— [( ) ( )] (( ) ( )) [( )] (( ))

If abatement increases, the external incentives to reduce emissions decrease whereas the cost of abatement in turn increases with the level of abatement.

[( ) ( )] (( ))

[( )] (( ))

An increase in output both leads to an increase in external incentives to reduce emissions and an increase in abatement due to an increase in emissions generated.

[( ) ( )] (( ) ( ))

[( )] (( ))

In order to solve the first order condition for the profit maximizing level of abatement a^*, in which case the marginal costs of emissions and abatement are equal, we assume the following functional forms:

(( ) ( ))

(( ))

We assume which yield the following profit maximizing level of abatement:

An increase in pressure by the media and competition leads to an increase in abatement and hence a decrease in emissions.

( )

( )

Since we assume that pressure from the media and competition are relatively small, we assume that . Abatement a has a positive mixed partial derivative, so that an increase in pressure due to competition raises the pressure from the media.

( )

The firm's decision regarding emissions consequently depend of the cost functions ( ) and ( ). If the firm face large penalties such as high emission tax or bad reputation, it is likely that they will increase abatement and in turn reduce emissions since it now has an incentive to do so. Furthermore, if pollution abatement is expensive, the firm is less likely to reduce emissions. Hence, changes in emissions depend on factors that involve the firm's incentive and ability to reduce emissions.

Hypotheses

Based on our theoretical analysis we state the following hypotheses:

Hypothesis 1: Media coverage of emissions positively affects the degree of internalization, but the effect has a time lag.

We do not expect the effect of media coverage to be instantaneous. As it might take some time for firms to react on government regulations as well as demand from consumers and other stakeholders we believe that it will take a few years for media coverage to affect the level of emissions and in turn the degree of internalization. The positive relationship is mainly brought about by an increase in abatement and in turn a reduction in industry emissions.

Hypothesis 2: More competitive industries have greater incentives to increase abatement and hence emit less than industries in more concentrated markets.

Hypothesis 3: More competitive industries are more sensitive to media pressure than more concentrated industries and therefore decrease their emissions to a larger extent.

In addition to a negative relationship between media coverage and emissions, we believe that incentives for reducing emissions are larger in less concentrated markets. As it is of greater importance for a firm to put in effort to protect their reputation and image in order to survive

in a market characterized by competition, industries in competitive markets should decrease emissions to a larger extent than industries in concentrated markets. We also believe that firms in more competitive markets are more sensitive to media attention.

3. Empirical Analysis

In this section, we describe our data and method. We will further specify our empirical models and present and discuss our results.

Data and Method

In order to empirically investigate whether media coverage has an impact on the degree of internalization in Swedish industries, time series analysis and panel data analysis are conducted. We start by conducting a time series analysis for each industry and then proceed to panel data analysis. The analysis is based on industry level micro-data from 1993 to 2008, collected from Statistics Sweden, OECD, Swedish Tax Agency and Swedish Energy Agency. In order to define media coverage, we use the database Retriever, which is a database that offers media monitoring from all media channels. We limit our analysis to four Swedish industries; paper and pulp industry (SNI[1] 21), chemical industry (SNI 24), machine industry (SNI 29) and automotive industry (SNI 34). The reason for choosing these industries is that we want to examine the time of reaction in industries on different markets with different characteristics as well as different technology which affects their ability of reducing emissions. An additional reason is that the paper and pulp industry and the chemical industries are high emitters compared to the machine industry and the automotive industry.

Variables

Degree of Internalization

The degree of internalization is, as earlier mentioned, a term mainly used in policy oriented work by Swedish authorities in order to measure social efficiency. Social efficiency measures the long term sustainability of society and to what degree a loss in welfare for one actor is compensated for by an increased welfare for another actor. In order to achieve social efficiency, the degree of internalization should be equal to 1 (Swedish Road Administration, 2009: Field & Field, 2009).

The degree of internalization is defined as the ratio between the total amount of emission taxes paid and external cost in current prices. This ratio illustrates to what extent the emission taxes paid covers the environmental damage cost inflicted on society.

[1] SNI groups are a universally used classification of industries.

External costs are in turn defined as the total amount of carbon dioxide emissions times the monetary value per kilo of carbon dioxide emissions obtained by the EPS method. According to EPS, the monetary value per kilo of carbon dioxide emissions is € 0.108 (Steen, 1999). This value is in the price level of year 2000 and is hence recalculated in current prices. Data concerning emissions and the total amount of emission taxes paid comes from Statistics Sweden.

Figure 1 illustrates an increase in the degree of internalization for all industries around the years 2003-2004. This increase is particularly substantial for the machine industry and the automotive industry. The increase is caused by an increase in tax payment. The paper and pulp industry and the chemical industry show a slightly positive trend, but at significantly lower levels compared to the other industries as these are heavier emitters. All industries show an increase in the degree of internalization in 1997, in the year where a higher tax percentage for the industry was introduced. Instead of paying 25 percent of the total marginal emission tax equal to 370 SEK per ton, the tax percentage increased to 50 percent. This resulted in a change in the industry tax rate from 93 SEK per ton in 1996 to 185 SEK per ton in 1997 (Swedish Energy Agency & Swedish EPA, 2004).

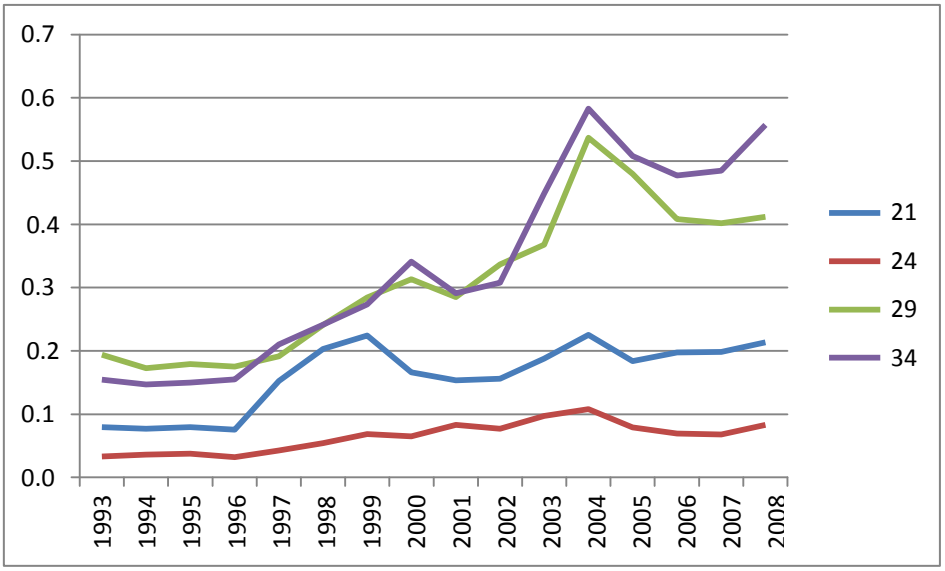

Figure 1: Degree of internalization between the years 1993-2008

Emissions

This variable is defined as the amount of carbon dioxide emissions to air in tons by the Swedish industries. Data on emissions of carbon dioxide emissions is the same as used in the degree of internalization measure, taken from Statistics Sweden. Based on figure 2, it is clear that machine industry and automotive industry are low emitters of carbon dioxide compared to the paper and pulp industry and the chemical industry. The paper and pulp industry increased its emissions during 1993 to 1996. The same increasing pattern but to a lower pace can be observed for the chemical industry. The large cut in emissions by the paper and pulp industry, beginning in 1996, could possibly be explained by the increase in the tax percentage of total carbon dioxide tax from 25 percent to 50 percent.

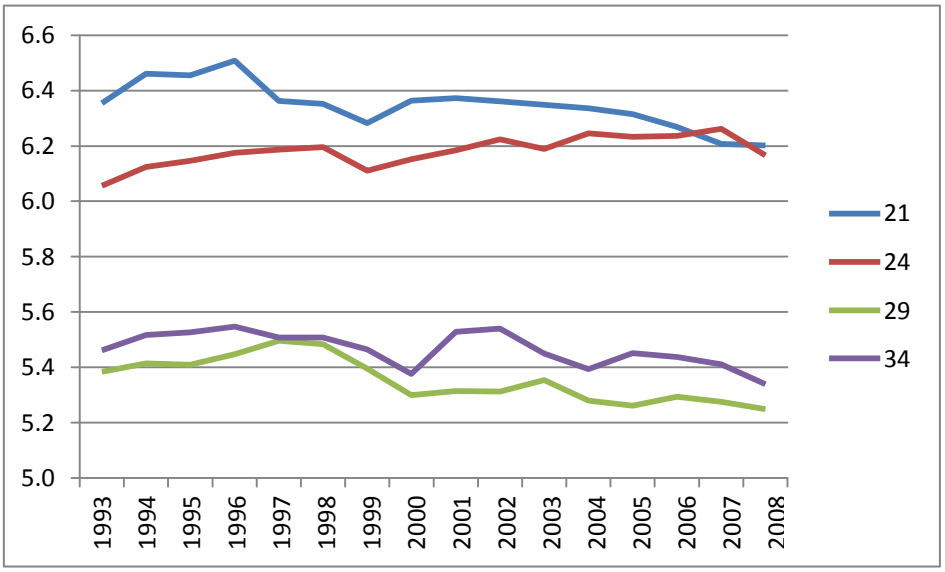

Figure 2: Emissions in tons between the years 1993-2008 in logarithmic scale

Tax Payment

Tax payment is defined as the amount of total carbon dioxide tax paid by the Swedish industries in Million SEK, adjusted to the price level of year 1990. As with the data on emissions, the data on tax payment is the same as used in the degree of internalization measure, taken from Statistics Sweden. As pointed out in figure 3, the tax payment of the paper and pulp industry increased markedly between 1996 and 1997. The chemical industry, machine industry and automotive industry also experienced an increase in tax payment but to a smaller extent. This increase was the result of an increase in marginal emission tax.

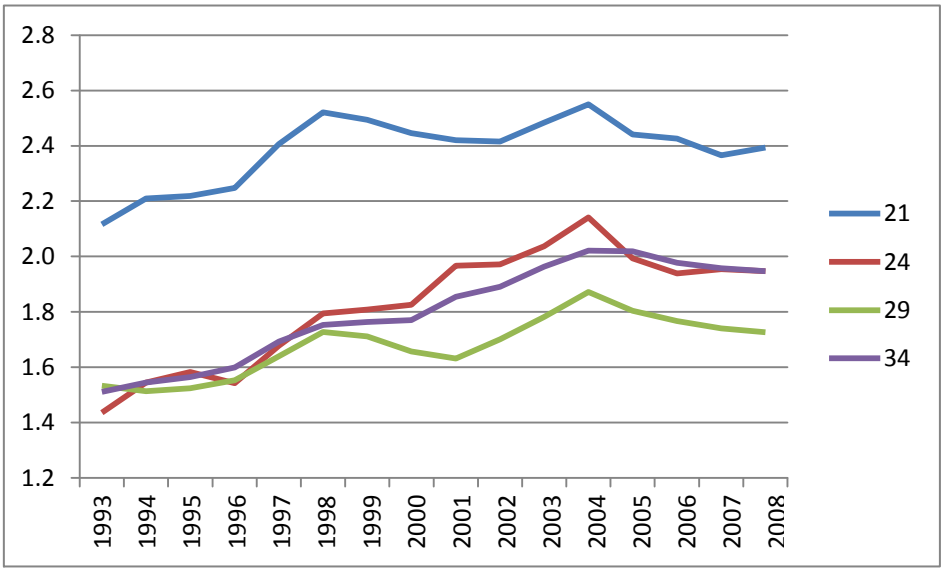

Figure 3: Tax payment in MSEK between the years 1993-2008 in logarithmic scale

Tax-Rate

Tax-rate is defined as the marginal carbon dioxide tax in SEK per kilo, adjusted to the price level of year 1990. The data is taken from the Swedish Tax Agency and Swedish Energy Agency (Swedish Energy Agency & Swedish EPA, 2004; Swedish Tax Agency, 2005, 2006, 2007, 2008). Figure 4 illustrates the development between 1993 and 2008, which shows a large increase in the tax-rate between 1996 and 1997 caused by the higher tax percentage imposed on Swedish industries, as mentioned above. At present, the Swedish industry pays 21 percent of the total marginal carbon dioxide tax. This tax subsidy is meant to facilitate survival for Swedish industries in competitive markets and prevent them from moving their production outside of Sweden (Byman et al., 2007).

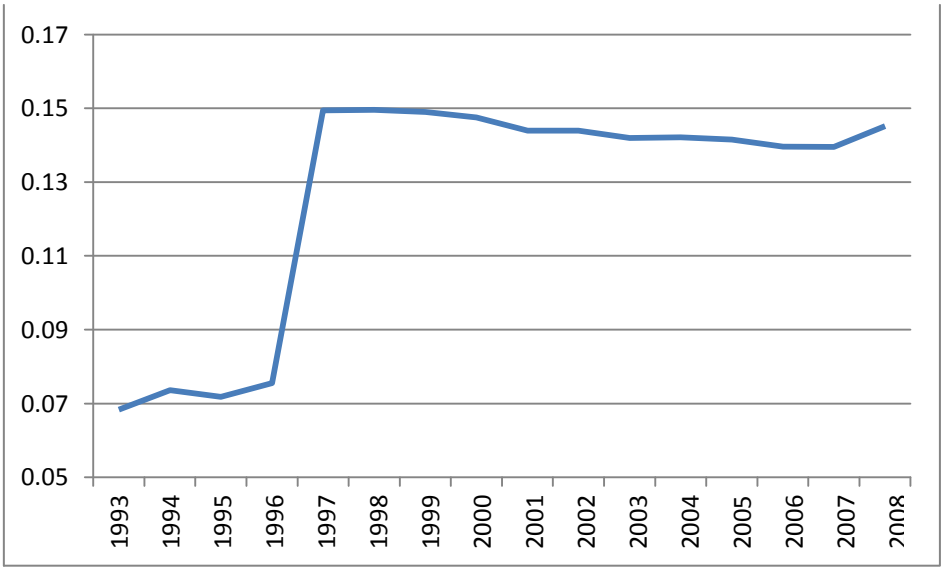

Figure 4: Tax-rate in SEK per kilo between the years 1993-2008

Value-Added

Value-added in the industry is defined as the value of the total production minus the cost of components, material and services bought from other firms in Million SEK, adjusted to the price level of year 1990. The data is taken from Statistics Sweden. As can be seen in figure 5, there is a positive trend during the 1990s for all industries. However, during the last decennium the figure shows a downward sloping pattern for all industries with the exception of the machine industry.

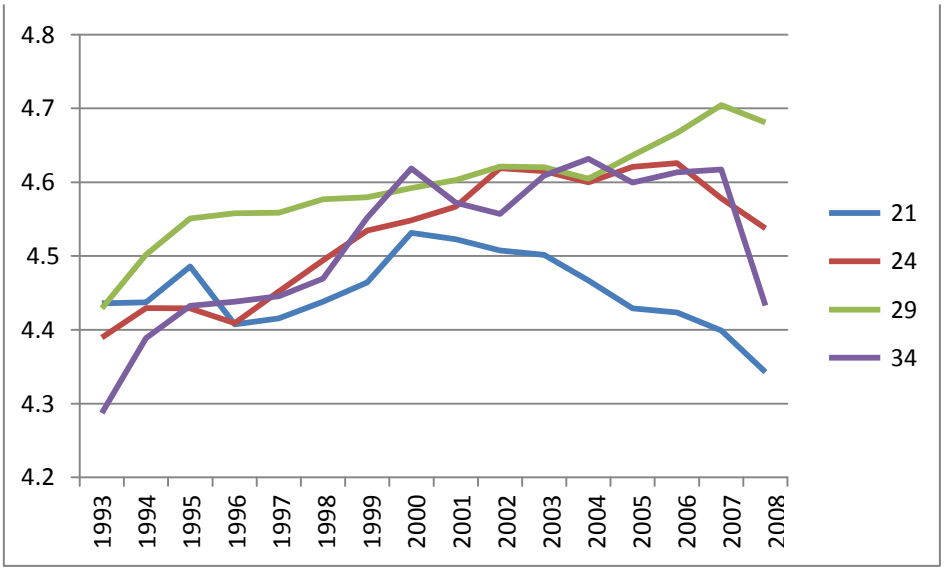

Figure 5: Value added in MSEK between the years 1993-2008 in logarithmic scale

Market Concentration

Market concentration is a measure of the degree of competition in a market. The variable is quantified by using a Herfindahl index for the years 2000-2008, taken from the OECD database. The Herfindahl index is defined as the sum of the squared market shares of the 50 largest firms within the industry. Figure 6 shows the development of the Herfindahl index for the sample period. The automotive industry is the most concentrated for nearly half of the time period. The paper and pulp industry is however shown to be the most concentrated in later years as the automotive industry is decreasing to about the same level as the chemical industry. The machine industry is the least concentrated for the whole period and shows a downwards sloping pattern.

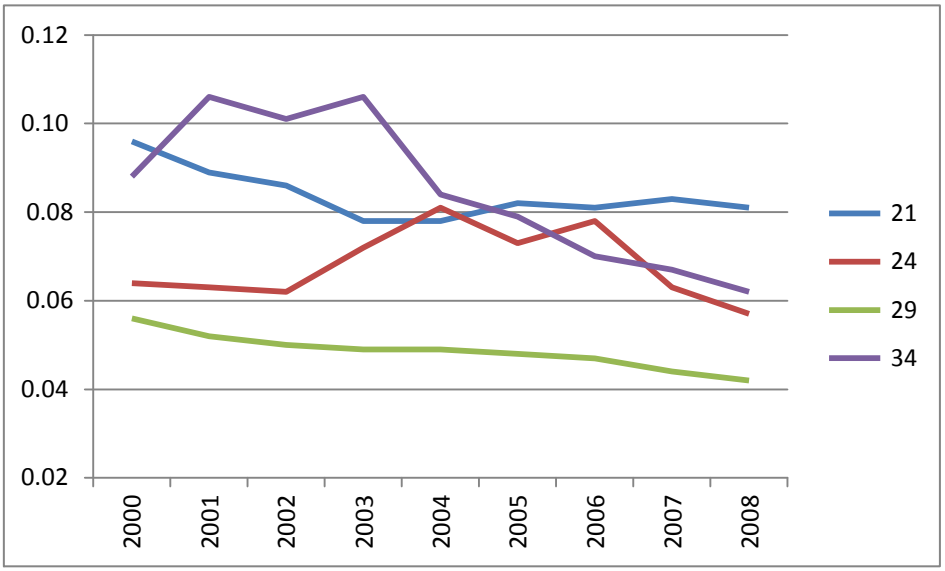

Figure 6: Market concentration between the years 2000-2008

Media Coverage

Media coverage is defined as the number of search results for emissions and carbon dioxide in the database Retriever. The search words used were "utsläpp AND koldioxid". The database covers all Swedish press, including TV, radio, newspapers, as well as Swedish web and blogs. When measuring media coverage we only consider the overall intensity of media and do not distinguish between positive and negative media coverage regarding emissions. This definition of media coverage is based on a definition used by Brown and Minty (2008) and Knyazeva (2007). Mazur and Lee (1993) emphasize that public concern about environmental hazards is mainly affected by the quantity of media coverage rather than by its substantive content.

Figure 7 illustrates the development of media coverage of carbon dioxide emissions during the years 1993 and 2008. The figure illustrates a positive trend in media coverage with a rapid increase during the last couple of years. There was for instance a substantial increase in 2007, which was a year when climate change was discussed frequently. This was likely the result of record of summer temperatures in Sweden and Al Gore winning the Nobel Peace Prize for his work on global warming, such as the documentary film "An Inconvenient Truth" which gained lots of publicity over the world.

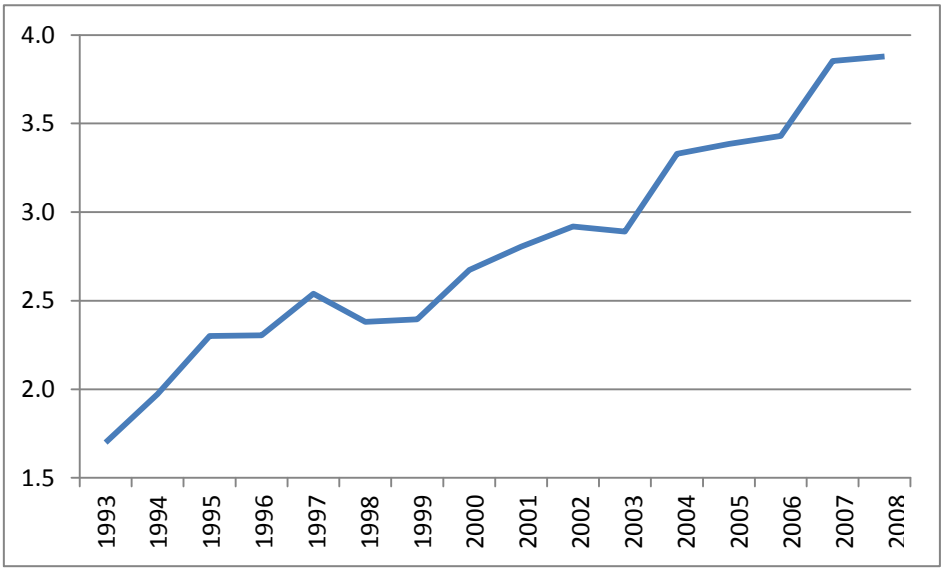

Figure 7: Media coverage between the years 1993-2008 in logarithmic scale

All variables included in our analyses and their notations are summarized in table 1.

Table 1: Variable Notations

Variable	Notation
Degree of internalization	INT
Emissions	EM
Tax payment	TAX
Tax-rate	T_RATE
Value-added	VA
Market concentration	HF
Media coverage	MCOV

Regression Models

Time Series Model

In this regression model, we investigate how the relationship between degree of internalization (*INT*) and media coverage (*MCOV*) has evolved over time for each industry. The model contains a time lag in the dependent variable since it is likely that the degree of internalization in time *t*-1 impact the degree of internalization in time *t*. Further, as it is likely that it takes time for media coverage to impact the degree of internalization, the model also contains time lags of the independent variable. Due to the limited amount of data, we limit our analysis to two time lags. The inclusion of time lags reduces our sample from 16 to 14 observations per industry.

Our time series analyses are based on the following model:

Panel Data Models

In order to analyze what part of the fraction that media coverage influences, we conduct panel data analysis using a fixed effects model. By using a fixed effects model, we assume that the intercept parameters vary across industries whereas the slope parameters are constant across all industries and time periods. In the first model, the dependent variable is emissions (*EM*) and the independent variable of central interest is the second time lag of media coverage ($MCOV_{t-2}$) and market concentration (*HF*). We also add an integrated variable of the second time lag of media coverage and Herfindahl index ($MCOV_{t-2}$*HF). Due to high correlation, market concentration and the interaction term will not be included in the same regression. A set of control variables which also is believed to impact emissions is included in order to account for variation in the dependent variable. The control variables included are value-added (*VA*) and tax-rate (*T_RATE*). A lag of the dependent variable is also included in the model, since it is likely that industry emissions in time *t*-1 impact industry emissions in time *t*. This panel data analysis is based on 36 observations due to the inclusion of the Herfindahl index, which is only available between the years 2000-2008.

In the second model, the dependent variable is tax payment (*TAX*) and the independent variable of central interest is the second time lag of media coverage ($MCOV_{t-2}$). The control variables included are emissions (*EM*), value-added (*VA*) and tax-rate (*T_RATE*). A lag of the dependent variable is also included in the model, since it is likely that the total amount of

emission taxes paid in time *t*-1 impact the total amount of emission taxes paid in time *t*. This panel data analysis is based on 56 observations.

Our panel data analysis is based on the following models:

$$\Sigma$$

$$\Sigma$$

$$\Sigma$$

where is the set of control variables included in our analysis and are the individual intercepts for each industry. These are assumed to capture all time invariant differences among industries that cannot be observed. Significance is obtained using robust standard errors. We assume that is ( ) and that , . We further assume that and are independent and that the individual intercepts for the same industry is uncorrelated .

Results

The results from the time series analysis presented in table 2 and the results from the panel data analysis are presented in table 3 and 4. Since our analysis is based on a small sample, we will consider a parameter as significant if its p-value is less than 20 percent. Obtaining significance by using cluster-robust standard errors is inappropriate since we use dynamic panel data model, in which a lag of the dependent variable is included. However, as a robustness check, the panel data models are estimated using cluster-robust standard errors. These results are presented in table 11 and 12 in appendix.

Time Series

The results from the time series analysis, presented in table 2, indicate that the second lag of media coverage is the most important since it is significant in all four industries in our sample. The second lag of media coverage is significant at a 1 percent level for the paper and pulp industry, at a 5 percent level for the automotive industry, at a 10 percent level for the

machine industry, and at a 20 percent level for the chemical industry. The current media coverage as well as the first lag of media coverage is constantly insignificant. These results are presented in table 7-10 in appendix. The results consequently imply that it takes at least two years for media coverage to impact the degree of internalization in these industries. This result is reasonable since it likely takes time for media attention to impact political forces and stakeholders to exert pressure and affect firm behavior.

Table 2: Results from the Time Series Analyses using Robust Standard Errors
Dependent Variable: Degree of Internalization in Logarithmic Scale

	(1)	(2)	(3)	(4)
VARIABLES	**log_INT_21**	**log_INT_24**	**log_INT_29**	**log_INT_34**
log_MCOV	-0.170	-0.0842	0.0282	0.00877
	(0.128)	(0.0999)	(0.126)	(0.117)
L.log_MCOV	-0.121	-0.0663	-0.151	-0.133
	(0.157)	(0.146)	(0.152)	(0.122)
L2.log_MCOV	0.410*****	0.190*	0.159***	0.226****
	(0.124)	(0.137)	(0.0731)	(0.0940)
L.log_INT_21	0.400**			
	(0.219)			
L.log_INT_24		0.731*****		
		(0.169)		
L.log_INT_29			0.787*****	
			(0.167)	
L.log_INT_34				0.685*****
				(0.158)
Constant	-0.705****	-0.368	-0.166	-0.376
	(0.277)	(0.340)	(0.199)	(0.276)
Observations	14	14	14	14
R-squared	0.818	0.795	0.889	0.926

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2

Panel Data

The result from the time series analysis motivates the inclusion of the second lag of media coverage in the panel data analysis. In the panel data analysis with emissions as dependent variable, which is presented in regressions (5) and (6) in table 3, we find a significant negative effect of the second lag of media coverage on emissions at a 1 percent level. Regression (5) indicates that a doubling of media coverage leads to a decrease of emissions

by approximately 5.6 percent, which is in agreement with our first hypothesis. Our results further indicate that there is a significant positive relationship between market concentration and emissions at a 15 percent level, which supports our second hypothesis. A decrease in market concentration by 0.01 units is associated with a decrease in emissions by 1.42 percent. In addition to this, regression (6) indicates a positive effect of the interaction of media coverage and market concentration on emissions which is in line with the predictions of the third hypothesis. However, since the parameter for the interaction term has a p-value equal to 0.276, this effect is considered insignificant.

Concerning the control variables, the first lag of emissions is positive and significant in both regression (5) and regression (6). Value-added has positive effect on emissions whereas tax-rate has a negative effect in both regression models. Tax-rate is significant in both regression models, whereas value added is only significant in regression (6).

Table 3: Results from the Panel Data Analysis using Robust Standard Errors
Dependent Variable: Emissions in Logarithmic Scale

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
VARIABLES	**log_EM**	**log_EM**	**log_EM**	**log_EM**	**log_EM**	**log_EM**
L.log_EM	0.590*****	0.597*****	0.268**	0.268**	0.253**	0.262**
	(0.124)	(0.127)	(0.158)	(0.169)	(0.152)	(0.164)
L2.log_MCOV	-0.0551*****	-0.0446****	-0.0264	-0.0621****	-0.0555*****	-0.0835*****
	(0.0145)	(0.0184)	(0.0204)	(0.0237)	(0.0148)	(0.0230)
log_VA	0.175***	0.207****	0.291****	0.325*****	0.192	0.227**
	(0.0964)	(0.0986)	(0.113)	(0.105)	(0.147)	(0.143)
log_T_RATE		-0.0954			-2.051***	-1.965**
		(0.0758)			(1.175)	(1.198)
HF			1.626**		1.423**	
			(0.985)		(0.943)	
L2.log_MCOV*HF				0.480*		0.355
				(0.333)		(0.319)
Constant	1.737****	1.442****	2.887*****	2.849*****	1.788***	1.762***
	(0.664)	(0.705)	(0.975)	(1.021)	(0.914)	(0.954)
Observations	56	56	36	36	36	36
R-squared	0.606	0.618	0.495	0.477	0.543	0.519
Number of industries	4	4	4	4	4	4

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.20

In the panel data analysis with tax payment as dependent variable, which is presented in regression (5) in table 4, we find an insignificant effect of media coverage on the tax payment. This result further supports our first hypothesis. Regarding the control variables, our results indicate that the first lag of tax payment as well as the effect of tax-rate is positive and significant at a 1 percent level. The effect of emissions is positive and significant at the 5 percent level. Value-added also has a positive effect but this effect is insignificant.

Table 4: Results from the Panel Data Analysis using Robust Standard Errors
Dependent Variable: Tax Payment in Logarithmic Scale

	(1)	(2)	(3)	(4)	(5)
VARIABLES	**log_TAX**	**log_TAX**	**log_TAX**	**log_TAX**	**log_TAX**
L.log_TAX	0.786*****	0.767*****	0.718*****	0.698*****	0.652*****
	(0.0989)	(0.0970)	(0.0879)	(0.126)	(0.115)
L2.log_MCOV	0.00860	0.0269	-0.0168	0.0156	0.00714
	(0.0213)	(0.0228)	(0.0202)	(0.0235)	(0.0226)
log_EM		0.188**			0.216****
		(0.113)			(0.103)
log_T_RATE			0.322*****		0.329*****
			(0.0702)		(0.0629)
log_VA				0.218*	0.108
				(0.165)	(0.147)
Constant	0.414*****	-0.694	0.896*****	-0.425	-0.784
	(0.149)	(0.720)	(0.168)	(0.633)	(0.767)
Observations	56	56	56	56	56
R-squared	0.813	0.820	0.853	0.819	0.865
Number of industries	4	4	4	4	4

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.20

The fact that the control variables have reasonable results and that the lag of the dependent variables are significant, are arguments that supports our chosen dynamic panel data models.

Discussion

Our empirical analysis provides support for two of our stated hypotheses. First, as hypothesized, our time series analysis indicates that it takes at least two years for media coverage to influence the degree of internalization in all four industries. The result that the second lag of media coverage is of great importance is also supported by our panel data analysis. A possible mechanism behind this result is that it takes time for political forces as

well as stakeholders to be affected by media attention and in turn exert pressure on firm behavior. Even though it may be a less time consuming activity for stakeholder to exert pressure on firms than for policy makers to induce firm regulation, firms still need time to react on this pressure by adjusting their production and improve their environmental performance. Even though the effects is not immediate, media coverage matters and is consequently a channel which can exert pressure on firm behavior. This is also in agreement with the underlying theory of why firms engage in environmental protection and results from earlier work of Konar and Cohen (2000) and Arora and Carson (2001).

We do not find any evidence that media coverage influence the tax payment. This further supports our first hypothesis that the positive effect of media coverage on the degree of internalization mainly is driven by reduction in emissions. In addition to being insignificant, our results indicate that the effect of media coverage on tax payment is practically zero. The reason for this could be that media coverage of emissions drives the process of firms adjusting their production to reduce emissions, which implies a negative effect on the total amount of emission taxes paid. However, media coverage may also drive the process of increased marginal emission tax which in turn implies a positive impact on the tax payment. Media coverage may consequently result in two effects working in opposite direction. It is therefore possible that these two effects will cancel out and result in a net effect close to zero.

Second, in line with our second hypothesis, we find that industries on less concentrated markets have greater incentives to reduce emissions. This result indicates that industries that operate in more concentrated markets pollute more than those in less concentrated markets. The mechanism behind this result could be that firms on concentrated markets have lower incentives for abatement as their market power makes them less concerned about their image and hence less sensitive to adverse consumer behavior.

Nevertheless, we do not find any significant result that supports our third hypothesis that industries in less concentrated markets are more sensitive to media coverage of emissions. However, as we have a small sample and that the integrated variable is not far from significant at a 20 percent level, evidence suggests that firms on less concentrated markets are more sensitive to media coverage. The motivating force behind this result could be that firms in competitive market need to be more concerned about their reputation in order to survive and therefore pay more attention to pressure from media.

With these results in mind, we conclude that media coverage plays an important role when firms make decisions about environmental performance. The competitive conditions in a market are also of great importance for how firms react in environmental issues. We have seen that competitive markets increase incentives for firms to reduce emissions, which should be accounted for in a policy makers' decision when deciding on emission taxes for these markets. Markets that are highly competitive and where incentives for reducing emissions already are present, are according to our results in less need of additional incentives such as emission taxes compared to their less competitive counterparts. If the aim of a policy maker would be to enforce as little regulation as possible in a market then it is advisable that more attention is paid to concentrated markets when inducing tax regulation. As firms in concentrated markets have lower incentives of abatement, these markets likely incorporate the heaviest emitters and are thus markets which is in most need of policy regulation.

4. Conclusion

The aim of this thesis have been to investigate the effect of media coverage on the degree of internalization in four Swedish industries, the paper and pulp industry, the chemical industry, the machine industry and the automotive industry. As the degree of internalization is determined by both the total amount of emission taxes and the level of emissions, we have investigated which part of the fraction that is affected by media coverage. We have further examined whether the market concentration has an effect on industry emissions as well as whether industries on less concentrated markets are more sensitive to media coverage.

Our empirical results support two of our stated hypotheses. We find a significant positive impact of media coverage on carbon dioxide for three industries in our sample, indicating that it takes two years for media coverage to impact the degree of internalization. We further find that changes in the degree of internalization are mainly driven by reductions in emissions rather than an increase in the tax payment. Regarding market concentration, we find that a lower market concentration is associated with a lower level of industry emissions. However, we do not find any significant result that supports our third hypothesis that industries on less concentrated markets are more sensitive to media coverage, even though evidence suggests that this might be the case.

Suggestions for Further Research

In this thesis we have focused on media coverage of emissions of carbon dioxide as this have been frequently covered in media during the last 20 years. However, there are certainly other types of emissions which may be of interest for further research, e.g. sulfur dioxide and nitrogen dioxide. Nevertheless, another perspective is necessary since these emissions are taxed in a way which is not compatible with the concept of the degree of internalization.

A factor that we have chosen to exclude from our empirical analysis is tradable emission permits. The reason for this is that this system was induced by the European Union in 2005, and has therefore only been available for industries for a few years of our sample, which ranges from 1993 to 2008. However this effect would be interesting to assess in further research as it is likely that the system of emission permits will have a greater impact on industry emissions in the future.

5. References

Arora, S. & Carson, T. N. (2001) *Why do firms volunteer to exceed environmental regulation? Understanding participation in EPA's 33/50 program.* Available online: http://www.krannert.purdue.edu/faculty/cason/papers/Arora-Cason1996LE.pdf [Accessed 09/05/2012].

Brown, P. H. & Minty, J. H. (2008) Media coverage and charitable giving after 2004 tsunami. *Southern Economic Journal,* 75(1), 9-25.

Byman, K., Grundfelt, E., Grönkvist, S., & Stenkvist, M. (2007) *Konsekvenser av en höjd koldioxidskatt i den icke handlande delen av industrin*. Available online: http:// www.energimyndigheten.se/Global/Om%20oss/Kontrollstation%202008/7_Konsekvenser%20av%20h%C3%B6jd%20koldioxidskatt,%20%C3%85F.pdf [Accessed 09/05/2012].

Conte Grand, M. & D'Elia, V. V. (2005) *Environmental news and stock markets performance: Further evidence for Argentina*. Available online: http://www. cibera.de/fulltext/11/11860/publicaciones/download/documentos/300.pdf [Accessed 09/05/2012].

Cordato, R. E. (2001) *The polluter pays principle: A proper guide for environmental policy.* Available online: http://iret.org/pub/SCRE-6.PDF [Accessed 09/05/2012].

Dyck, A. & Zyngales, L. (2002) *The Corporate Governance Role of the Media*. NBER Working Paper No. 9309.

Field, B. C. & Field, M. K. (2006) *Environmental economics: An introduction*. (4. ed.) New York, NY: McGraw-Hill.

Forge, F. & Williams, T. (2008) *Policy options to reduce greenhouse gas emissions.* Available online: http://www.parl.gc.ca/content/LOP/ResearchPublications/ prb0819-e.pdf [Accessed 09/05/2012].

Harris, M. & Holmström, B. (1982) A theory of wage dynamics. *Review of Economic Studies*, 49, 315-333.

Hindriks, J. & Myles, G. D. (2006) *Intermediate public economics.* Cambridge, MA: MIT press.

Knyazeva, D. (2007) *Corporate governance, analyst following, and firm behavior*. Available online: http://ww.bus.wisc.edu/finance/workshops/documents/DianaKnyazeva _Jobmarketpaper_Januarydraft.pdf [Accessed 09/05/2012].

Konar, S. & Cohen, M. A. (1997) Information as regulation: The effect of community right to know laws on toxic emissions. *Journal of Environmental Economics and Management*, 32, 109-124.

Konar, S. & Cohen, M. A. (2000) *Why do Firms Pollute (and Reduce) Toxic Emissions?* Available online: http://www.vanderbilt.edu/vcems/papers/WhyDoFirms Pollute.pdf [Accessed 09/05/2012].

Lefebvre, E., Lefebvre, L. A. & Talbot, S. (2003) Determinants and impacts of environmental performance in SME's, *R&D and Management*, 33(3), 263-283.

Mazur, A. & Lee, J. (1993) Sounding the global alarm: Environmental issues in the US national news. *Social Studies of Science*, 23(4), 681-720.

McCombs, M. (2003) *The agenda-setting role of the mass media in the shaping of public opinion.* Available online: http://www.infoamerica.org/documentos_pdf/ mccombs01.pdf [Accessed 09/05/2012].

Mcwillian, A. & Siegel, D.S. (2001) Corporate Social responsibility: A theory of the firm perspective. *Academy of Management review*, 26, 117-127.

OECD (2012) *OECD Stat Extracts.* Available online: http://stats.oecd.org/index.aspx? [Accessed 09/05/2012].

O'Heffernan, P. (1991) *Mass media and American foreign policy. Insider perspectives on global journalism and foreign policy process.* Westport, CT: Ablex Publishing.

Retriever (2012) *Retriever* [online]. Available at http://ret web05.int.retriever.no. ezproxy.ub.gu.se/services/archive.html [Accessed 09/05/2012].

Robinson, P. (2000) *The news media and intervention: critical media coverage, policy uncertainty and airpower intervention during humanitarian crisis.* Available online: http://www.psa.ac.uk/cps/2000/Robinson%20Piers.pdf [Accessed 09/05/2012].

Roos, J. (2010) *ExternE – Externalities of energy. A research project of the European Union*. Available online: http://www.externe.info/ [Accessed 09/05/2012].

Sampei, Y. & Aoyagi-Usui, M. (2009) Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. *Global Environmental Change*, 19, 203–212.

Statistics Sweden (2012) *Statistikdatabasen.* Available online: http://www.ssd.scb.se/databaser/makro/start.asp [Accessed 09/05/2012].

Steen, B. (1999) *A systematic approach to environmental priority strategies in product development (EPS). Version 2000 – Models and data of the default method*. Chalmers University of Technology, Göteborg, Sweden.

Steen, B. (2011) *Quality aspects on monetary weighting indicators and weighting factors in LCA.* Chalmers University of Technology, Göteborg, Sweden.

Swedish Energy Agency & Swedish EPA (2004) *Utvärdering av styrmedel i klimatpolitiken.* Available online: http://www.baff.info/rapporter/Utv%C3%A4rdering%20av%20styrmedel%20i%20klimatpolitiken1.pdf [Accessed 09/05/2012].

Swedish Road Administration (2009) *Vägtransportssektorn: Sektorsrapport 2008.* Available online: http://publikationswebbutik.vv.se/upload/4774/2009_13_vagtransportsekton_sektorsrapport_2008.pdf [Accessed 09/05/2012].

Swedish Road Administration (2010) *Vägtransportsektorn: Sektorsrapport 2009*. Available online: http://publikationswebbutik.vv.se/upload/5528/2010_23_vagtransportsektorn_sektorsrapport_2009.pdf [Accessed 09/05/2012].

Swedish Tax Agency (2005, 2006, 2007, 2008, 2010) *Tax Statistical Yearbook of Sweden*. Available online: http://www.skatteverket.se/privat/blanketterbroschyrer/broschyrer/info/152.4.39f16f103821c58f680007237.html [Accessed 09/05/2012].

Swedish Transport Administration (2011) *Förkortad underlagsrapport utifrån samrådsversion av JNB 2013*. Available online: http://www.trafikverket.se/PageFiles/52216/underlagsrapport_utifran_samradsversion_av_jnb_2013_1112.pdf [Accessed 14/05/2012].

Yanovitsky, I. (2002) Effect of news coverage on policy attention and actions: A closer look into the media policy connection. *Communication research*, 29(4,), 422-451.

Zhang, B., Bi, J., Yuan, Z., Ge, J., Liu, B. & Bu, M. (2008) Why do firms engage in environmental management? An empirical study in China. *Journal of Cleaner Production*, 16, 1036-1045.

Zyglodopoulus, S. C., Georgiadis, A. P., Caroll, C.E. & Siegel, D. G. (2011) Does media attention drive social corporate sustainability? *Journal of Business Research.*

Appendix

Table 5: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
log_INT_21	16	-.8235875	.177807	-1.1216	-.6471
log_INT_24	16	-1.219031	.1714354	-1.4939	-.9659
log_INT_29	16	-.5359813	.1659354	-.763	-.2703
log_INT_34	16	-.5260688	.2178741	-.8335	-.2346
L.log_INT_21	15	-.83384	.1790855	-1.1216	-.6471
L.log_INT_24	15	-1.228253	.1732958	-1.4939	-.9659
L.log_INT_29	15	-.5460467	.1666269	-.763	-.2703
L.log_INT_34	15	-.5441933	.2126696	-.8335	-.2346
log_MCOV	64	2.797162	.6235561	1.699	3.878
L.log_MCOV	60	2.725107	.5750672	1.699	3.8521
L2.log_MCOV	56	2.644607	.5057504	1.699	3.4302
log_EM	64	5.837126	.4413063	5.249504	6.507852
L.log_EM	60	5.843657	.4401995	5.261553	6.507852
log_TAX	64	1.922568	.3155847	1.436832	2.550249
L.log_TAX	60	1.917184	.3191911	1.436832	2.550249
log_T_RATE	64	-.915623	.1318071	-1.165228	-.8251159
log_VA	64	4.522023	.0921124	4.287397	4.704405
HF	36	.0713056	.0177133	.042	.106
L2.log_MCOV*HF	36	.4187796	.1153887	.2223655	.6097595

Table 6: Correlation Matrix

	log_MCOV	log_EM	log_TAX	log_T_RATE	log_VA	HF	log_MCOV*HF
log_MCOV	1.0000						
log_EM	-0.0541	1.0000					
log_TAX	0.0676	0.7647	1.0000				
log_T_RATE	-0.4983	-0.0076	-0.1230	1.0000			
log_VA	-0.1524	-0.5557	-0.7400	-0.1270	1.0000		
HF	-0.3005	0.4000	0.5511	0.0889	-0.4076	1.0000	
log_MCOV*HF	0.2222	0.4109	0.6237	-0.1963	-0.5477	0.8551	1.0000

Table 7-10: Results from the Time Series Analysis using Robust Standard Errors
Dependent Variable: Degree of Internalization in Logarithmic Scale

Table 7: Paper and Pulp Industry

	(1)	(2)	(3)
VARIABLES	**log_INT_21**	**log_INT_21**	**log_INT_21**
L.log_INT_21	0.681****	0.638****	0.400**
	(0.266)	(0.275)	(0.219)
log_MCOV	0.0459	-0.0554	-0.170
	(0.0539)	(0.146)	(0.128)
L.log_MCOV		0.115	-0.121
		(0.144)	(0.157)
L2.log_MCOV			0.410*****
			(0.124)
Constant	-0.369	-0.427	-0.705****
	(0.353)	(0.340)	(0.277)
Observations	15	15	14
R-squared	0.713	0.727	0.818

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2

Table 8: Chemical Industry

	(1)	(2)	(3)
VARIABLES	**log_INT_24**	**log_INT_24**	**log_INT_24**
L.log_INT_24	0.800*****	0.789*****	0.731*****
	(0.174)	(0.184)	(0.169)
log_MCOV	0.0127	-0.0349	-0.0842
	(0.0418)	(0.112)	(0.0999)
L.log_MCOV		0.0521	-0.0663
		(0.111)	(0.146)
L2.log_MCOV			0.190*
			(0.137)
Constant	-0.255	-0.274	-0.368
	(0.313)	(0.314)	(0.340)
Observations	15	15	14
R-squared	0.793	0.796	0.795

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2

Table 9: Machine Industry

	(1)	(2)	(3)
VARIABLES	**log_INT_29**	**log_INT_29**	**log_INT_29**
L.log_INT_29	0.750*****	0.757*****	0.787*****
	(0.144)	(0.167)	(0.167)
log_MCOV	0.0534	0.0659	0.0282
	(0.0461)	(0.139)	(0.126)
L.log_MCOV		-0.0147	-0.151
		(0.141)	(0.152)
L2.log_MCOV			0.159***
			(0.0731)
Constant	-0.268	-0.260	-0.166
	(0.202)	(0.220)	(0.199)
Observations	15	15	14
R-squared	0.866	0.866	0.889

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2

Table 10: Automotive Industry

	(1)	(2)	(3)
VARIABLES	**log_INT_34**	**log_INT_34**	**log_INT_34**
L.log_INT_34	0.753*****	0.741*****	0.685*****
	(0.186)	(0.208)	(0.158)
log_MCOV	0.0752	0.0577	0.00877
	(0.0596)	(0.117)	(0.117)
L.log_MCOV		0.0221	-0.133
		(0.125)	(0.122)
L2.log_MCOV			0.226****
			(0.0940)
Constant	-0.313	-0.329	-0.376
	(0.273)	(0.297)	(0.276)
Observations	15	15	14
R-squared	0.906	0.906	0.926

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2

Table 11: Results from the Panel Data Analysis using Cluster-Robust Standard Errors
Dependent Variable: Emissions in Logarithmic Scale

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**log_EM**	**log_EM**	**log_EM**	**log_EM**	**log_EM**	**log_EM**
L.log_EM	0.590****	0.597****	0.268	0.268	0.253	0.262*
	(0.120)	(0.125)	(0.178)	(0.182)	(0.156)	(0.153)
L2.log_MCOV	-0.0551****	-0.0446***	-0.0264	-0.0621****	-0.0555***	-0.0835***
	(0.0152)	(0.0144)	(0.0260)	(0.0140)	(0.0219)	(0.0274)
log_VA	0.175*	0.207*	0.291*	0.325**	0.192	0.227
	(0.0922)	(0.113)	(0.165)	(0.164)	(0.276)	(0.274)
log_T_RATE		-0.0954*			-2.051	-1.965
		(0.0552)			(1.511)	(1.500)
HF			1.626*		1.423***	
			(0.861)		(0.604)	
L2.log_MCOV*HF				0.480		0.355*
				(0.331)		(0.216)
Constant	1.737*	1.442	2.887*	2.849	1.788**	1.762**
	(1.008)	(1.043)	(1.681)	(1.743)	(0.845)	(0.868)
Observations	56	56	36	36	36	36
R-squared	0.606	0.618	0.495	0.477	0.543	0.519
Number of industries	4	4	4	4	4	4

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2

Table 12: Results from the Panel Data Analysis using Cluster-Robust Standard Errors
Dependent Variable: Tax Payment in Logarithmic Scale

	(1)	(2)	(3)	(4)	(5)
VARIABLES	**log_TAX**	**log_TAX**	**log_TAX**	**log_TAX**	**log_TAX**
L.log_TAX	0.786*****	0.767*****	0.718*****	0.698*****	0.652*****
	(0.0465)	(0.0520)	(0.0737)	(0.0701)	(0.0879)
L2.log_MCOV	0.00860	0.0269**	-0.0168*	0.0156**	0.00714
	(0.00673)	(0.0134)	(0.00919)	(0.00755)	(0.0128)
log_EM		0.188***			0.216****
		(0.0748)			(0.0520)
log_T_RATE			0.322****		0.329****
			(0.0743)		(0.0911)
log_VA				0.218	0.108*
				(0.157)	(0.0613)
Constant	0.414****	-0.694	0.896****	-0.425	-0.784****
	(0.0808)	(0.428)	(0.179)	(0.619)	(0.140)
Observations	56	56	56	56	56
R-squared	0.813	0.820	0.853	0.819	0.865
Number of industries	4	4	4	4	4

Robust standard errors in parentheses

*****p<0.01, ****p<0.05, ***p<0.1, **p<0.15, *p<0.2