**Variable definitions and descriptions**

|  |  |  |  |
| --- | --- | --- | --- |
| Types | Variable | Name | Calculation/Value |
| Explained variable | ESG | Corporate ESG performance | Huazheng ESG Quarterly Rating Assignments (1-9), averaged and logarithmic. |
| Core Explanatory variable | IM | Intelligent Manufacturing Development Levels | The logarithm of the sum of intelligent manufacturing keyword frequencies plus 1 |
| Mediating variables | TRANS | Information Transparency | Constructed from percentile means of five transparency-related variables |
| GTI | Green Technology Innovation | ln(number of green patent applications+1) |
| CI | Supply Chain Collaborative Innovation | ln(the sum of joint patent applications by customers and suppliers+1) |
| Control variables | SIZE | Corporate Size | The natural logarithm of the corporate's total assets. |
| Age | Corporate Age | Year of operation of the enterprise = Year of observation - Year of establishment of the enterprise |
| LEV | Financial Leverage | Total liabilities/Total assets |
| ROA | Return On Assets | Operating profit for the year/Total assets at the end of the year |
| GRO | Growth Rate of Operating Revenue | (Operating income for the current period - Operating income for the previous period)/(Operating income for the previous period) |
| CAS | Cash Flow Ratio | Net cash flows from operating activities/Total assets |
| BM | Book-to-market Ratio | Annual book assets/Total market capitalization at year-end |
| IND | Ratio of Independent Directors | Number of independent directors/Number of directors |
| TOP | Equity Concentration | Sum of shareholdings of the company's top 10 largest shareholders |
| Robust test variables | ESG2 | Corporate ESG performance | Bloomberg ESG index |
| IM2 | Intelligent Manufacturing Development Levels | the keyword range for IM was adjusted and narrowed down to six specific terms |
| IV\_IM | Instrumental variables | Instrumental variables for IM |
| Heterogeneity Analysis variables | CO2 | Carbon Emission Risk | 1 is high carbon emission risk firm, 0 is low carbon emission risk firm |
| SOE | Nature of Property Rights | 1 is state-owned enterprises, 0 is non-state-owned enterprises |
| TEC | Industry Traits | 1 is high-tech enterprises, 0 is non-high-tech enterprises |