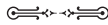


Complementarity between CSR Practices and Corporate Performance: An Empirical Study

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The empirical link between Corporate Social Responsibility (CSR) and Corporate Financial Performance (CFP) has received considerable attention for the last 35 years. Yet, no conventional wisdom tends to emerge as whether CSR leads (or not) to superior firm performance (see for instance, Margolis and Walsh, 2003, or Margolis, Elfenbein and Walsh, 2007).

Instead of analyzing the impact of a single dimension of CSR (focused on environmental, social or governance factors), this chapter examines whether it would rather be a set of complementary CSR practices and which set of practices would likely lead to superior performance. This issue represents a major stake for practitioners, politics and academics; as achieving sustainable development goals in a context of economic, financial and ecological worldwide crisis imposes well-fitted and profitable strategies to be implemented.

According to the abundant literature on corporate responsibility and performance, the relationship between CSR and firm profitability may in principle be negative, neutral or positive.

A negative sign would imply 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. A positive sign would imply that the actual costs of CSR are covered by the benefits since for instance socially responsible companies have less risk of negative events (fines, costly lawsuits etc.), and a better take into account the growing demands of their stakeholders, thereby minimizing risks and maximizing value in the long run through better management practices (Orlitzky et al. 2003).

However, many empirical results reveal no significant relationship between CSR and financial performance. The number of variables at play and the measurement biases may in fact prevent to test properly for such a relation. This issue is analyzed in Forget (2010).

One reason for this absence of consensus can be found in the criticisms raised by researchers pointing at numerous biases and problems with such type of studies (see e.g. Elsayed and Paton, 2005, or McWilliams and Siegel, 2000). In fact, many studies are confronted with limited data (small samples, old periods), often cross-sectional (ruling out the possibility of a dynamic analysis of performance). Besides, a number of

papers also rely on mis-specified empirical models leading to endogeneity¹ problems; or omitted variables in the determinants of profitability.

The results and the comparisons between these studies should therefore be considered with strong precaution. In particular, comparing the results of previous studies is all the more complicated as the measurements of both CSR and firm performance vary widely across articles.

For instance, different types of variables are considered as representative of a firm's CSR policy and are not always comparable. Environmental variables are measured by indicators such as disclosure of pollution control; expenditures on environmental practices; timing and intensity of pollution-reducing technologies; waste prevention practices etc. Social, governance and business behaviors variables are measured by indicators such as fortune reputation rating; contributions to community relations; observations of charitable contributions; expenses for consumer protection or product safety; equal employment opportunity policy; human resources practices; mutual fund screens; minority hiring and training; contributions to education and art; etc.

Similarly, firm performance is accounted for by different variables across studies. There are either accounting based measures (e.g. return on assets, on equity or on sales) or market based measured (e.g. Tobin's² q). While accounting measures capture historical aspects of a firm performance but are subject to bias from management manipulation and differences in accounting procedures (Branch and Cole, 1983); market-based measures focus on market performance and represent an investor's evaluation of the firm ability to generate future earnings, they are thus forward looking by nature (Hillman and Keim, 2001). Therefore both types of measures capture different dimensions of a firm's performance profile (past versus future performance in particular), and corporate social responsibility might affect firm performance differently, depending on whether accounting-based or market-based measures are used.

Another problem also lies in the direction and mechanisms of causation between CSR and firm performance. 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. Orlitzky et al. (2003) show for instance that CSR (reputation ratings, disclosures or observable outcomes) appears to be more highly correlated with accounting-based measures of firm performance than with market-based indicators, and CSR reputation indices (for instance the Fortune reputation rating) are more highly correlated with firm performance than are other indicators of CSR (for instance environmental performance indicators).

In this chapter, we consider that the absence of consensus on the links between CSR and intangible assets in general and corporate financial performance may suggest that it should be a specific combination of firm CSR policies that would likely lead to superior corporate performance. We therefore analyze the interactions between the different dimensions of CSR and their impact on corporate performance.

By considering that the nature of interaction among the different dimensions of a firm's CSR policy matters in the relationship between CSR and performance, we question what types of CSR practices would be rela-

1. A variable is endogenous when it is predicted by other variables than those in the model. For instance, the omission to control for R&D investment or firm size when explaining corporate firm performance (CFP) leads to mis-specification and endogeneity. The consequences are that in an econometrics regression, the independent variable will be correlated with the error term and the regression coefficient in a linear regression will be biased.

2. The Tobin's q is a ratio comparing the market value of a company's stock with the value of a company's equity book value.

tively more complementary (or substitutable) inputs of firm performance. Substitutability would imply that firms face a trade-off when deciding to engage in CSR (see e.g. the case of Wal-Mart which is considered as pro-active on environmental dimensions but very reluctant on social dimensions) whereas complementarity would imply that investing simultaneously in more than one dimension should be a profitable strategy. To examine this question, we propose an empirical analysis based on a matched dataset of environmental, social and governance ratings from the Vigeo database, together with performance indicators from the Orbis database.

This chapter is organized as follows. Section 2 develops our methodology. Section 3 presents our data and main results, and section 4 concludes.

Assumptions and Methodology

To analyze the impact of CSR on firm performance and the nature of interaction among CSR practices on this relationship, we have to make two definitions: the first one defines precisely CSR given our data, and the second defines the nature of interaction among CSR practices we will focus on.

Definition 1: Corporate social responsibility has several dimensions, which we group into five broad domains:

☞ *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, bio-diversity, waste management, management of local pollution, management of environmental impacts from transportation, etc.

☞ *A human resources component*

This dimension refers to responsible human resources management and respect for human rights: respect for human rights standards, nondiscrimination, elimination of child labor, management of safety, etc.

☞ *A business behavior (or clients and suppliers) component*

This dimension refers to firms' practices toward customers, suppliers and community in general: prevention of conflicts of interest, corruption or anti-competitive practices, product safety, information to consumers, integration of CSR in the supply chain, etc.

☞ *A community and human rights component*

This dimension refers to the involvement and respect for human rights: non discrimination, elimination of child labor, charitable contributions.

To define relative complementarity or substitutability among CSR practices, we rely on Milgrom and Roberts (1995)'s notion of complementarity, whereby two or more practices are complements, when using one

more intensively increases the marginal benefit of using others more intensively. Applying this definition to the analysis of the relationship between CSR and firm performance leads to the following definition.

Definition 2: Complementarity or substitutability between CSR dimensions

Two CSR practices are relative complements (resp. substitutes) when the presence of one increases the marginal impact on the firm performance of the other.

Given our definition of CSR and relative complementarity, we can write the following testable assumptions.

Assumption 1: Two CSR practices are relative complements (resp. substitutes) if their joint impact on firm performance is positive (resp. negative).

When CSR practices are relative complements, their impact on firm performance should be higher than when they are relative substitutes, as using one more intensively increases the marginal benefit of the other, and vice versa. Hence, we have the following testable assumption.

Assumption 2: Complementary CSR practices have a higher impact on firm performance than substitutable CSR practices.

We now present our empirical strategy and results.

Empirical Strategy and Results

Data Description and Variables

The corporate social performance variables come from the **Vigeo** database, and the economic and financial performance variables come from the **Orbis** database.

Vigeo is the leading European Corporate Social Responsibility rating agency, it measures companies' CSR performance on Environmental, Social and Governance (ESG) criteria, and identifies ESG risk factors.

The areas³ under review are: Human Rights, Environment, Human Resources, Business Behavior, Corporate Governance, and Community Involvement.

All of the six 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.

3. Out of these 6 broad domains, up to 40 criteria are covered, among which: Respect for freedom of association and right to collective bargaining, Promotion of labor 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, Contribution to general interest causes, Balance of power & functioning of board of directors, Remuneration of directors and key executives etc.

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 addressed 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.

Points	Level of company's CSR engagement and management of associated risks
0	Little evidence of commitment – Poor to very poor guarantee of risk management
30	Commitment initiated – Poor to moderate guarantee of risk management
65	Consolidated commitment – Reasonable guarantee of risk management
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).

Our economic and financial performance variables come from the **Orbis database (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 annual accounts, consolidated and unconsolidated, together with financial profile (balance sheet, P&L account, financial ratios), activities and ownership, such as 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.

From this type of database, two types of variables are available to measure corporate performance. On the one hand, 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, 1983). On the other hand, market based measures like Tobin's Q (market value divided by book value) are more forward looking and focus on market performance. They are less susceptible to different accounting procedures and represent the investor's evaluation of the firm's ability to generate future economic earnings (McGuire et al., 1988).

Market-based measure can be more appropriate to capture the expected future impact of CSR on performance since such variables are forward-looking measures (Hillman and Keim, 2001); therefore we rely here on a market based performance measure the Tobin's q. Such an indicator reflects the financial market valuation of firm performance, including the level and risk of future profitability. Our analysis hence allows examining how (and which combination of) CSR strategies affects future profitability valued on financial markets in a dynamic setting (see the econometrics method below).

Variable Definition and Descriptive Statistics

Table 1 presents the variables used in our estimations. To measure firm performance, we rely on a market measure, and use the Tobin's q as indicator, defined as the sum of the market value of common equity, preferred stock and total debt, divided by total assets.

The control variables characterizing firm's operations level (e.g. sales, R&D), financial structure and risk are defined in table 1. Descriptive statistics for these variables are provided in table 3.

Table 1: Variables Definitions for Firms' Characteristics

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

Firm size is measured by sales on a log scale, and is a relevant control variable as smaller firms might invest less in CSR than larger firms. Firm leverage also represents an important control variable, and a proxy for risk is given by the level of debt (long-term debt to total assets ratio). R&D is defined as R&D divided by total sales. Many firms however do not report on their R&D expenditures, thus a dummy variable is included which takes the value of 1 if the firm's R&D expenses are not reported. To control for sensitivity to the stock market variations, we introduce a dummy variable reporting firms listed at the Dow Jones STOXX600 index. We also control for countries' differences by including countries dummies.

To measure CSR, we rely on the scores attributed by Vigeo and thus take into account the fact that CSR is a multidimensional construct. For computation reasons, out of the six broad domains evaluated by Vigeo, we restrict our attention to four practices:⁴ environment (ENV), human resources (HR), corporate governance (CG), clients and suppliers (CS). The score allocated to a company on each domain is adjusted in order to take into account the characteristics and risks related to the sector. Rather than using discrete measures of each CSR practice (i.e. having or not implemented a practice) we use continuous measures of CSR practices and take into account their intensity.

4. In particular, one should note that the human rights factor is not evaluated in a systematic way in the database because it is not considered as a major stake for all sectors by Vigeo.

Table 2 provides the descriptive statistics for all variable used in our analysis.

Table 2: 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 score	36.96	0.52	0	82
ENV score	35.78	0.59	0	87
CG score	46.31	0.47	3	91
C_S score	39.09	0.44	6	81

Tables 3 and 4 report the CSR average scores per country and per sector.

Table 3: CSR average scores per Country

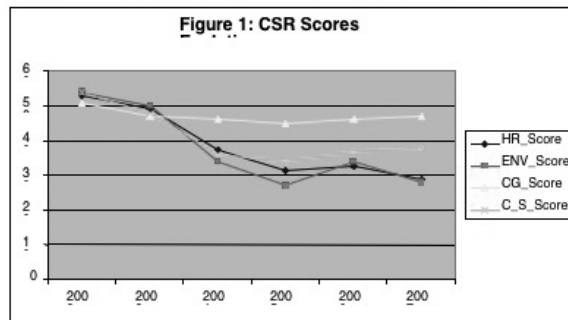
Country	HR_Score	ENV_Score	CG_Score	C_S_Score
Belgium	33	36	35	26
Denmark	33	35	34	35
Finland	42	37	50	38
France	43	35	40	40
Germany	42	40	42	40
Greece	19	15	27	21
Ireland	17	14	42	25
Italy	33	30	31	34
Norway	44	43	48	39
Portugal	37	37	28	33
Spain	35	35	39	31
Sweden	33	38	40	41
Switzerland	36	37	43	40
The Netherlands	42	37	49	43
United Kingdom	37	41	61	42

Table 4: CSR Average Scores per Sector

formation on financial data, and firms which are not observed over at least two consecutive years (as detailed in section 3 below, in our estimations we introduce the lagged value of the dependent variable and therefore we need to have at least two consecutive years of observation for each firm).

In sum, our final unbalanced panel sample comprises 1 094 observations (around 300 firms per year) belonging to about 15 countries over the period 2002- 2007.

Figure 1 displays the comparative evolution of these score over the period. We observe that the evolution of CG score is regular (small decrease over the period). However, the HR, ENV and CS scores appear more sensitive to macroeconomic fluctuations like institutional modifications. The fact that environmental, governance or business behaviors (clients and suppliers) scores tend to decrease over the 2002-2007 period might be explained by institutional factors pertaining to maturation of Vigeo's ESG analysis and/or stronger market contestability on these dimensions of CSR.



Thus, first we introduce year dummies 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.

Empirical Strategy

A first preliminary investigation of possible synergies and interactions between CSR factors can be conducted by examining the correlations between the different ESG scores.

Table 5 thus reports the estimation of the unconditional correlations (Spearman rank correlation) between the 4 CSR scores.

Table 5: Correlation Matrix for CSR Scores

CSR Scores	HR	ENV	CG	C_S
HR	1			
ENV	0.7469	1		
CG	0.2756	0.3170	1	
C_S	0.6805	0.6784	0.3959	1

Chi-2 statistic is 0.001 for all pairs.

Table 5 shows that scores on environment are highly positively correlated with human resources, client and suppliers, as well as scores on human resources and client and suppliers. This suggests that there are some synergies or complementarities between CSR factors at the firm level.⁵ However, those correlations might be induced by unobserved factors; therefore we have to go further in the empirical analysis.

The high degree of inter-correlation among CSR practices reported in table 5 indicates that empirical models estimating the impact of any one CSR policy on firm performance will yield biased coefficients due to the omission of the other CSR practices.

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 by Ichniowski et al. (1997), this approach is subject to a severe collinearity problem among CSR practices, making any one coefficient impossible to interpret. Besides, this strategy would not directly test if the combinations of CSR practices are the critical determinants of firm performance. In order to examine the effects of highly correlated variables sets, we rather simultaneously estimate the effects of all the pair-wise interactions among the practices.

When estimating the relationship between CSR investment and firm performance, current performance is likely to be correlated with both observable and unobservable factors that explain CSR strategies; and the direction of causality may go from CSR to performance or from performance to CSR (see our discussion in the introduction of this chapter). The key point here is to take into account both endogeneity problems and the dynamics of firm performance when estimating the relationship between CSR and performance. A dynamic panel data model allows us to control for persistence (lagged value) in performance levels and differences among firms (unobservable heterogeneity).

To obtain consistent and unbiased results, we estimate the relationship between CSR and firm performance using the dynamic Generalized Method of Moments technique (System GMM method, see Blundell and Bond, 1998). More precisely, we estimate firm's performance (as measured by Tobin's q), labeled $Y_{i,t}$, its lagged value $Y_{i,t-1}$, the CSR scores, labeled $CSR_{i,t}$, and a set of control variables, labeled $X_{i,t}$, according to the following equation:

$$Y_{i,t} = \beta_1 Y_{i,t-1} + \beta_2 CSR_{i,t} + \beta_3 X_{i,t} + \gamma_i + \epsilon_{i,t}$$

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

The system GMM estimator⁶ enables us to obtain consistent estimates by controlling for lagged values of the dependent variable, unobserved heterogeneity, simultaneity, 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 second-order 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 to check the validity of the instruments used. The overall validity of the instruments can be corroborated by a test of over-identifying restrictions: the Hansen J statistic.

5. Note that the corporate governance factor differs from the other criteria in that it is less correlated and relatively more stable (very slight decrease over the period, see figure 1) compared to the other scores.

6. For details on the advantages of such an econometrics estimation technique, see Cavaco and Crifo (2009).

Our results are detailed in the following section.

Results: Complementarity and Substitutability between CSR Scores?

Table 6 displays the regression analysis for the system GMM.

Table 6: GMM System Estimation – CSR Scores Interaction

Variables	Tobinq	
	Coeff	SE a
Lag Tobinq	0.719***	0.081
HR	0.017*	0.010
ENV	-0.0219*	0.013
CG	0.012*	0.006
CS	0.028	0.017
HR & ENV	-0.00003	0.00017
HR & CG	-0.00038**	0.0002
HR & CS	0.00001	0.0003
ENV & CG	0.00055**	0.00021
CG & CS	-0.00047*	0.00025
ENV & CS	-0.00009	0.0001
Ln_Assets	-0.130***	0.037
Ln_Sales	0.0507**	0.024
RD_ratio	1.142***	0.286
NoRD_dummy	0.021	0.0266
Debt_ratio	-0.00005	0.00004
DJSTOXX600 index	0.082*	0.045
Constant	0.526*	0.29
Year dummies	Yes	
Sector dummies	Yes	
Countries dummies	Yes	
AR1	p = 0.008	
AR2	p = 0.111	
Hansen test	p = 0.741	

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

a Robust standard errors are reported

Let first note that 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.⁷ Our results show that three groups of variables are significant determinants of firm market performance, measured by the Tobin's q .

The first group of determinants is traditional in the empirical literature on firm performance: firm performance is increasing in sales and decreasing in assets, an expected result (Baron, Harjoto and Jo, 2008) found a similar pattern on American data. Firm performance is also increasing in R&D (and the absence of information on R&D expenses or no R&D expenses do not impact this link). Belonging to the group of DJSTOXX600 also positively affect firm performance in the long run as it might be expected.

Finally, lagged performance raises current firm performance, i.e. firm performance is persistent. This result is important as it shows that in our dynamic setting, econometric estimations of firm performance should not omit past performance as it is a significant explanatory variable of current performance.

The second group of variables relates to the CSR scores and their interaction (see assumption 1 and the description in the previous section).

We see that when we include all the practices in the same regression, the firm performance increases with scores on human resources and corporate governance, but decreases with scores on environment when those scores are treated as isolated practices. In short, in isolation, the social and business behaviors scores positively affect corporate performance but the environmental score has an opposite effect on firm performance. These results are consistent with the evidence found by Orlitzky et al. (2003).

However, when considering these practices in combination (pair-wise), we observe that obtaining good scores on environment and corporate governance increases firm performance, while the combined scores on human resources and corporate governance or on corporate governance and clients and suppliers have a negative impact on firm performance.

In other words, our results suggest that environment and corporate governance appear to be complementary inputs in raising firm performance, whereas human resources and governance or governance and business behaviors rather appear to be substitutable (and more costly) inputs in explaining firm performance. Moreover, in line with assumption 2, we do observe that for CSR practices such as environment and corporate governance, the interaction coefficient is higher and thus highlights that complementary ESG factors may have a higher impact on firm performance than substitutable CSR factors.

Hence, the relative complementarity or substitutability between environmental, social and governance policies matters in the long run relationship between CSR and CFP.

Our results suggest that firms' (future) profitability valued on financial markets is positively affected by CSR policies relying on a combination of good environmental and governance practices. Firms are likelier facing a trade-off in terms of human resources and governance or governance and clients and suppliers. Future profitability (higher Tobin's q) is likely to increase with high scores on both environmental and governance factors and some firms may be tempted to 'specialize' (independently on human resources, business behaviors or governance) rather than invest in several dimensions simultaneously.

7. Other specifications have been tested and our qualitative results remain.

Conclusion

This chapter proposes an empirical analysis of the interactions between different CSR practices and firm performance. 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 individual score and the interaction terms of the respective CSR practices. On one hand, our empirical evidence suggests that there are synergies between specific combinations of CSR practices. In particular, some specific complementary CSR practices are likely to positively affect firm performance. Some combinations may on another hand be relatively substitutable highlighting a trade-off between the various dimensions of CSR.

These results represent a first step of the analysis of the complementarity between CSR practices. A second step will be to estimate simultaneously common clusters of CSR practices rather than simple interaction terms between pair-wise scores.

However, instead of analyzing complementarities between continuously measured scores, one has to examine the effect of discrete practices. Hence, to extend our analysis and test for the robustness of these first results, a 'productivity approach' allowing for a direct proper test for supermodularity is needed (see Mohnen and Roller, 2005).⁸ This is our agenda for future research.

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