Dynamic Panel Model Test on the Impact of Environmental Accounting Information Disclosure on Enterprise Value-Based on Stata Analysis

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Abstract: This article focuses on the impact of environmental accounting information (EAI) disclosure (EAID) on enterprise value. On the basis of diverse and representative sample selection, this article collects data from corporate annual report, social responsibility report and financial database, and uses dynamic panel model and Stata analysis method to explore the relationship between them. Descriptive statistics show that the average Tobin Q value of sample enterprises is 1.85, and the average EAID index is 35.62, with obvious differences among enterprises. Correlation analysis shows that EAID is positively related to enterprise value. The regression results of dynamic panel model show that the index coefficient of EAID is 0.02, which is significant at the level of 1%, indicating that it has a positive impact on enterprise value; Enterprise scale and profitability are also positively correlated with enterprise value, while financial leverage is negatively correlated. The research proves that improving the disclosure level of EAI is of positive significance to improving the value of enterprises and provides decision-making reference for enterprises, investors and regulatory agencies.

1. Introduction

With the increasingly serious global environmental problems, as the main body of economic activities, the environmental behavior of enterprises has attracted much attention [1]. EAID, as an important way for enterprises to show their environmental responsibilities and environmental performance to the outside world, has gradually become the focus of academic research and practical discussion [2-3]. At the same time, the maximization of enterprise value is always the core goal of enterprise management, and how to realize the coordinated development of the two has become an important issue to be solved urgently [4].

Previous studies focused on the content and quality of EAID. Although the internal relationship between EAID and enterprise value was involved, there is still room for improvement in research depth and breadth [5]. Some studies only analyze the relationship between them from a static point of view, and fail to fully consider the characteristics of enterprise value affected by various dynamic factors [6]. This study will use the dynamic panel model, based on Stata analysis, to deeply explore the impact of EAID on enterprise value, and strive to fill this research gap.

From the perspective of enterprises, an accurate understanding of the relationship between EAID and enterprise value will help enterprises to formulate more scientific and reasonable environmental strategies and information disclosure strategies, and enhance their competitiveness and sustainable development capabilities. For investors, the relevant research results can provide a more comprehensive and accurate reference for their investment decisions and help them identify the potential risks and values of enterprises. As far as regulators are concerned, the conclusion of this study can provide strong theoretical support and empirical basis for improving the EAID system and guiding enterprises to standardize disclosure behavior. Through rigorous empirical analysis, this article aims to clearly reveal the direction and extent of the impact of EAID on enterprise value, and deeply analyze the impact mechanism.

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2. Research and design

2.1 Sample selection and data source

The purpose of this study is to comprehensively and accurately reveal the impact of EAID on enterprise value, so the diversity of industries and the representativeness of enterprises are fully considered in sample selection. The sample covers many industries, including but not limited to manufacturing, energy industry, chemical industry and other industries with high pollution and high energy consumption, as well as some service industries and high-tech industries, so as to make the research results widely applicable.

Specifically, the research sample is 50 listed companies in 2015-2022. The listed companies are chosen as the research object, mainly because their information disclosure is relatively standardized and open, which is convenient for obtaining a large number of accurate data. The data sources are extensive and reliable. On the one hand, corporate annual reports, social responsibility reports and environmental reports are important sources to obtain data related to EAID. These reports record the information of enterprises in environmental governance investment, pollutant discharge and environmental performance in detail. On the other hand, financial databases, such as CSMAR, provide convenience for obtaining financial data and market value-related data of enterprises, including financial indicators such as balance sheet and income statement of enterprises, as well as market data such as stock price and market value. Through multi-channel data collection, the integrity and accuracy of the research data are ensured, which lays a solid foundation for the subsequent empirical analysis.

2.2 Variable setting

Explained variable: In this study, the enterprise value is taken as the explained variable, and $Tobin\ Q$ value is selected to measure it. $Tobin\ Q$ value is equal to the ratio of enterprise market value to asset replacement cost, which comprehensively reflects the market's expectation of enterprise's future profitability and growth potential, and can comprehensively reflect enterprise value. Its calculation formula is:

$$TobinQ_{it} = \frac{\left(Market\ value\ of\ tradable\ shares + Book\ value\ of\ non\text{-}tradable\ shares + Book\ value\ of\ liabilities\right)}{Asset\ replacement\ cost} \tag{1}$$

The advantage of using $Tobin\ Q$ value is that it not only considers the book value of the enterprise, but also integrates the evaluation of the enterprise by the market, which can more accurately reflect the true value of the enterprise in the capital market.

Explanatory variable: The disclosure level of EAI is the core explanatory variable of this study. In order to accurately measure this variable, a comprehensive EAID index is constructed. The index covers the information of enterprises' environmental policies and objectives, environmental costs and benefits, environmental governance measures and effects. Through the detailed content analysis of enterprise-related reports, according to the pre-set scoring standards, the information disclosure of each dimension is scored, and then the EAID index (EDI) is obtained by weighted summary. The determination of weight refers to the opinions of experts in related fields and the experience of past research to ensure that the index can reasonably reflect the true level of corporate EAID.

Control variables: Considering that the enterprise value may be affected by many factors, a series of control variables are selected. The scale of an enterprise ($Size$), measured by the natural logarithm of its total assets, usually has advantages in resource acquisition and market share, which may have an impact on its value. Financial leverage (Lev), expressed by asset-liability ratio, reflects the debt burden of an enterprise. Excessive debt may increase the financial risk of the enterprise, and then affect the value of the enterprise. Profitability (ROE), measured by return on net assets, reflects the ability of an enterprise to obtain profits by using shareholders' equity. The

more profitable an enterprise is, the higher its value is. In addition, the Industry dummy variable (industry) and the annual dummy variable (Year) are also included to control the influence of industry characteristics and macroeconomic environment on enterprise value.

2.3 Model construction

Enterprise value has the characteristics of dynamic change, which is not only influenced by various factors in the current period, but also related to the past enterprise value level. The traditional static model cannot fully capture this dynamic relationship, while the dynamic panel model can effectively solve this problem. It can analyze the dynamic adjustment process of enterprise value and describe the long-term influence of EAID on enterprise value more accurately by incorporating the lag term of the explained variable into the model. Dynamic panel model can also alleviate endogenous problems to some extent and improve the reliability of estimation results. Based on the above considerations, the following dynamic panel model is constructed:

$$TobinQ_{it} = \alpha + \beta_1 TobinQ_{i,t-1} + \beta_2 EDI_{it} + \sum_{j=3}^{n} \beta_j Control_{jit} + \mu_i + \lambda_t + \in_{it} \quad (2)$$

Where: $TobinQ_{it}$ represents the $TobinQ$ value of the i enterprise in the t period; $TobinQ_{i,t-1}$ is the $TobinQ_{it}$ value of the i enterprise in $t-1$ period, which reflects the lag effect of enterprise value. EDI_{it} is the EAID index of i company in t period. $Control_{jit}$ represents the value of the j control variable in the t period of the i enterprise, including enterprise scale, financial leverage, profitability, etc. μ_i is an individual fixed effect, which is used to control the heterogeneous factors that do not change with time at the individual level of enterprises. λ_t is a time-fixed effect to capture common factors such as macroeconomic environment that change with time. $\in_{it}$ is a random error term. Through this model, Stata software is used for estimation and analysis to explore the influence of EAID on enterprise value.

3. Empirical results and analysis

3.1 Descriptive statistical analysis (DSA)

Firstly, DSA is carried out, and the results are shown in Table 1.

Table 1 Descriptive Statistics

Variable	Mean	Standard deviation (SD)	Minimum	Maximum
Tobin Q	1.85	0.72	0.56	4.21
EDI	35.62	12.45	10.00	78.00
Size	21.34	1.27	18.56	24.11
Lev	0.43	0.15	0.12	0.78
ROE	0.12	0.08	-0.05	0.35

The average value of $Tobin\ Q$ is 1.85, indicating that the ratio of the average market value of sample enterprises to the replacement cost of assets is at a certain level, but the SD is 0.72, indicating that the value difference between enterprises is obvious. The average value of the disclosure index EDI of EAI is 35.62, and the SD is 12.45, which reflects that there is a big gap in the disclosure level of EAI among enterprises. Some enterprises have higher disclosure level, while others are relatively low. The average value of enterprise scale $Size$ is 21.34, and there are certain fluctuations in different enterprise scales. The average value of financial leverage Lev is 0.43, which indicates that the debt level of the whole sample enterprises is moderate. In terms of profitability, the average ROE is 0.12, which shows that the overall profitability of the sample enterprises is acceptable, but there are also enterprises with poor profitability (the minimum value is

-0.05).

3.2 Correlation analysis

In order to test whether there is multicollinearity between variables, correlation analysis is carried out, and the results are shown in Table 2.

Table 2 Correlation Analysis

Variable	*Tobin Q*	*EDI*	*Size*	*Lev*	*ROE*
Tobin Q	1	-	-	-	-
EDI	0.35**	-	-	-	-
Size	0.28**	0.22**	-	-	-
Lev	-0.25**	-0.18*	-0.30**	-	-
ROE	0.42**	0.27**	0.33**	-0.21*	1

Note: * means significant at 5% level, * * means significant at 1% level.

The correlation coefficient between EAID index EDI and $Tobin\,Q$ value is 0.35, and there is a significant positive correlation at the level of 1%, which preliminarily indicates that the higher the level of EAID, the higher the enterprise value may be. There is a positive correlation between enterprise scale $Size$ and $Tobin\,Q$ value and EAID index, which shows that larger enterprises often have higher value and better EAID level. Financial leverage Lev is negatively correlated with $Tobin\,Q$ value and EAID index, and significantly correlated with $Tobin\,Q$ value at 1% level, which means that higher debt burden may reduce enterprise value and EAID level. Profitability ROE is positively correlated with $Tobin\,Q$ value and EAID index, indicating that enterprises with strong profitability usually have higher value and better EAID. The correlation coefficient between the variables is mostly less than 0.5, so it is preliminarily judged that there is no serious multicollinearity problem, and further regression analysis can be carried out.

3.3 Regression results of dynamic panel model

Stata software is used to estimate the dynamic panel model, and the regression results are shown in Table 3.

Table 3 Dynamic Panel Model Regression Results

Variable	Coefficient	Standard Error	T - value	P - value
$TobinQ_{i,t-1}$	0.58**	0.06	9.67	0.000
EDI_{it}	0.02**	0.005	4.00	0.000
$Size_{it}$	0.15**	0.03	5.00	0.000
Lev_{it}	-0.30**	0.08	-3.75	0.000
ROE_{it}	0.22**	0.04	5.50	0.000
Constant	-2.15**	0.45	-4.78	0.000

Note: * means significant at 5% level, * * means significant at 1% level.

The lag $TobinQ_{i,t-1}$ coefficient of $TobinQ$ value is 0.58, which is significant at the level of 1%, indicating that the enterprise value has a strong inertia, and the early enterprise value has a positive impact on the current enterprise value. The coefficient of EAID index EDI_{it} is 0.02, which is also significant at the level of 1%. This further proves that EAID has a significant positive impact on enterprise value, that is, $TobinQ$ value will increase by 0.02 units for every unit of EAID level. The $Size_{it}$ coefficient of enterprise scale is 0.15 and significant, which shows that the expansion of enterprise scale is helpful to enhance enterprise value. The Lev_{it} coefficient of financial leverage

is -0.30, which is significantly negative, indicating that excessive financial leverage will reduce the enterprise value. The ROE_{it} coefficient of profitability is 0.22 and is significantly positive, which shows that the enhancement of profitability has a positive effect on the promotion of enterprise value.

To sum up, through DSA, the basic characteristics of sample data are understood, the relationship between variables is preliminarily judged by correlation analysis, and the regression results of dynamic panel model further verify that EAID has a positive impact on enterprise value. At the same time, the direction of other control variables on enterprise value is clarified, and the research hypothesis is strongly supported.

4. Conclusions

Through rigorous empirical analysis, this study reveals the close relationship between EAID and enterprise value. Descriptive statistics of sample data show that enterprises have great differences in value and information disclosure level. Correlation analysis preliminarily verifies the positive correlation between EAID and enterprise value, and the regression result of dynamic panel model further clarifies that Tobin Q value will increase by 0.02 unit for every unit of EAID index, which strongly proves that it has a significant positive impact on enterprise value.

Enterprise scale and profitability have a positive effect on enterprise value promotion, while excessive financial leverage will reduce enterprise value. This shows that enterprises need to control the debt level reasonably while pursuing scale expansion and profit growth. For enterprises, we should attach importance to and improve the quality of EAID, so as to enhance the market's recognition of its own value. For investors, the disclosure level of enterprise EAI can be taken into consideration in investment decision-making. Regulators should strengthen relevant supervision and promote enterprises to standardize the disclosure of EAI. This study provides valuable reference for all parties, helps enterprises achieve win-win economic and environmental benefits, and promotes the sustainable development of the market.

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