# The CSP-CFP missing link: complementarity between environmental, social and governance practices? *

Sandra Cavaco† and Patricia Crifo‡

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**Abstract**

This article analyzes the relationship between corporate social performance (CSP) and corporate financial performance (CFP) by proposing a theoretical model and by testing its main predictions through an econometric study on a matched CSP-CFP panel data for the biggest European listed firms over the 2002-2007 period. Our matched micro-economic dataset gathers two sources of information: environmental, social and governance ratings from the Vigeo database and economic and financial performance data from the Orbis database. Using panel data technique, we examine how the complementarity between various corporate social responsibility practices is likely to increase performance, as predicted by our theoretical model.

**Keywords**: Corporate social responsibility, firm performance, econometrics, panel data.

**Journal of Economic Literature**: M14 , L21, C33.

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†LEM, University Paris II Pantheon-Assas and CPP, Aarhus School of Business. sandra.cavaco@u-paris2.fr.

‡Ecole Polytechnique, University Paris X Nanterre and IRES, Catholic University of Louvain. patricia.crifo@polytechnique.edu.

# 1 Introduction

In all OECD countries, firms are making a lot of effort to be, or at least to appear, socially responsible. In 2005 for instance, 52% of the top 100 corporations in the 16 more industrialized countries published a report on their corporate and socially responsible (CSR) activities (Becchetti et al. 2005). In the US, 1 dollar out of 9 invested on financial markets in 2007 embedded a dimension of CSR (11%), 3% in France and nearly 4% in Europe (EFAMA 2008 and Euro SIF 2008).

Being socially responsible means that, beyond legal constraints, firms accept to bear the cost of a more ethical behavior by voluntarily committing for instance to improve employment conditions, ban child labor and countries that do not respect human rights, protect the environment and invest in abatement equipment to reduce carbon footprint, develop partnerships with NGOs, provide funds to charity etc.

Many reasons in the literature are invoked to explain the prevalence of CSR strategies: the shrinking role of government, the society's demands for greater disclosure, the increased customer interest in CSR, the growing investor pressure, the competition on labour markets for competent and motivated employees, the increasing risk associated with unethical behaviors, the importance of taking into account relationships with suppliers, external pressure from the civil society etc. CSR strategies would in fact allow firms maximizing value and minimizing risk in the long run, responding to increased competitive pressure and market differentiation, and such strategies would more generally allow taking into account the growing demands of their stakeholders (customers, consumers, employees, savers). These arguments are known as the so-called 'Porter hypothesis' or 'doing well by doing good' (see Porter and Kramer, 2002).

The empirical link between corporate social performance and corporate financial performance has received considerable attention for 35 years but no consensus has yet emerged (see for instance, Margolis and Walsh, 2003, or Margolis, Elfenbein and Walsh, 2007). Recent research points at numerous biases and problems of previous work (eg: Elsayed and Paton, 2005 or McWilliams and Siegel, 2000) among which: model misspecification (endogeneity); omitted variables in the determinants of profitability; limited data (small samples, old periods); cross-sectional analysis invalid in the presence of significant firm heterogeneity; problems of measurement of CSR; wide diversity of measures used to assess financial performance. Another problem also lies in the direction and mechanisms of causation. Whether corporate social responsibility would lead (or not) to superior financial performance, or whether financial performance would rather be a necessary condition for corporate social performance is still a major stake to be investigated.

In this paper, we consider that the absence of consensus on the links between corporate social responsibility and intangible assets in general, and corporate financial performance suggests that it should be a specific combination of firm policies that would likely lead to superior corporate performance. By definition, two or more practices are complements when using one more intensely increases the mar-

ginal benefit of using others more intensively (Milgrom and Roberts, 1995). During the 1990s, this argument has proven a useful explanation of the Solow paradox, whereby "you can see the computer age except but in the productivity statistics" (Solow, 1987). Indeed, several researchers have shown that only those firms that have adopted both computerization and complementary innovative HRM (human resources management) practices (teamwork, multi-tasking, quality circles etc.) did enjoy superior performance (see e.g. Ichniowski and Shaw 2003; Boucekkine and Crifo, 2008). By analogy, the apparently ambiguous link between corporate social performance and financial performance could presumably be explained by taking into account the complementarity between the multi-dimensional facets of corporate social responsibility and intangible assets. In fact, a simple analysis on the Vigeo database (the French environmental and social rating agency) reveals that the distribution of correlation among environmental, social and governance scores shows strong positive correlations between many environmental, social and governance factors. This pattern clearly is consistent with the idea that corporate social responsibility or performance (labeled CSP), decomposed into environmental, social and governance (labeled ESG) factors, would be complementary in raising corporate financial performance (labeled CFP).

This article analyzes how the complementarity between various ESG factors affects corporate financial performance by proposing a theoretical model and by testing its main predictions through an econometric study on a matched CSP-CFP panel data for the biggest European listed firms over the 2002-2007 period. Our theoretical model formalizes the CSR decision by considering that entrepreneurs (or managers) have to allocate their available time between purely productive (non CSR) activities and CSR activities. A firm's CSR policy therefore has $n$ distinct dimensions in our theroetical model. CSR activities are also evaluated by a rating agency, and obtaining a rating above sectoral average on one CSR dimension increases firm's expected revenues. Moreover, CSR factors are characterized by relative complementarity. We are able to distinguish between either weak or strong complementaroty. Under weak complementarity, the marginal return from one CSR practice increases when another CSR practice has already been implemented even if the rating over the other practice is below the sectoral average. Under strong complementarity, the marginal return from one CSR practice increases when another CSR practice has already been implemented if and only if the rating over the other practice is above the sectoral average. Weak complementarity therefore is more rewarding for the firm.

In this context, we show that firms invest in CSR provided that they are relatively high performing. Under strong complementarity, investment in CSR is more widespread (more firms invest in CSR) and firms invest more in CSR, except for the very high performing firms. In terms of performance, we also show that expected profits are higher under weak complementarity because this form of complementarity is more rewarding (compared to strong complementarity). Finally, our comparative statics exercises show that an increase in the degree of complementarity between practices or an increase in the probability of obtaining a score above sectoral aver-

age decreases investment in CSR and increases expected profits. Intuitively, when CSR investment is relatively more rewarding, there is a substitution effect in favor of purely productive activities. Nevertheless, expected profits are increased because firms benefit from a higher comparative advantage in CSR investment.

Our contribution to the theoretical literature on the links between CSR investments and firm performance is twofold. On the one hand, we propose a model where CSR decisions are made over $n \geq 2$ dimensions, which enrich existing approaches often focusing on one particular dimension of a firm's CSR policy. In fact, an important theoretical literature considers CSR as a product differentiation strategy (see among others Baron (2007, 2008a,b), Graff Zivin and Small (2005), Becchetti et al. (2005 a and b), Manasakis et al. (2007)). Other approaches, for instance Bagnoli and Watts (2003), consider CSR as a private provision of a public good. Similarly, Cespa and Cestone (2008) formalize CSR decision as stakeholder protection when investing in uncertain technologies, and Benabou and Tirole (2006) consider CSR as a pro-social behavior. Our model formalizes CSR investments over multiple dimensions and may therefore be considered as complementary to these approaches. The second originality of our model is to consider explicitly the role of rating agencies in the CSR decision process and allows analyzing, within a simple partial equilibrium model, the impact of extra-financial ratings on invetsment in CSR and expected profits.

The main predictions of our model are then tested on a matched CSP-CFP panel database of the biggest European listed firms over the 1998-2007 period. More precisely, we examine whether CSR investment is positively correlated with firm performance and how the complementarity between two CSR practices affects this relationship, given the chance of getting a rating above sectoral average. In our database, the corporate social performance variables come from the Vigeo database and consist in detailed ratings attributed by the French environmental and social rating agency Vigeo over 4 broad domains of firms' intangible assets and corporate social responsibility (human resources, environment, customers and suppliers and corporate governance). The corporate financial performance variables come from the Orbis database (Bureau Van Dijk) and consist in detailed information from the companies' standardized annual accounts (Cash Flow, Employees, Total Assets, Profitability ratios etc.).

We examine the impact of CSR ratings on firm performance by exploiting the dynamic dimension of our dataset through the Generalized Method of Moments technique (see Blundell and Bond, 1998), in order to analyze the dynamic impact of complementary environmental, social and governance practices on firm performance. Our empirical results show that the complementarity of environmental, social and governance policies matters in the long run relationship between CSP and CFP.

This paper is organized as follows. Section 2 presents the theoretical model. Section 3 summarizes the main theoretical predictions to be tested. The empirical strategy and results are developed in section 4. Section 5 presents ongoing tests and research and section 6 concludes the article.

# 2 The theoretical model

## 2.1 Basic set-up and definitions

The economy is composed of both a continuum of risk-neutral entrepreneurs (or managers) who develop a project, and a rating agency. In our model, a firm's CSR policy has several dimensions as detailed in the following definition.

**Definition 1** *Corporate social responsibility has $n \geq 2$ dimensions, among which:*
· ***A corporate governance component***
*This dimension refers for instance to the respect for shareholders' rights, promotion of independent and competent administrators and auditors, transparent compensation policy of key executives.*
· ***An environmental component***
*This dimension refers to the incorporation of environmental considerations into the design, manufacturing and distribution of products: pollution prevention and control, protection of water resources, biodervisty, waste management, management of local pollution, management of environmental impacts from transportation etc.*
· ***A human resources (or social) component***
*This dimension refers to responsible human resources management: training and career development, employee participation, quality of working conditions etc.*
· ***A business behavior component***
*This dimension refers to firms' practices towards clients and suppliers: prevention of conflicts of interest, corruption or anti-competitive practices*[1]*, product safety, information to consumers, integration of CSR in the supply chain etc.*
· ***A community and human rights component***
*This dimension refers to contibutions to local and general interest causes, charitable contributions, respect for human rights, elimination of child labor.*

Decomposing CSR into $n \geq 2$ dimensions is consistent with and complementary to the existing literature. Theoretical models of CSR in fact focus on one broad dimension of CSR, which might include several criteria, but which - for analytical purpose - is meant to capture an overall CSR strategy at the firm level. For instance, the firm's CSR policy may be formalized as a product differentiation strategy (see e.g. Graff Zivin and Small, 2005 or Baron 2007, 2008a and b) or as a broader notion of stakeholder protection (see Cepsa and Cestone, 2007). Our definition of CSR therefore provides a complementary analysis to such kinds of models in that we decompose broad CSR into several sub-categories.

In the abundant empirical literature, many papers also focus on one broad dimension of firms' CSR policy (see for instance the survey of Mercer and UnepFi, 2007) but recent papers tend to systematically focus on a wider set of dimensions of

[1]Such practices are for instance encouraged by international organizations like United Nations, OECD, World trade organization.

CSR. For instance, in their meta-analysis of 167 studies on the links between CSR and CFP, Margolis, Elfenbein and Walsh (2007) decompose CSR strategies into 9 categories : Charitable contributions, Corporate policies, Environmental performance, Revealed misdeeds, Transparency, and 4 other categories reflecting different ways researchers attempt to capture firms CSR (Self-reported social performance, Observers' perceptions, Third-party audits and Screened mutual funds). Our approach is consistent with such types of studies, as we consider $n$ possible categories of CSR behaviors in our theoretical and empirical analysis.

Projects are developped by managers given an extra-financial evaluation of their CSR policies by the rating agency. The rating agency produces scores or ratings over governance, environmental and social decisions made by firms, which influence the revenues and costs of the firm: if a positive amount of time $x$ is devoted to CSR, the probability that the firm gets a rating higher than the sectoral average[2] is given by $p(x) = \mu.x$, $p \in [0, 1]$, and the probability that the firm gets a rating lower than average is $1 - \mu.x$. The higher $\mu$, the higher the chance of getting a rating above average. Hence $\mu.x$ represents an index of the difficulty of being 'best in class' (above average) in a given sector.

We further consider that the different components of the firm's CSR policy may be relative complements (or substitutes). A group of CSR factors is complementary if doing more of any subset of them increases the returns from doing more of any subset of the remaining factors, in other words when 'the whole is more than the sum of its parts'. In the present model, we restrict the analysis to a $2 \times 2$ complementarity to keep the resolution analytically tractable. Given the evaluation of the CSR decision by the rating agency and since the firm's revenues depend on the probability of attaining a rating above or below the sectoral average, we consider the following definition of complementary among two CSR practices.

**Definition 2** *Two CSR practices are characterized by*

- ***weak complementarity*** *($\theta = w$) when the marginal return from one CSR practice increases when another CSR practice has already been implemented even if the rating over the other practice is below the sectoral average.*
- ***strong complementarity*** *($\theta = s$) when the marginal return from one CSR practice increases when another CSR practice has already been implemented if and only if the rating over the other practice is above the sectoral average.*

Both types of complementarity are characterized by **super-modularity** whereby the marginal product of two or more practices jointly implemented is higher than the sum of the marginal product of each practice implemented separately.

[2]Given that we have a continuum of entrepreneurs and firms, the notion of sector matters only for the empirical analysis.

Note that in the case of substitutability between CSR practices, definition 2 is symmetric in the sense that substitutability implies that the marginal return from one CSR practice woudl decrease when another CSR practice has been implemented.

## 2.2 Firm's expected profits

The problem facing an entrepreneur is how to allocate her available time between $n$ CSR practices (governance, environment, human resources, business behavior etc.) and other (purely productive) activities (non CSR). We denote by $\tau_i$ the time allocated to the type $i$ CSR practice, where $i = 1..n$, and normalize available time to 1 so that $1-\sum_{i=1}^{n} \tau_i$ denotes the time allocated to non-CSR activities (pure productive tasks without concerns for CSR factors).

The problem facing an entrepreneur is how to allocate her available time between exerting an effort over each type $i$ CSR dimension and purely productive activities. The firm's effort over CSR practices are evaluated by the rating agency and the probability of receiving a rating higher than the sectoral average $p_i = (\mu.\tau_i)$ affects the firm's marginal revenues due to a pure rating effect and to a complementarity effect (between CSR practices).

The firm's expected profits have two components:

1. the marginal revenue (or product) of non-CSR (purely productive) activities, labelled $y > 0$ in efficiency units.
   The total productive return therefore is equal to $y \cdot (1 - \sum_{i=1}^{n} \tau_i)$
2. the marginal revenue (or product) of CSR activities, composed of three elements:
   - the marginal CSR revenue from investing in $i$ denoted by $z > 0$ in efficiency units. The return from the $i^{th}$ component therefore equals $z \cdot \tau_i$
   - the net benefit of a rating higher than the sectoral average, labelled $b > 0$ in efficiency units. The return from a rating above the sectoral average over the $i^{th}$ dimension therefore equals $b \cdot \tau_i$
   - the additional benefit from investing in complementary CSR practices labelled $g^{\theta} > 0$ in efficiency units where, according to definition 2, $\theta = w$ (resp. $\theta = s$) denotes weak (resp. strong) complementarity.

With probability $p_i = (\mu \cdot \tau_i)$ the firm gets a rating higher than sectoral average over the type $i$ CSR dimension. The firm's expected revenues from investing in the $i^{th}$ CSR dimension are therefore such that: with probability $(\mu \cdot \tau_i)$ the firm generates a net revenue $z \cdot \tau_i + b \cdot \tau_i + g^{\theta}$ and with probability $(1 - \mu \cdot \tau_i)$ the firm generates a net revenue $z \cdot \tau_i$.

The firm's overall expected profits from investing $\tau_i$ in $i = 1..n$ CSR dimensions, and $(1 - \sum_{i=1}^{n} \tau_i)$ in purely productive activities, hence write:

$$\Pi = y \cdot \left(1 - \sum_{i=1}^{n} \tau_i\right) + \sum_{i=1}^{n} \left[(\mu \cdot \tau_i) \cdot \left(z \cdot \tau_i + b \cdot \tau_i + g^{\theta}\right) + (1 - \mu \cdot \tau_i)\,(z \cdot \tau_i)\right]$$

Simplifying this expression leads to:

$$\Pi = y \cdot \left(1 - \sum_{i=1}^{n} \tau_i\right) + \sum_{i=1}^{n} \left[z \cdot \tau_i + \mu \cdot b \cdot (\tau_i)^2 + (\mu \cdot \tau_i) \cdot g^{\theta}\right] \quad \theta = w, s \qquad (1)$$

The complementarity gains $g^{\theta}$ are earned with probability $\mu \cdot \tau_i$ and are specified according to definition 2. Let $g > 0$ denotes the marginal gain from complementarity[3] between two CSR practices $i$ and $j$, such that $i, j = 1..n$, $j \neq i$.
Under *weak complementarity* ($\theta = w$), the marginal return from investing in $i$ increases when $j$ has already been implemented even if the rating over $j$ is below the sectoral average. The gains from weak complementarity between type $i$ and type $j$ CSR practices therefore simply equals $g^w = g$ (these gains are obtained with probability $\mu \cdot \tau_i$ as explained above).
Under *strong complementarity* ($\theta = s$), the marginal return from investing in $i$ increases when $j$ has already been implemented if and only the rating over $j$ is above the sectoral average, which occurs with probability $\mu \cdot \tau_j$. Hence, the expected gains from strong complementarity between types $i$ and $j$ CSR practices therefore equal $g^s = (\mu \cdot \tau_j) \cdot g$ .

In sum, the firm's overall expected profits under both types of complementarity write:

$$\Pi^w = y \cdot \left(1 - \sum_{i=1}^{n} \tau_i\right) + \sum_{i=1}^{n} \left[z \cdot \tau_i + \mu \cdot b \cdot (\tau_i)^2 + (\mu \cdot \tau_i) \cdot g\right] \qquad (2)$$

$$\Pi^s = y \cdot \left(1 - \sum_{i=1}^{n} \tau_i\right) + \sum_{i=1}^{n} \left[z \cdot \tau_i + \mu \cdot b \cdot (\tau_i)^2 + (\mu \cdot \tau_i) \cdot (\mu \cdot \tau_j) \cdot g\right] \qquad (3)$$

where $\quad j \neq i.$

Note that given $g > 0$, expected profits are super-modular: the joint implementation of two complementary CSR factors generates returns higher than the sum of returns from each of those factors implemented separately: $\Pi^{\theta} \geq y \cdot (1 - \sum_{i=1}^{n} \tau_i) + \sum_{i=1}^{n} \left[z \cdot \tau_i + \mu \cdot b \cdot (\tau_i)^2\right] \quad \theta = w, s.$

We now turn to the optimal investment in CSR factors.

[3]Note that our model allows analyzing in a completely symmetric manner the case of substitutability between CSR practices. In this case indeed, parameter $g$ would be negative.

## 2.3 Equilibrium CSR decisions

The equilibrium investment level $\tau_i$ in the type $i$ CSR dimension solves the following firm's profit maximization programs.

- **Case i: Investment in CSR practices under weak complementarity**

Given (2) , the firm's optimization program writes

$$\max_{\tau_i} \Pi^w = y \cdot (1 - \sum_i \tau_i) + \sum_i [z \cdot \tau_i + \mu \cdot b \cdot (\tau_i)^2 + (\mu \cdot \tau_i) \cdot g]$$

The solution of this program writes:

$$\tau^w = \frac{y - z}{2\mu b} - \frac{g}{2b} \tag{4}$$

The firm's expected profits under weak complementarity then write:

$$E\Pi^w = y - \frac{n(y - z - g\mu)^2}{4b\mu} \tag{5}$$

- **Case ii: Investment in CSR practices under strong complementarity**

In this case, we shall distinguish among three types of CSR dimensions: type $i$ ans type $j$ CSR dimensions are relative complements, and let denote by $k$ the other, non complementary, CSR dimensions. Given (3), the firm's optimization program writes

$$\max_{\tau_j, \tau_i, \tau k} \Pi^s = y \cdot (1 - \sum_i \tau_i) + \sum_i [z \cdot \tau_i + \mu \cdot b \cdot (\tau_i)^2 + (\mu \cdot \tau_i) \cdot (\mu \cdot \tau_j) \cdot g]$$

where $j, k = 1..n \quad j, k \neq i$.

The solution of this program writes:

$$\tau_i^s = \tau_j^s = \frac{y - z}{\mu(2b + g\mu)} \tag{6}$$

$$\tau_k^s = \frac{y - z}{2b\mu} \tag{7}$$

The firm's expected profits under strong complementarity then write:

$$E\Pi^s = y - \frac{(y - z)^2}{4b\mu} \frac{2nb + (n - 2)g\mu}{2b + g\mu} \tag{8}$$

## 2.4 Existence of equilibrium and comparative statics

To ensure that $0 < \tau^w < 1$, $0 < \tau_i^s = \tau_j^s < 1$ and $0 < \tau_k^s < 1$, we make the following assumption.

**Assumtion 1.** $z + \mu g < y < 2b\mu$

We now analyze the equilibrium values of investments in CSR.

**Result 1.** *Under assumption 1, firms invest in CSR provided that their productive performance y is high. Under strong complementarity, investment in CSR is more widespread (more firms invest in CSR) and more intensive (firms invest a higher amount of time in complementary CSR dimensions) when productive performance is below the threshold* $\bar{y} = z + g\mu + 2b$.

**Proof.** Under weak complementarity, we show that :

$$\tau^w = \frac{y-z}{2\mu b} - \frac{g}{2b} > 0 \Leftrightarrow y > z + g\mu$$

Under strong complementarity, we show that :

$$\tau_i^s = \tau_j^s = \frac{y-z}{\mu(2b+g\mu)} > 0 \quad \text{and} \quad \tau_k^s = \frac{y-z}{2b\mu} > 0 \Leftrightarrow y > z$$

There is therefore a threshold level $\tilde{y}$ such that firms with productive performance $y > \tilde{y}$ choose to invest in CSR. The threshold level is lower under strong complementarity ($\tilde{y}^s = z$) compared to weak complementarity ($\tilde{y}^w = z + g\mu$), therefore more firms invest in CSR under strong complementarity.

Moreover, we have: $\tau^w < \tau_k^s$ and $\tau^w > \tau_i^s = \tau_j^s \Leftrightarrow y > z + g\mu + 2b$. Hence, firms for which $y \leq \bar{y} = \tilde{y}^w + 2b = z + g\mu + 2b$ invest more in relatively complementary CSR dimensions under strong complementarity. ■

To analyze the expected profit levels given the equilibrium CSR investments, some numerical simulations are needed to have a simple representation of profits levels. Indeed, the profits functions are not linear in $y$ and assumption 1 imposes restrictions on $y$, therefore a numerical analysis is more straightforward. These simulations have be realized using the following parameters values (satisfying assumption 1):

Table 1: Parameters values for the simulation exercise

| n | z | g | $\mu$ | b |
|---|---|---|---|---|
| 10 | 2 | 1 | 0.5 | 10 |

The results of the simulation are reported in figures 1a, 1b and 2.

*[Insert Figures 1a, 1b and 2]*

Figures 1a and 1b illustrate result 1 and show that CSR investment is higer under strong complementarity (solid line) unless firm performance becomes very high, that is above the threshold $\bar{y} = z + g\mu + 2b$ (see figure 1a). In this case, the difference $(\tau^w - \tau_i^s)$ becomes positive and investment under weak complementarity becomes higher than under strong complementarity (see figure 1b).

Figure 2 shows that expected profits are higher under weak complementarity (dashed line). This property is due to the fact that strong complementarity implies lower expected revenues for firms investing in CSR: to benefit from complementarity between two CSR practices, firms have to invest more and this is relatively less rewarded. Weak complementarity therefore is the highest rewarding mechanism when two CSR practices are relative complements.

We now analyze how the equilibrium values of investment in CSR factors and expected profits vary with the degree of complementarity practices $g$.

**Result 2.** *Under assumption 1, for both types of complementarity (weak and strong), an increase in the degree of complementarity between practices $g$:*

- *decreases investment in CSR*
- *increases expected profits*

**Proof.**

We have $\frac{\partial \tau^w}{\partial g} < 0$, $\frac{\partial \tau_i^s}{\partial g} < 0$ , $\frac{\partial E\Pi^s}{\partial g} > 0$ , and under assumption 1: $\frac{\partial E\Pi^w}{\partial g} > 0$

Moreover, we have $\frac{\partial \tau^w}{\partial \mu} < 0$, $\frac{\partial \tau_i^s}{\partial \mu} < 0$ , $\frac{\partial E\Pi^s}{\partial \mu} > 0$ , and under assumption 1: $\frac{\partial E\Pi^w}{\partial \mu} > 0$ ■

**Result 3.** *Under assumption 1, for both types of complementarity (weak and strong), an increase in the probability of obtaining a rating higher than sectoral average $\mu$:*

- *decreases investment in CSR*
- *increases expected profits*

**Proof.**

We have $\frac{\partial \tau^w}{\partial \mu} < 0$, $\frac{\partial \tau_i^s}{\partial \mu} < 0$ , $\frac{\partial E\Pi^s}{\partial \mu} > 0$ , and under assumption 1: $\frac{\partial E\Pi^w}{\partial \mu} > 0$ ■

When firms invest in complementary CSR factors, a higher degree of complementarity or a higher chance of getting a rating above average increase the overall benefit of CSR investment (see equation (1)). This decreases the incentives to invest in each CSR dimension (see equations (4), (7) and (7)) because CSR investment is relatively more rewarding and yields a substitution mechanism in favor of purely productive activities. Expected profits are however increased because firms enjoy a higher comparative advantage in investing in CSR (see equations (5) and (8)).

Note finally, that all our results have to be interpreted both in terms of complementarity or in terms of substitutability between CSR factors. In this latter case, our parameter $g$ has a negative sign, and our results are opposite.

# 3 Theoretical predictions to be tested

Our comparative statics results lead to the following testable predictions.

Result 1 has two implications. First, CSR investments appear to be positively correlated with firm performance since only high performing firms invest a positive amount in CSR. Second, when CSR practices are strongly complementary, firms' investment in CSR is lower when producitve performance is very high (above the threshold $\bar{y}$, therefore the positive correlation between CSR investment and firm performance tends to diminish (or disappear) above the thershold $\bar{y}$. These thereotical results lead to the following testable predictions.

**Prediction 1.** *CSR investment is positively correlated with firm performance.*

**Prediction 2.** *Under strong complementarity (substitutability) between CSR practices, the correlation between CSR investment and firm performance is not linear and may increase or decrease with productive performance.*

Results 2 and 3 have two implications. The higher the degree of complementarity between practices or the higher the chance of getting a rating above average, the lower the firm's investment in CSR. There is a trade-off in the determinants of CSR invetsments and profits between investing in purely productive activities or in CSR activities, and as CSR practices are more rewarding, there is a substitution mechanism towards purely productive (non CSR) investment in order to raise profits. These results yield the following predictions.

**Prediction 3.** *When high performing firms invest in complementary (resp. substitutable) CSR practices, a higher degree of complementarity between practices or a*

*higher chance of obtaining a rating above average decreases (resp. increases) firms' investment in CSR.*

**Prediction 4.** *When high performing firms invest in complementary (resp. substitutable) CSR practices, a higher degree of complementarity between practices or a higher chance of obtaining a rating above average increases (resp. decreases) firm's expected profits.*

We now turn to the empirical analysis given these theoretical predictions.

# 4 Empirical strategy and results

Our purpose is to examine the scope of synergy effects on firm performance that arise when firms combine several CSR activities using panel data for European countries. We consider that two CSR activities are complementary whenever their joint execution will produce synergy effects for a given performance measure. Besides, we take into account dynamics and correct for endogeneity in order to specifically examine the relationship between CSR practices and firm performance. A plausible model of the CFP-CSR process should in fact exploit the panel structure of our data and allow for dynamics in which past CFP helps to explain current performance.

## 4.1 Empirical set-up

The main issue is that when we investigate the relationship between CSR investments and firm performance, current firm performance is likely to be correlated with both the observable and unobservable factors (i.e. observable and unobservable heterogeneity) that also determine CSR strategies. Moreover, causality may run in both directions, that is from CSR to firm performance and from performance to CSR.

We thus estimate the relationship between firm performance, labelled $\Pi_{it}$, its lagged value, $\Pi_{i-t}$, the CSR scores, $CSR_{it}$ and a set of control variables, labelled $X_{it}$, as follows:

$$\Pi_t = \beta_1 \Pi_{it-1} + \beta_2 CSR_{it} + \beta_3 X_{it} + \eta_i + \varepsilon_{it} \tag{9}$$

where $i$ refers to individual firm and $t$ to time dimension, $\eta_{it}$ represents the unobservable time-invariant heterogeneity and $\varepsilon_{it}$ is the error term. $X_{it}$ are potentially predetermined firm-level time-variant control variables

With respect to equation (9), past realizations of our dependent variable are endogenous to the fixed effect in the error term. Ordinary Least Squares (OLS) estimates that ignore the unobserved heterogeneity will be biased if unobservable factors that determines performance are also correlated with CSR strategies. This inconsistency can be mitigated by using instrumental variables regressions (IV) but it is in general difficult to identify valid appropriate instruments that are strictly exogenous. Fixed effects regressions can be estimated in order to eliminate the unobservable heterogeneity. However, fixed effects models can be biased if the explicative variables are correlated with past realizations of the dependent variable. Indeed, we argue that this is the case with CSR practises and firm performance. The estimates of coefficients provided by OLS are upward biased and those coming from the Within-group estimator are downward biased (Bond, 2002)[4].

Thus, to obtain consistent and unbiased results, we estimate the relationship between CSR investments and firm performance using the dynamic Generalised Method of Moments (GMM) estimator, called system GMM. The GMM estimator was first introduced by Holz-Eakin et al.(1988) and Arellano and Bond (1991) and then further developed both in Arellano and Bover (1995) and Blundell and Bond (1998). The estimation procedure exploits the dynamic endogeneity inherent in our variables.

The system GMM estimator extends the GMM in difference by estimation of a system of first-differenced equations and the equations in levels in which more instruments can be exploited. In the first-differenced equations we use the lagged level values of the variables as instruments as in the GMM difference estimator (Arellano and Bond, 1991); in the levels equations we use differences as instruments. Indeed, the use of a new set of intruments in differences improves efficiency as it directly deals with the problem of weak instruments of difference GMM (Arellano and Bond, 1991) in persistent series. Besides, another advantage of system GMM method is that it allows the other regressors to be predetermined (explained by their past realizations) or endogenous (explained by current and past realizations of other variables and by their own autoregressive process).

The system GMM estimator enables us to obtain consistent estimates by controlling for unobserved heterogeneity, simultaneity and endogeneity and time-invariant variables. However, two conditions are necessary for estimators to be consistent. According to the first one, the error term has to exhibit no serial correlation. In order to test if this condition is satisfied, we use the autocorrelation test on the residuals proposed by Arellano and Bond (1991). The second condition imposes the validity of the instruments that are used. The overall validity of the instruments can be corroborated by a test of over-identifying restrictions, the Hansen J statistic. The requirement for the validity of the instruments for the level equations is

[4]Although OLS and fixed effects estimators are biased, they can be useful since they give an interval in which a consistent estimation of the coefficients should lie.

that they have to be uncorrelated with the fixed effect. Athey and Stern (1998) have specifically discussed the problem of identifying complementarities in cross-sectional datasets. As pointed out by Leiponen (2005), the system GMM panel data approach controls for unobserved firm fixed effects that are the source of bias in many studies. Finally, the system GMM framework flexibly accommodates unbalanced panels.

## 4.2 Data and variables

In this section we discuss the data, the performance and CRS measures and the control variables we use in our empirical analysis.

### 4.2.1 Data description

The main predictions of the model are tested using a matched CSR-CFP panel database.

The CSR variables come from the Vigeo database. Vigeo, the leading European CSR rating agency, measures companies' CSR performance and risk factors on Environmental, Social and Governance (ESG) criteria and supplies this information to investors and asset managers notably. The areas under review are: Human Rights, Environment, Human Resources, Business Behaviour, Corporate Governance, Community Involvement. Out of these 6 broad domains, up to 40 criteria are covered, among which: Promotion of labour relations, Quality of remuneration systems, Improvement of health and safety conditions, Pollution prevention and control, Protection of water resources, Management of environmental impacts from the use and disposal of products/services, Waste management, Development of "Green" products and services, Integration of environmental and social factors in the supply chain, Balance of power and functioning of board of directors, Remuneration of directors and key executives etc. The evaluation is realized by Vigeo, and not by the firms themselves. Each criterion is applied in relation to its sector relevance and is given a consideration representing the relative weight of social responsibility objectives relating to it (see appendix 7.1 for details). Vigeo provided detailed data on 595 European firms. The data are available from 1998 to 2007.

We supplement the information on CSR with financial data extracted from Orbis (Bureau Van Dijk). Orbis is a comprehensive database of companies around the world containing information combined from nearly 100 sources (Datamonitor, Zephyr, Coface etc.) filtered into various standard report formats. The information has up to 25 data sections and 10 years of history, including detailed information from the companies' standardized[5] annual accounts, consolidated and unconsolidated, together with financial profile (balance sheet, P & L account, financial ratios),

[5]Orbis information is standardized information given the differences in accounting practices among the different countries.

activities and ownership, like for instance: Cash Flow, Employees, Total Assets, Intangible Assets valuation, Shareholders Funds, Profitability ratios (Profit Margin, Return on shareholders Funds, Return on Capital Employed, Solvency Ratio, Price Earning Ratio), Operational and Structure ratios etc.

In order to avoid sample selection issue, we do not require balanced panel, i.e. the number of firms differs from year to year and the estimations strategy uses as many observations as available. Besides, as we introduce the lagged value for the dependent variable, we have to observe firms over at least two years. Then we excluded from our sample firms that do not provide complete information on financial data. Our final unbalanced panel sample comprises 1 094 observations (around 300 firms per year) belonging to about 15 countries over the period 2002-2007.

The control variables characterize both the operations of the firm (e.g. Research and Development) and the financial structure and risk of the firm (e.g. debt ratio). The variables are defined in Appendix **??**. Table 1 provides descriptive statistics for all variables.

*[Insert Table 1]*

Size is a relevant control variable since there is some evidence that smaller firms may not invest in CSR strategies as much as do larger companies. Firm size is measured in terms of a firm's total sales on a log scale. The leverage of the firm is also an important control variable, and as a proxy for a risky behavior we include the level of debt held by the firm (long-term debt to total assets ratio). We introduce a Research and Development intensity indicator measured by the Research and Development expenses divided by total sales. To identify the non-reporting Research and Development expenditures, a dummy variable with a value of 1 is included if Research and Development expenses are not reported by firms. In order to control for sensitivity to the stock market variations, we introduce a dummy variable reporting firms listed at the Dow Jones STOXX600 index. We then also control for countries' differences by including countries dummies. Table 2 displays the average scores by country.

*[Insert Table 2]*

The best performances in terms of human scores are observed in France, Norway, the Netherlands and Germany. The best performances regarding environment are observed in Norway, Germany and the United Kingdom. Finally, the United Kingdom, the Netherlands, Finland and Norway report the highest scores for both corporate governance and business behavior criteria. For both social and environmental domains, Greece and Ireland report the lowest scores. It is worth controlling

for countries' differences since the level of CSR is likely to depend on the legal system.

Furthermore, clear differences in performance and CSR strategies may exist among different industries. Table 3 reports the average industry CSR scores.

*[Insert Table 3]*

Table 3 shows that the sectors who have the best performances in terms of CSR are also sectors which have to face a negative image in the public opinion regarding the environmental or social responsibility such as automobile, transport or energy industries. There are differences between industries with the lowest environmental and social rated sectors being media and hotel around 20 (as explained in appendix 7.1 the scores spread out from 0 to 100). We can observe that in general, social and environmental scores have the same magnitude and the same evidence can be observed for both corporate governance and business behavior (towards customers and suppliers). This descriptive analysis indicates the importance of controlling for sectors in the assessment of the relationships between financial performance and CSR. These evidence support our choice to introduce in the firm performance regressions the dummies CSR variables taking into account the sector average score performance, that is to rely on ratings rather than on continuous scores, as detailed in appendix 7.1 (see section 5.2.2).

### 4.2.2 Measuring firm performance and CSR

One of the reasons for the ambiguous relationship between CSR and firm performance lies in the difficulty of measuring and in the variety of available measures of CSR and CFP. Since CSR is integrated into business practices, it is by definition complicated to estimate its effects separately. Indeed, there is little consensus on the nature of variables that best measure both corporate performance and CSR.

Firm financial performance can be measured by different variables providing a range of measures used to assess corporate financial performance by the investment community. Studies use in general two accounting variables (return on assets and return on equity) and the Tobin's q indicator.

Accounting measures like return on assets, return on equity or return on sales, capture the historical aspects of firm performance (Mcguire et al., 1986). These types of variables are however subject to bias from managerial manipulation and differences in accounting procedures across countries (Branch and Cole, 1983). The Tobin's q represents a measure of return based on the stock market and is more sensitive to variations that may be independent of the operations and social activities of firms such as macroeconomic shocks and political issues and which can affect market values. The Tobin'q is also more dependent on industry-specific factors such

as rising or falling prices due to shifts in industry demand or restrictions on supply, as in the case of oil or other raw materials. Both market and accounting measures which represent different perspectives on how to evaluate firm financial performance, have different implications and are both subject to specific biases. In other words, accounting measures can suffer from biases from differences in accounting procedures. Market performance represents investors' evaluation of the ability of a firm to generate future economic earnings. However, market-based measure can be more appropriate to capture the expected future impact of CSR on performance (Hillman and Keim, 2001) since such variables are forward-looking measures rather than backward-looking measures (such as accounting performance variables). Thus, in order to control for such biases, first we introduce year dummies (year fixed effects) in order to control for macroeconomic variations and business cycle fluctuations homogeneous across individuals. Second, we include industry dummy variables to capture differences across industries. Considering all these evidence, we consider as our dependent variable, the Tobin's q.

Although, CSR is a multidimensional construct, the measures used in empirical studies have mainly been one-dimensional and have been applied to small sample of firms and cross sectional data. Each company differs in how it implements CSR. The differences depend on factors such as the firm's size, the particular industry involved, the firms business culture and the stakeholder demands. Some companies focus on a single dimension, which is either considered as the most important for them or where they have the highest impact or vulnerability, while others aim to integrate CSR in all aspects.

This paper proposes a multidimensional measure applied across a wide range of sectors and countries. In order to test the main predictions of our model and to deal with the measurement problems quoted above, CSR is reported into four subcategories: corporate governance, business behavior component (practices towards customers and suppliers), environmental criteria and social aspects[6]. Vigeo provides information on a rating for each item by sector. The score allocated to a company in each of the domains is adjusted in order to take into account the characteristics and risks related to the sector under review (see appendix 7.1. Here, given our theoretical model and in order to assess the strategic dimension of such corporate investments, we choose to consider criteria according to the relative importance of the social responsibility objectives in the sector concerned and not the continuous scores. Thus, we construct four CSR dummies equal to 1 if the firm is really active, i.e. if her respective score is equal or above the average score of the sector and equal to 0 otherwise (i.e. if her score is below the average of the sector)[7].

[6]Although, Vigeo provides CSR criteria divided into six fields, for computation reasons we restrict our analysis to these four practices which appear to be more complementary. Besides, we should note that the human rights criterion is not specified for all firms as it is not considered as a major stake in all sectors by Vigeo.

[7]The Vigeo rating variable has initially five modalities ranging from active to very inactive in the criterion considered.

In order to assess synergies derived from the adoption of alternative CSR strategies, we first estimate the pair-wise correlation between the four CSR sub-categories considered. Table 4 reports the estimation of unconditional correlations (e.g. Spearman rank correlation) between the four CSR dummies. Positive correlation points to complementarity between the different CSR activities.

*[Insert Table 4]*

We observe that business behavior (towards customers and suppliers), environmental and social rates are highly positively correlated and that they are in a lower proportion respectively correlated with the corporate governance score. The argument that complementarities exist among CSR practises is consistent with the view that they are highly correlated with each other. However, it should be quoted that since correlations might be induced by unobserved factors, we cannot conclude on a true existence of complementarities from these first results.

Besides, the high degree of intercorrelation among CSR practises indicates that empirical models that estimate the impact of any one CSR policy on firm performance will yield biased coeffcients due to the omission of the other CSR practises. One possible solution to this problem would be to enter the entire set of potentially important CSR variables into the firm performance equation. However, as pointed out by Ichniowski et al. (1997), this approach is confounded by the severe collinearity among CSR practices, making any one coefficient uninterpretable, and would not directly test whether combinations of CSR practises are the critical determinants of firm performance. In order to examine the effects of highly correlated variables sets, one should simultaneously estimate the effects of all the pair-wise interactions among the practises. Once more, a complete set of interaction terms still would be confounded by collinearity among practices, so finally we should identify common clusters of practices.

Following this approach, we first introduce in the firm performance regression the pair-wise dummies CSR interaction in order to test for complementarity. Second, we identify clusters of practises since each CSR activity is dichotomously measured. We construct exclusive categories to represent the four CSR activities. Table 5 displays the definition for the different CSR states. In particular, we define 16 dummy variables by following the convention of binary algebra. They are equal to one when the combination of CSR practices are adopted and zero otherwise. It should be noted that coefficient $\beta(0000)$ is normalized to zero in our empirical design. Thus, we introduce 15 dummies variables for exclusive combinations of CSR practises. Estimations will generate coefficients for mutually excluding dummies for the different indicator combinations.

*[Insert Table 5]*

## 4.3 Results

Table 6 displays the regression analysis for the system GMM estimations[8]. In all the specifications the set of instruments is composed of the dependent variable, the CSR scores and the control variables, all in lag two. We use robust standard errors and valid the two previously presented standard tests on misspecification. The Arellano and Bond test on autocorrelation supports the overall validity of the model by providing evidence of first order autocorrelation (AR1) and the absence of second order autocorrelation (AR2) while the Hansen test supports the consistency of the GMM instruments. Thus, our estimation controls properly for potential correlation between unobserved factors and the regressors, which is a critical issue in the empirical literature on complementarities (Leiponen, 2005). Finally, Blundell and Bond (1998) recommend the one-step results instead of the efficient two-step ones, which deflate standard errors and may produce "too" significant coefficients particularly if the data are heteroskedastic.

*[Insert Table 6]*

The positive and significant coefficient of the lagged dependent variable confirms that firm performance is persistent. Firm performance depends substantially on its own past realizations. Regarding control variables determining firm performance, we find that the majority of the estimates have the expected signs. Firm performance is negatively related to debt-to-asset ratio. Table 6 illustrates that both sales and Research and Development intensity have a positive impact on firm performance.

We then test for the sign of the relationship between CSR and firm performance. In line with the literature, the sign may imply negative, neutral or positive linkages between firm performance and CSR. A negative sign implies that socially responsible firms have a competitive disadvantage because they incur costs that reduce profits, while these costs could be avoided or borne by individuals or the government. However, many empirical results reveal no significant relationship between CSR and financial performance. The number of variables at play and the measurement biases may prevent to test properly for such a relation. Finally, a positive sign implies that the actual costs of CSR are covered by the benefits since socially responsible companies have less risk of negative events (fines, costly lawsuits etc.).

In order to accept complementarity, the coefficient of the interaction term has to be significantly larger than zero. A significant and negative coefficient would be a sign for submodularity and thus for the two CSR activities to be substitutes.

First, we observe that only performing actively business behavior (towards customers and suppliers) activity raises firm performance, but the other CSR activities

[8]Estimations were carried out using the Stata module Xtabond2 developed by D. Roodman (2006).

are non significant. Hence, our first prediction is confirmed for the business behavior component of CSR.

However, joint implementation of business behavior and human resources practises has a positive and significant impact on firm performance. We find also strong interaction effects associated with the adoption of environment and governance activities. Not only the returns of the environment policy is higher when it is adopted, but they are higher when corporate governance practise is implemented. In contrast, human resources and corporate governance on the one hand and environment and business behavior practices on the other hand seem to be rather substitutes as the significant and negative interaction term shows. Hence, our second prediction is partially confirmed, with complementarity between business behavior and human resources and between environment and governance, but with substitutability between human resources and governance and between environment and business behavior.

Table 7 displays the results with the CSR clusters which, in contrast to the first estimation with pair-wise CSR practices, have the advantage to test simultaneously for the four practices combinations. The coefficients on the different states convey little information. However, the test is inconclusive for most of the states. The corporate governance practice implemented alone has a positive impact on firm performance. As pointed out before, we do find complementarity for State1001 (between HR and CS). Finally, State1101 and State0111 coefficients show a strong interaction effect on firm performance. Thus, we can say that the coefficients for states with multiple practices are higher than those for individual practises thus suggesting that complementarity applies. In our theoretical model, under weak complementarity, the marginal return from one CSR practice increases when another CSR practice has already been implemented even if the rating over the other practice is below the sectoral average. Hence our prediction 4 is partially confirmed.

*[Insert Table 7]*

It is important to note that these empirical results only partially support our theoretical predictions since predictions 1 and 4 are only predicted for some specific combinations. Moreover, we still have to test more specifically predictions 2 and 3 of the model.

# 5 Ongoing tests and research

Several alternative empirical testing procedures have been derived to formally examine complementarity among business practices (see Athey and Stern, 1998 for an overview). More specifically, the productivity approach has been implemented in

various specifications in the innovation literature (Mohnen and Roller, 2005; Leiponen, 2005; Belderbos et al., 2006) with a precise examination of multiple complementarities. As pointed out by Mohnen and Roller (2005), the individual significance and signs of the coefficients on the obstacles do not directly reveal whether practices are complementary or substitutable for two reasons. First, complementarity involves testing linear restrictions of several coefficients. Second, complementarity requires testing the joint distribution of several of these linear restrictions. For both reasons, it is possible that all coefficients are statistically insignificant, even though the joint hypothesis for supermodularity is accepted.

In order to test the robustness of our results, we will use the productivity approach which is a direct test for supermodularity. Following Mohnen and Roller (2005), we will first obtain consistent and efficient estimates of the states coefficients as displayed in Table 7, and second CSR pair-wise practises will be tested using methods developed by Kodde and Palm (1986). This additional empirical strategy is under progress.

# 6 Conclusion

This article proposes a theoretical and empirical analysis of the interactions between firm CSR practices and performance. Our model shows that firms invest in CSR provided that they are relatively high performing and that the complementarity between CSR practices increases expected profits. The ongoing empirical debate on whether CSR activities do have or not a positive impact on firm performance reveals the difficulties to provide unambiguous evidence on the existence of positive synergies effects. Our empirical analysis examines the joint implementation of CSR practices measured by the interaction terms of the respective CSR practices. The results of our analysis are twofold. First, the empirical evidence suggests that there are significant complementarities between specific combinations of CSR practices. However, a straightforward conclusion cannot be drawn at this stage. Our empirical results on complementarity highlight their sensitivity to model specification and measurement. Hence, to extend our analysis and provide robust evidence, a productivity approach allowing for a direct proper test for supermodularity is needed and under progress.

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# 7 Appendix

## 7.1 Vigeo's rating methodology

Vigeo measures companies' CSR performance on 6 broad domains: Human Rights, Environment, Human Resources, Business Behaviour, Corporate Governance, Community Involvement. All of the 6 domains are not investigated for the whole sample by Vigeo because before companies are rated, an analysis is done to identify the key CSR issues within the business sector. This determines which criteria in each of the 6 domains will be activated. A 'weight' is then assigned to each criterion on a scale from 1 to 3, based on: the nature of the impact of the CSR issue on the sector's stakeholders; the exposure of stakeholders to that impact and the risks (legal, operational, etc.) run by companies in the sector that do not manage this impact adequately. Once the evaluation criteria have been customized for the sector, Vigeo's analysis focuses on how each company addresses each criterion in terms of Leadership, Implementation, and Results through a series of detailed questions:

- **Leadership**
  - Visibility: types of policies in place?
  - Content: content of these policies?
  - Ownership: responsibility for these policies?
- **Implementation**
  - Means and resources: programs and tools in place?
  - Scope: aspects addresses by these tools?
  - Coverage: parts of the company covered by these tools?
- **Results**
  - Indicators: quantitative data?
  - Controversies : stakeholder information ?

Each of these questions is scored on a scale from 0 to 100, representing the level of firm's CSR engagement and management of associated risks:

*Vigeo Scores*

| Points | Level of firm's CSR engagement and rsik management (RM) |
|---|---|
| 0 | Little evidence of commitment - Poor to very poor guarantee of RM |
| 30 | Commitment initiated - Poor to moderate guarantee of RM |
| 65 | Consolidated commitment - Reasonable guarantee of RM |
| 100 | Advanced commitment - Social responsibility objectives actively promoted |

Points given for each question are consolidated through a system of weighted averages to give an overall score for each criterion and each domain (out of 100).

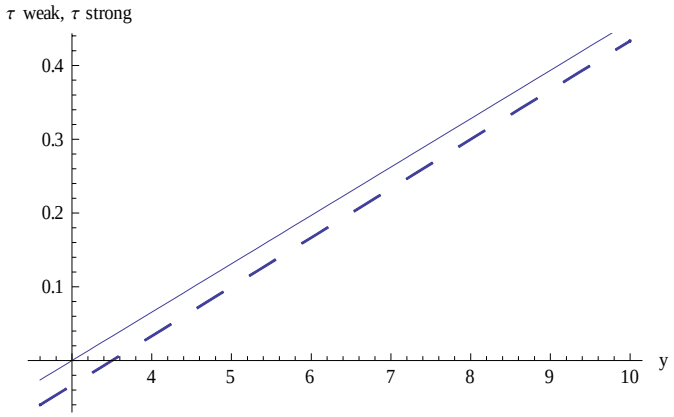
The score allocated to a company in each of the 6 domains is compared against the scores of all other companies in the sector.

This score leads to one of the 5 different ratings, depending on the distribution of scores within the sector, on that domain:

*Vigeo Ratings depending on the distribution of scores within the sector*

| | |
|---|---|
| - - | Company ranked as the least performing in the sector |
| - | Company ranked as below average performer in the sector |
| = | Company ranked as an average performer in the sector |
| + | Company ranked as an active performer in the sector |
| + + | Company ranked as a leading performer in the sector |

**Figure 1a: Investments in CSR under weak and strong complementarity**




Note : the dashed line corresponds to CSR investment under weak complementarity and the solid line corresponds to CSR investments under strong complementarity

**Figure 1b: Difference between CSR investments under weak and strong complementarity**

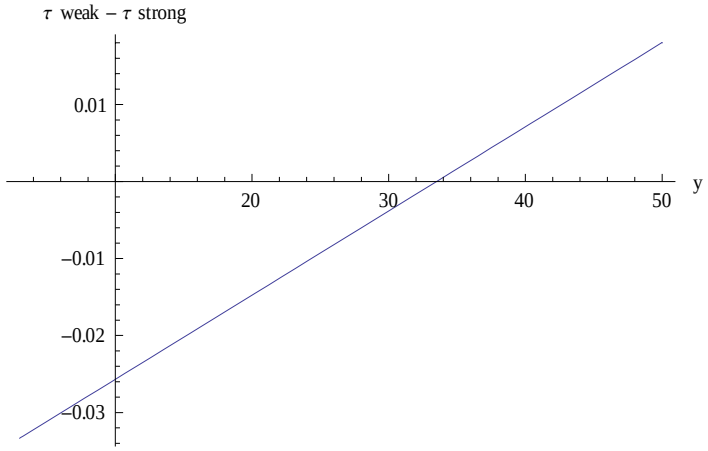
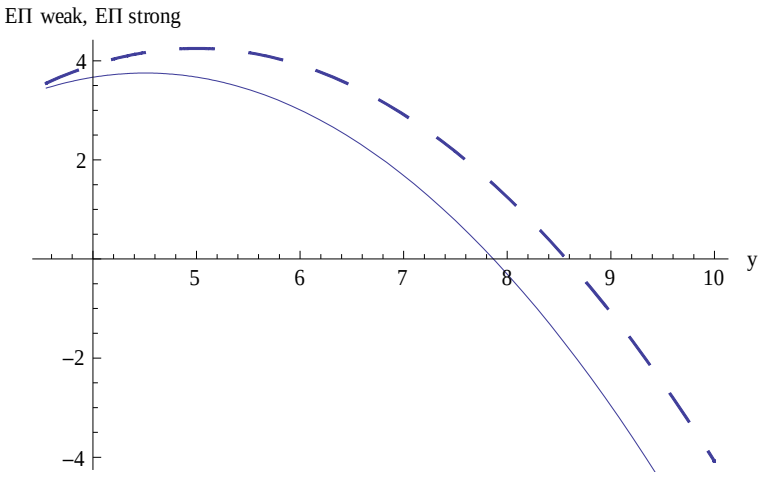



**Figure2: Expected profits under weak and strong complementarity**




Note : the dashed line corresponds to expected profits under weak complementarity and the solid line corresponds to expected profits under strong complementarity.

Table 1. Descriptive statistics

| Variable | Mean | SD | Min | Max |
|---|---|---|---|---|
| Tobinq | 1.28 | 1.17 | 0.11 | 11.26 |
| Ln_Sales | 15.64 | 1.36 | 11.64 | 19.55 |
| Ln_Assets | 15.98 | 1.33 | 11.97 | 19.45 |
| Debt_ratio | 0.20 | 0.14 | 0 | 1.13 |
| RD_ratio | 0.02 | 0.05 | 0 | 0.72 |
| RD_dummy | 0.58 | 0.49 | 0 | 1 |
| DJSTOXX600 dummy | 0.86 | 0.35 | 0 | 1 |
| HR_dummy | 0.66 | 0.47 | 0 | 1 |
| ENV_dummy | 0.67 | 0.46 | 0 | 1 |
| CG_dummy | 0.68 | 0.45 | 0 | 1 |
| C_S_dummy | 0.64 | 0.47 | 0 | 1 |

Table A1: Variables definitions and measures

| Variable | Definition |
|---|---|
| Tobinq | (Market value of common equity + preferred stock + total debt)/Total assets |
| Ln_Sales | Natural log of firm's annual net sales |
| Ln_Assets | Natural log of firm' annual total assets |
| Debt_ratio | Long term debt divided by total assets |
| RD_ratio | Research and Development expenses divided by total sales |
| RD_dummy | Dummy variable = 1 if firms do not have reported R&D expenses |
| HR_dummy | Dummy variable = 1 if firms have a human resources score equal or above the average sector |
| ENV_dummy | Dummy variable = 1 if firms have a environment score equal or above the average sector |
| CG_dummy | Dummy variable = 1 if firms have a corporate governance score equal or above the average sector |
| C_S_dummy | Dummy variable = 1 if firms have a business behaviour score (towards customers and suppliers) equal or above the average sector |

Table 2. CSR average scores per country

| Country | HR_score | ENV_score | CG_score | C_S_score |
|---|---|---|---|---|
| Belgium | 33 | 36 | 35 | 26 |
| Denmark | 33 | 35 | 34 | 35 |
| Finland | 42 | 37 | 50 | 38 |
| France | 43 | 35 | 40 | 40 |
| Germany | 42 | 40 | 42 | 40 |
| Greece | 19 | 15 | 27 | 21 |
| Ireland | 17 | 14 | 42 | 25 |
| Italy | 33 | 30 | 31 | 34 |
| Norway | 44 | 43 | 48 | 39 |
| Portugal | 37 | 37 | 28 | 33 |
| Spain | 35 | 35 | 39 | 31 |
| Sweeden | 33 | 38 | 40 | 41 |
| Switzerland | 36 | 37 | 43 | 40 |
| Netherlands | 42 | 37 | 49 | 43 |
| United Kingdom | 37 | 41 | 61 | 42 |

Table 3. CSR average scores per sector

| Sector | HR_score | Env_score | CG_score | C_S |
|---|---|---|---|---|
| Commerce | 28 | 29 | 48 | 40 |
| Consumption | 28 | 25 | 44 | 37 |
| Construction | 32 | 34 | 39 | 34 |
| Energy | 43 | 43 | 49 | 40 |
| Equipment | 28 | 20 | 41 | 38 |
| Finance | 42 | 35 | 50 | 45 |
| Hotel | 23 | 19 | 51 | 35 |
| IAA | 28 | 27 | 49 | 40 |
| Intermediary | 39 | 39 | 47 | 40 |
| ITC | 31 | 24 | 41 | 37 |
| Media | 24 | 21 | 46 | 33 |
| Telecom | 42 | 38 | 49 | 40 |
| Transport | 35 | 40 | 47 | 40 |

Table 4. Correlation matrix for CSR rates

| *CSR dummies* | *HR* | *ENV* | *CG* | *C_S* |
|---|---|---|---|---|
| HR | 1 | | | |
| ENV | 0.4591 | 1 | | |
| CG | 0.2505 | 0.2461 | 1 | |
| C_S | 0.4251 | 0.4391 | 0.3072 | 1 |

Chi-2 statistic is 0.001 for all pairs

Table 5. CSR states definition

| CSR activities | Combinations |
|---|---|
| Low scores for the four criteria | (0000) |
| Human resources only (HR) | (1000) |
| Environment only (ENV) | (0100) |
| Corporate governance (CG) | (0010) |
| Business behaviour (towards customers & suppliers; CS) | (0001) |
| HR & ENV | (1100) |
| HR & CG | (1010) |
| HR & CS | (1001) |
| ENV & CG | (0110) |
| ENV & CG | (0101) |
| CG & CS | (0011) |
| HR, ENV & CG | (1110) |
| HR, CG & CS | (1011) |
| ENV, CG & CS | (0111) |
| HE, ENV & CS | (1101) |
| HR, ENV, CG & CS | (1111) |

Table 6. GMM System estimation – CSR rates interaction

| Variables | Tobinq | |
|---|---|---|
| | Coeff | SE [a] |
| Lag Tobinq | 0.669*** | 0.090 |
| HR | 0.162 | 0.149 |
| ENV | 0.188 | 0.236 |
| CG | 0.151 | 0.154 |
| CS | 0.414** | 0.200 |
| HR & ENV | 0.052 | 0.198 |
| HR & CG | -0.332** | 0.166 |
| HR & CS | 0.823*** | 0.265 |
| ENV & CG | 0.397* | 0.235 |
| CG & CS | -0.333 | 0.269 |
| ENV & CS | -0.482** | 0.207 |
| Ln_Assets | -0.126*** | 0.044 |
| Ln_Sales | 0.051* | 0.028 |
| RD_ratio | 1.274*** | 0.299 |
| NoRD_dummy | 0.013 | 0.028 |
| Debt_ratio | -0.001 | 0.001 |
| DJSTOXX600 index | 0.136*** | 0.050 |
| Constant | 0.914*** | 0.339 |
| Year dummies | Yes | |
| Sector dummies | Yes | |
| Countries dummies | Yes | |
| AR1 | p = 0.007 | |
| AR2 | p = 0.215 | |
| Hansen test | p = 0.528 | |

[*] Significant at 10%; [**] significant at 5%; [***] significant at 1%

[a] Robust standard errors are reported

Table 7. GMM System estimation – CSR states

| Variables | Tobinq | |
|---|---|---|
| | Coeff | SE [a] |
| Lag Tobinq | 0.723*** | 0.084 |
| state1111 | 0.128 | 0.154 |
| state1110 | 0.247 | 0.201 |
| state1100 | 0.009 | 0.167 |
| state1000 | 0.136 | 0.150 |
| state1011 | 0.133 | 0.216 |
| state1001 | 1.651*** | 0.723 |
| state0111 | 0.293* | 0.172 |
| state0011 | 0.101 | 0.211 |
| state0010 | 0.199* | 0.112 |
| state0100 | 0.276 | 0.313 |
| state0110 | 0.051 | 0.504 |
| state0101 | 0.026 | 0.178 |
| state1010 | -0.072 | 0.170 |
| state0001 | -0.071 | 0.261 |
| state1101 | 0.417*** | 0.187 |
| Ln_Assets | -0.112*** | 0.042 |
| Ln_Sales | 0.044* | 0.017 |
| RD_ratio | 1.138*** | 0.302 |
| NoRD_dummy | 0.014 | 0.028 |
| Debt_ratio | 0.000 | 0.000 |
| DJSTOXX600 index | 0.130*** | 0.053 |
| Constant | 0.962*** | 0.345 |
| Year dummies | Yes | |
| Sector dummies | Yes | |
| Countries dummies | Yes | |
| AR1 | p = 0.008 | |
| AR2 | p = 0.238 | |
| Hansen test | p = 0.674 | |

[*] Significant at 10%; [**] significant at 5%; [***] significant at 1%

[a] Robust standard errors are reported