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The Moderating Role of Agency Problems in the Context of the Impact of Business Strategy on Labor Investment Efficiency[1]

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Research Paper

Abstract

In this research, the moderating role of agency problems was investigated in the context of the impact of business strategy on the labor investment efficiency in companies listed on the Tehran Stock Exchange during the final period 2017-2022. For this study, a sample of 134 companies was selected. The pooled/panel regression models were applied to analyze of data in EViews 10 and Stata17. The findings of the research showed that among the different criteria of the business strategy, only the effect of the prospector strategy on labor investment efficiency of the companies was negative and significant. In other words, companies with a prospector strategy generally face higher risk in terms of labor investment. One of the reasons for this is the complexity and difficulty of predicting the optimal labor demand for such companies. However, the labor investment efficiency of companies has been independent of the overall score of business strategy and defender strategy. Also, the relationship between business strategy and labor investment efficiency has been independent of the moderating variable of agency problems.

Keyword: Agency Problems, Business Strategy, Labor Investment Efficiency.

JEL Classification: H21, G10, G19.

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Introduction

Efficient investment is a key driver of the economic development of companies and business enterprises. According to annual reports from the United States Census Bureau, manufacturers in 2015 spent $923 billion on salaries and employee benefits compared with $240 billion in capital expenditures. Beyond direct labor costs, firms also allocate substantial resources to maintaining employee health and safety. Therefore, considering the significant direct and indirect labor-related expenses, the efficiency of labor investment becomes essential for firms seeking profitability and competitive advantage (Habib & Hasan, 2019, p.4). In this regard, Merz and Yashiv (2007, pp.1419-1422) contend that a company's value is shaped more by its labor investment and the value generated by its workforce than by its physical capital. Similarly, Chowdhury et al. (2025, p.1-3) argue that social capital enhances the efficiency of labor investment.

With the expansion of human societies and the growth of business markets, companies must adapt to dynamic conditions to sustain and strengthen their competitive position and improve strategic decision-making (Rezaei & Mehrazin, 2013, p.90-91). Miles and Snow (1978, pp.549-551) define business strategy as senior managers' response to the opportunities and constraints they encounter. Business strategy thus represents a fundamental pillar influencing organizational performance and economic outcomes (Abdulwase et al; 2020, pp.135-136). Existing research demonstrates that business strategy significantly affects investment decisions, financial performance, information environments, and managerial compensation (Bentley et al; 2013, pp.780-781; Navisi et al; 2017, pp.85-86). Yet, although prior studies have examined overall investment efficiency (Biddle et al; 2009; Chen et al; 2011, p.112), evidence on determinants of labor investment efficiency remains limited, despite labor accounting for nearly two-thirds of total economic value added.

Since different firms are unlikely to deviate from optimal labor investment to the same extent, business strategy is expected to explain cross-sectional differences in labor investment efficiency (Habib & Hasan, 2019, p.10). Agency problems may further distort managers' decisions when their interests diverge from those of shareholders (Abbasi et al; 2021,

pp.1-3). Thus, agency problems are expected to influence the relationship between business strategy and labor investment efficiency, motivating the present study to examine their moderating role.

Prior organization theory suggests that firms with aggressive strategies often exhibit weak corporate governance, irregular financial reporting, poor internal controls, and overinvestment (Bentley et al; 2013, pp.780-781; Habib & Hasan, 2017, pp.5-7; Navisi et al; 2017, pp.85-86). Rapid growth incentives in such firms may lead managers to expand units, over hire, or retain excess employees, driven by managerial imperialism and at the cost of shareholders. The inherent difficulty of forecasting optimal labor needs, given constant environmental scanning and high transaction costs, may also contribute to inefficient labor investment in aggressive firms (Habib & Hasan, 2019, p.2).

Conversely, defensive strategy firms focus on stable products and single-core technologies, exhibiting gradual growth, less complexity, and more predictable profitability. These firms typically demonstrate stronger corporate governance and fewer managerial irregularities. Their stable product demand enhances the accuracy of labor forecasting, leading to more optimal labor investment and lower inefficiency (Habib & Hasan, 2019, p.3). Nonetheless, regardless of strategy, agency problems may cause overinvestment, such as over hiring for personal managerial motives, or underinvestment, particularly under information asymmetry, where investors respond with lower valuations and firms face costly financing (Jung et al; 2013, p.1049). Given that labor demand depends on firm-level, industry-level, and macroeconomic factors, predicting optimal labor needs is inherently complex (Addison et al; 2014, p.4).

Habib and Hasan (2019, p.10), studying 92,148 U.S. firm-years from 1980–2015, found that aggressive strategy firms experience inefficient labor investment due to uncertainty rather than agency problems, whereas defensive firms maintain efficiency. Additional findings indicate that inefficiency among aggressive firms leads to lower subsequent profitability. Similarly, Rezaei et al. (2023, p.58), analyzing 124 firms from 2009–2019, concluded that aggressive firms overinvest in human resources while defensive firms underinvest.

Therefore, the research hypotheses have been formulated as follows (without direction):

Hypothesis 1: There is a significant relationship between business strategy and the efficiency of investment in labor.

Hypothesis 2: Agency problems moderate the relationship between business strategy and the efficiency of investment in labor.

The conceptual model of the present study is presented in Figure 1.

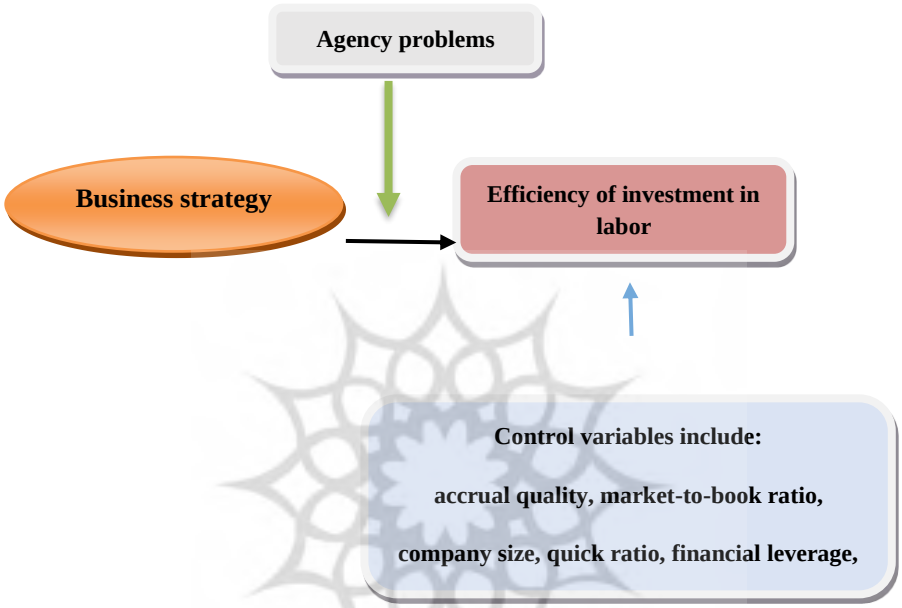

Figure 1. (Conceptual research model (Source: Researcher))

Materials and Methods

The present study is classified as deductive-inductive research in terms of its implementation logic, as descriptive research in terms of its implementation purpose, as correlational research in terms of its implementation method, as quantitative research in terms of its implementation process (type of data studied), as fundamental research in terms of its implementation outcome, and as a longitudinal (post-event) research in terms of its time dimension. Fundamental research lacks commercial goals, and its results and findings have limited practical applications in a specific location or for a specific group. In other words,

fundamental research is result-oriented (BaniMahd et al; 2018, p.54). The research hypotheses are based on combined data, and statistical tests and analyses have been conducted using EViews 10 and Stata. In the present study, given the nature of the research and the existence of inconsistencies (lack of uniformity) among companies listed on the Tehran Stock Exchange, the conditions as shown in Table 1 were considered to determine the statistical sample:

Table 1. Selection of companies to be studied

Column	conditions	Quantity
1	Total number of listed companies during the research period	443
2	Companies whose fiscal year-end is not March	(83)
3	Companies that changed their fiscal year during the research period	(16)
4	Investment companies, banks and financial intermediaries	(116)
5	Companies with trading interruptions	(76)
6	Companies without a minimum sample size in the industry	(18)
	Research sample	134

In this study, due to the existence of a volatility and standard deviation criterion in relation to some variables (including the standard deviation of operating cash flow, the standard deviation of sales, and the standard deviation of the percentage change in the number of employees over a 5-year rolling period (from t-1 to t-5), data from 2011 to 2016 were also used to measure the variables.

Research models

In this study, to test the first hypothesis, following Habib and Hasan (2019), the following regression model was estimated in a combined/integrated mode:

$$|ABN\_NET\_HIRE_{it}| = \beta_0 + \beta_1 STRATEGY_{it-1} + \beta_2 AQ_{it-1} + \beta_3 MTB_{it-1} + \beta_4 SIZE_{it-1} + \beta_5 QUICK_{it-1} + \beta_6 LEV_{it-1} + \beta_7 DIV\_D_{it-1} + \beta_8 SD\_CF_{it-1} + \beta_9 SD\_SALES_{it-1} + \beta_{10} TANGIBLE_{it-1} + \beta_{11} LOSS_{it-1} + \beta_{12} SD\_NET\_HIRE_{it-1} + \beta_{13} LAB\_INT_{it-1} + \beta_{14} AGE_{it-1} + \varepsilon_{it} \quad (1)$$

Which in this model:

$|ABN\_NET\_HIRE_{it}| = |\varepsilon_{it}|$ = The level of inefficiency in investment in labor for company i at the end of fiscal year t.

$STRATEGY_{it-1}$= Company i's business strategy score at the end of fiscal year t-1.

AQ_{it-1} = The quality of accruals for company i at the end of fiscal year t-1.

MTB_{it-1} = The ratio of market value to book value for company i at the end of fiscal year t-1.

$SIZE_{it-1}$ = The size of the company i (the natural logarithm of the market value of equity (number of shares at the price per share)) at the end of fiscal year t-1.

$QUICK_{it-1}$ = Quick ratio (ratio of current assets, including cash and short-term investments and accounts receivable, to current liabilities) for company i at the end of fiscal year t-1.

LEV_{it-1} = Financial leverage of company i (ratio of long-term debt to total assets) at the end of fiscal year t-1.

DIV_D_{it-1} = Dummy variable of cash dividend payment of company i at the end of fiscal year t-1 (if the company has paid cash dividend, its value will be 1, and otherwise it will be 0).

SD_CF_{it-1} = Standard deviation of operating cash flow to total assets for company i during the period t-1 to t-5.

SD_SALES_{it-1} = Standard deviation of sales to total assets for company i during the period t-1 to t-5.

$TANGIBLE_{it-1}$ = Ratio of property, equipment, and machinery to total assets for company i at the end of fiscal year t-1.

$LOSS_{it-1}$ = Dummy variable indicating whether company i is loss-making at the end of fiscal year t-1 (if the company has reported a net loss, its value will be 1, otherwise it will be 0).

$SD\_NET\_HIRE_{it-1}$ = Standard deviation of the percentage change in the number of employees for company i during the period t-1 to t-5.

LAB_INT_{it-1} = Ratio of the number of employees to the total assets of the company i at the end of fiscal year t-1.

AGE_{it-1} = Age of company i (natural logarithm of the number of years of admission to the Tehran Stock Exchange) at the end of fiscal year t-1.

The above model has been estimated in three different cases to test the first hypothesis. In the first case, the business strategy score was entered into the model in general (and based on the natural logarithm of the business strategy score in order to standardize, homogenize, and make this variable uniform). In this case, the regression coefficient β1 is expected to be positive and significant. Also, in the second case, the above model has been estimated by considering a dummy variable

(dichotomous) for the business strategy score equal to or less than 10 (which indicates a defensive business strategy). In this case, the regression coefficient β1 is expected to be negative and significant. Finally, in the third case, the above model has been estimated by considering a dummy variable (dichotomous) for the business strategy score equal to or greater than 20 (which indicates an aggressive business strategy). In this case, the regression coefficient β1 is expected to be positive and significant.

Also, to test the second hypothesis of the present study, the following regression model has been estimated in a combined/integrated mode:

$$
\begin{aligned}
|ABN\_NET\_HIRE_{it}| &= \beta_0 + \beta_1 STRATEGY_{it-1} \\
&+ \beta_2 AP\_D_{it-1} \\
&+ \beta_3 STRATEGY_{it-1} AP\_D_{it-1} \\
&+ \beta_4 AQ_{it-1} \\
&+ \beta_5 MTB_{it-1} + \beta_6 SIZE_{it-1} \\
&+ \beta_7 QUICK_{it-1} + \beta_8 LEV_{it-1} \\
&+ \beta_9 DIV\_D_{it-1} + \beta_{10} SD\_CF_{it-1} \\
&+ \beta_{11} SD\_SALES_{it-1} \\
&+ \beta_{12} TANGIBLE_{it-1} + \beta_{13} LOSS_{it-1} \\
&+ \beta_{14} SD\_NET\_HIRE_{it-1} \\
&+ \beta_{15} LAB\_INT_{it-1} + \beta_{16} AGE_{it-1} \\
&+ \varepsilon_{it}
\end{aligned} \qquad (2)
$$

Which in this model:

$AP\_D_{it-1} =$ is the dummy variable of the high level of agency problems in company i at the end of fiscal year t-1 (if the level of agency problems of the company is above the median, its value is 1, and otherwise 0). Other variables are explained above.

To test the second hypothesis, the above model was estimated in three different cases (case 1. Business strategy score in general and based on the natural logarithm; case 2. Business strategy score in virtual form to measure the defensive strategy and case 3. Business strategy score in virtual form to determine the offensive strategy. In this case, the regression coefficient β_3 is also expected to be positive and significant and significantly larger than the regression coefficient β_1. Also, in the second case, the regression coefficient β_3 is expected to be insignificant or even positive and significant. Finally, in the third case, the regression coefficient

β_3 is expected to be positive and significant and significantly larger than the regression coefficient β_1. If necessary, the Wald test is used to determine the significant difference between the regression coefficients β_1 and β_3.

Independent variable

In the present study, the independent variable is business strategy, which was measured and calculated using a discrete business strategy score and spectrum, following Bentley et al. (2013, p.787), so that higher scores and scores indicate companies with an aggressive business strategy, and lower scores and scores indicate companies with a defensive business strategy.

The characteristics and criteria considered by Bentley et al. (2013, p.787) in creating the business strategy spectrum and score are: 1. The ratio of research and development expenses to sales (a criterion for measuring the company's willingness to search for new products); 2. The ratio of the number of employees to sales (a criterion for calculating the company's ability to efficiently produce and distribute its goods and services); 3. The criterion of employee fluctuations (standard deviation of the total number of employees); 4. The criterion of historical growth (percentage of one-year change in total sales); 5. The ratio of administrative, distribution and sales expenses (operating expenses) to sales (an indicator of companies' emphasis on marketing and sales) and 6. The capital intensity measure (the ratio of net property, equipment and machinery to total assets) (an indicator of companies' focus on production). It is necessary to explain that, because in Iranian companies, research and development expenses are not fully disclosed, the ratio of research and development expenses to sales, like domestic studies such as Rezaei et al. (2023, p.55), was excluded from measuring business strategy, and the rest of the aforementioned variables were calculated using a rolling average over 5 years. Each of the remaining five variables was ranked separately and based on a quintile in each industry-year. Then, for each company-year, observations of each variable in the highest quintile were assigned a score of 5, in the second quintile a score of 4, and so on, and observations in the lowest quintile a score of 1 (except for capital intensity, which is scored in reverse; observations in the lowest (highest) quintile were assigned a score of 5 (1). Finally, for each

company-year, the scores of the five variables were summed such that a company could receive a maximum score of 25 (aggressive business strategy) and a minimum score of 5 (defensive business strategy). In this study, this spectrum and continuum were used as the primary business strategy variable. Also, to classify and determine the type of business strategy, companies with a score equal to or less than 10 (first and second quintiles) were categorized as companies with a defensive business strategy, companies with a score equal to or more than 20 (fifth quintile) were categorized as companies with an aggressive business strategy, and companies with a score between 10 and 20 (third and fourth quintiles) were categorized as companies with an analytical business strategy.

Data analysis

Dependent Variable

Following Jung et al. (2013, p.11), labor investment efficiency is measured as the absolute value of the residuals from the following regression; the larger the absolute residual, the lower the efficiency of labor investment.

$$\begin{aligned} NET\_HIRE_{\mathrm{it}} = {} & \beta_0 + \beta_1 SGROW_{it-1} + \beta_2 SGROW_{it} \\ & + \beta_3 \Delta ROA_{it-1} + \beta_4 \Delta ROA_{it} \\ & + \beta_5 ROA_{it} + \beta_6 RETURN_{it-1} \\ & + \beta_7 SIZE_{it-1} + \beta_8 QUICK_{it-1} \\ & + \beta_9 \Delta QUICK_{it-1} + \beta_{10} \Delta QUICK_{it} \\ & + \beta_{11} LEV_{it-1} + \beta_{12} LOSSBIN1_{it-1} \\ & + \beta_{13} LOSSBIN2_{it-1} \\ & + \beta_{14} LOSSBIN3_{it-1} \\ & + \beta_{15} LOSSBIN4_{it-1} \\ & + \beta_{16} LOSSBIN5_{it-1} + \varepsilon_{\mathrm{it}} \end{aligned} \quad (3)$$

Which in this model:

$NET\_HIRE_{\mathrm{it}} =$ Percentage change in the number of employees (net hiring) for company i at the end of fiscal year t.

$SGROW_{it-1} =$ The relative change (growth) in sales for company i at the end of fiscal year t-1 (to measure the relative change (growth) in sales at the end of the previous year, the sales of the two years before are subtracted

from the sales of the previous year and divided by the sales of the two years before).

$SGROW_{it}$ = The relative change (growth) in sales for company i at the end of fiscal year t (to measure the relative change (growth) in sales at the end of the current year, the sales of the year before are subtracted from the sales of the current year and divided by the sales of the previous year).

ΔROA_{it-1} = The relative change (growth) in return on assets (net profit on total assets) for company i at the end of fiscal year t-1 (to measure the relative change (growth) in return on assets at the end of the previous year, the return on assets of the two previous years is subtracted from the return on assets of the previous year and divided by the return on assets of the two previous years).

ΔROA_{it} = The relative change (growth) in return on assets for company i at the end of fiscal year t (to measure the relative change (growth) in return on assets at the end of the current year, the return on assets of the previous year is subtracted from the return on assets of the current year and divided by the return on assets of the previous year).

ROA_{it} = The return on assets (net profit on total assets) for company i at the end of fiscal year t.

$RETURN_{it-1}$ = The annual stock return for company i at the end of fiscal year t-1.

$SIZE_{it-1}$ = The size of company i (percentiled based on the natural logarithm of the market value of equity (number of shares at the price per share)) at the end of fiscal year t-1.

$\Delta QUICK_{it-1}$ = he relative change (growth) in the quick ratio (the ratio of current assets including cash and short-term investments and accounts receivable to current liabilities) for company i at the end of fiscal year t-1 (to measure the relative change (growth) in the quick ratio at the end of the previous year, the quick ratio of the two years prior is subtracted from the quick ratio of the previous year, and the result is divided by the quick ratio of the two years prior).

$\Delta QUICK_{it}$ = The relative change (growth) in the quick ratio for company i at the end of fiscal year t (to measure the relative change (growth) in the quick ratio at the end of the current year, the quick ratio of the previous year is subtracted from the quick ratio of the current year, and the result is divided by the quick ratio of the previous year).

$QUICK_{it}$ = The quick ratio for company i at the end of fiscal year t.

LEV_{it-1} = Financial leverage of company i (ratio of long-term debt to total assets) at the end of fiscal year t-1.

$LOSSBIN1_{it-1}$ = ummy variable of company i being unprofitable at the end of fiscal year t-1 (if the company's return on assets is in the range of 0 to -0.005).

$LOSSBIN2_{it-1}$ = Dummy variable of company i being unprofitable at the end of fiscal year t-1 (if the company's return on assets is in the range of 0 to -0.01).

$LOSSBIN3_{it-1}$ = Dummy variable of company i being unprofitable at the end of fiscal year t-1 (if the company's return on assets is in the range of 0 to -0.015).

$LOSSBIN4_{it-1}$ = Dummy variable of loss-making of company i at the end of fiscal year t-1 (if the return on assets of the company is in the range of 0 to -0.02).

$LOSSBIN5_{it-1}$ = Dummy variable of loss-making of company i at the end of fiscal year t-1 (if the return on assets of the company is in the range of 0 to -0.025).

$|ABN\_NET\_HIRE_{it}| = |\varepsilon_{it}|$ = Absolute value of the residuals of the regression model for company i at the end of fiscal year t as an indicator of inefficiency of investment in labor (inverse measure of efficiency of investment in labor)

Control variables

Control variables as other factors affecting the efficiency (inefficiency) of investment in labor and following Habib and Hasan (2019, p.9) are:

1. Accrual quality: The modified Jones model (modified by Kothari et al; 2005, p.13) was used to measure it. This model is as follows:

$$\frac{TAC_{it}}{TA_{it-1}} = \alpha_0 + \alpha_{1j}\left(\frac{1}{TA_{it-1}}\right) + \frac{\alpha_{2j}(\Delta REV_{it} - \Delta REC_{it})}{TA_{it-1}} + \alpha_{3j}\left(\frac{PPE_{it}}{TA_{it-1}}\right) + \alpha_{3j}\left(\frac{NA_{it-1}}{TA_{it-1}}\right) + \varepsilon_{it} \quad (4)$$

TAC_{it} = Total accruals (the difference between operating profit and operating cash flows) at the end of fiscal year t in company i

TA_{it-1} = Total assets at the end of fiscal year t-1 in company i

ΔREV_{it} = The amount of change in sales during years t-1 to t for company i

ΔREC_{it} = The amount of change in accounts receivable and accounts payable during years t-1 to t for company i

PPE_{it} = Net property, equipment, and machinery at the end of fiscal year t for company i

NI_{it-1} = Net income at the end of fiscal year t-1 for company i

ε_{it} = Regression error.

After estimating the above regression coefficients, the amount of managed accruals (earnings management as an inverse measure of accruals quality) is obtained from the difference between unmanaged accruals and total accruals as follows.

$$EM_{it} = \frac{TAC_{it}}{TA_{it-1}} - \left(\alpha_0 + \alpha_{1j}\left(\frac{1}{TA_{it-1}}\right) + \alpha_{2j}\left(\frac{\Delta REV_{it}}{TA_{it-1}} - \frac{\Delta REC_{it}}{TA_{it-1}}\right) + \alpha_{3j}\left(\frac{PPE_{it}}{TA_{it-1}}\right) + \alpha_{3j}\left(\frac{NI_{it-1}}{TA_{it-1}}\right)\right) \quad (5)$$

In which:

$AQ_{it} = EM_{it}$ = The managed components of accruals of company i at the end of fiscal year t, the absolute value of which is equal to the sum of discretionary accruals and equal to the amount of earnings management (the inverse measure of accrual quality).

2. Market-to-book ratio, measured by the ratio of the market value of equity (the product of the number of shares multiplied by the market price per share) to the book value of equity at the end of each year.
3. Firm size is equal to the natural logarithm of the market value of equity at the end of the year (the number of shares divided by the price per share).
4. Quick ratio is equal to the ratio of current assets, including cash and short-term investments and accounts receivable, to current liabilities.
5. Financial leverage (the ratio of long-term liabilities to total assets).
6. Cash dividend payment is a dummy variable; if the company has paid a cash dividend, its value will be 1, otherwise it will be 0.
7. Operating cash flow volatility, measured by the standard deviation of operating cash flows over the average total assets over a 5-year rolling period.
8. Sales volatility, which will be measured by the standard deviation of sales over the average total assets over a 5-year period.
9. Tangible assets ratio, which was measured by the ratio of net property, equipment, and machinery to total assets.
10. Loss-making of the company, which is a dummy variable (two-way); so that for loss-making companies, its value was 1 and otherwise 0.

11. Employment volatility, standard deviation, percentage change in the number of employees over a 5-year period, rotating.
12. Employee intensity (ratio of number of employees to total assets of the company).
13. Company age is equal to the natural logarithm of the number of years the company has been listed on the Tehran Stock Exchange.

The moderating variable in this study is agency problems, for which, following Giroud and Muller (2010, p.5), Chhaochharia et al. (2012, p.34), and Habib and Hasan (2019, p.37), the growth of property, equipment, and machinery was used as follows:

$$\Delta PPE_{\text{it}} = \left(\frac{PPE_{it} - PPE_{it-1}}{PPE_{it-1}}\right) \quad (6)$$

In which:

ΔPPE_{it} =Growth of property, equipment and machinery for company i at the end of fiscal year t.

PPE_{it} = The amount of property, equipment and machinery of company i at the end of fiscal year t.

PPE_{it-1} = The amount of property, equipment and machinery of company i at the end of fiscal year t-1.

It is necessary to explain that the moderator variable, according to the median of the data, has been used in a virtual (bivariate) way in the regression models. The higher growth of property, equipment and machinery indicates a high level of agency problems.

Results and Discussion

Descriptive statistics of the quantitative variables of the study are presented in Table (2).

Table 2. Descriptive statistics of quantitative research variables

Criteria Quantitative variables	number	average	median	maximum	minimum	standard deviation	coefficient of variation	statistic of a random sample	Probability of a random sample
ABNNETHIRE	804	0.06	0.04	0.57	0.00	0.08	1.25	2.4520	0.00
STRATEGY	804	2.69	2.71	3.18	1.79	0.21	0.08	19.90	0.00
AQ	804	0.11	0.08	0.66	0.0010	0.09	0.82	0.5470	0.00
MTB	804	5.75	4.14	19.22	0.27	5.06	0.88	1.3020	0.00

Criteria Quantitative variables	number	average	median	maximum	minimum	standard deviation	coefficient of variation	statistic of a random sample	Probability of a random sample
SIZE	804	16.12	16.29	22.27	11.90	1.71	0.11	12.50	0.0020
QUICK	804	1.13	0.81	6.55	0.09	1.14	1.01	1.6240	0.00
LEV	804	0.53	0.53	0.94	0.06	0.23	0.43	27.50	0.00
SDCF	804	0.70	0.68	1.30	0.14	0.27	0.39	25.80	0.00
SDSALES	804	0.48	0.48	1.06	0.04	0.24	0.50	20.30	□
TANGIBLE	804	0.24	0.18	0.70	0.0010	0.19	0.79	1.95	0.00
SDNETHIRE	804	0.07	0.05	0.50	0.0050	0.09	1.29	3.5810	0.00
LABINT	804	0.0001	0.0001	0.0010	0.00	0.0002	2.0000	3.7120	0.00
AGE	804	3.15	3.14	3.99	2.40	0.29	0.09	3.37	0.00

The results of the descriptive statistics of the quantitative variables in Table (2) indicate that the average financial leverage (debt-to-asset ratio) in the companies under study was 53%, the average market-to-book ratio was 5.75, the average quick ratio was 1.13, and the average operating cash flow volatility, sales volatility, and employment volatility of the company were 70%, 48%, and 7%, respectively. Also, the average tangible asset ratio was 24%. The results of the Jarque-Bera statistic indicate that the distribution of the quantitative variables under study is non-normal. Of course, it is necessary to explain that due to the closeness of the mean and median of the research variables and also based on the law of large numbers, the assumption of normality can be accepted for all quantitative variables of the research (including independent, dependent, and control).

Other descriptive statistics results indicate that among the quantitative and control variables, the intensity of the number of employees and the quick ratio had the highest coefficient of variation (the result of dividing the standard deviation by the mean) and dispersion, and as a result, the least stability and stability, and in contrast, the age and size of the company) had the lowest coefficient of variation and dispersion, and as a result, the most stability and stability during the research period. This indicates that the companies under study had a relatively significant

difference in terms of the number of employees and also in terms of the amount of quick assets.

The results of the stationarity test for the research variables are reported in Table (3). The Levin–Lin–Chu (LLC) test was used for panel data. In this test, the null hypothesis is the presence of a unit root; therefore, probability values less than 0.05 indicate the rejection of the null hypothesis and confirmation of variable stationarity. Due to the nominal nature of dummy variables (dichotomous), these variables were not included in the unit root tests.

Table 3. Reliability test of research variables

Type / Variables	Levin, Lin & Chu Statistic	Levin, Lin & Chu p-value
Labor Investment Efficiency (ABNNETHIRE)	-24.57	0.00
Overall Business Strategy (STRATEGY)	-32.03	0.00
Accrual Quality (AQ)	-26.69	0.00
Market-to-Book Ratio (MTB)	-15.66	0.00
Firm Size (SIZE)	-17.68	0.00
Quick Ratio (QUICK)	-12.78	0.00
Financial Leverage (LEV)	-24.11	0.00
Operating Cash Flow Volatility (SDCF)	-14.61	0.00
Sales Volatility (SDSALES)	-10.5	0.00
Tangible Asset Ratio (TANGIBLE)	-68.64	0.00
Hiring Volatility (SDNETHIRE)	-137.87	0.00
Labor Intensity (LABINT)	-81.65	0.00
Firm Age (AGE)	-131.59	0.00

Also, the dependent variable of labor investment efficiency compared to the independent variable of overall business strategy had

a much higher coefficient of variation and dispersion and, as a result, much lower stability and sustainability during the research period. This indicates that labor investment efficiency must be influenced by other factors in addition to business strategy, and in the present study, a number of these factors were used as control and moderating variables.

Descriptive statistics of the frequency distribution of qualitative (virtual) variables are presented in Table 4.

Table 4. Frequency distribution of qualitative research variables

Criteria / Qualitative (Dummy) Variables	Relative Frequency (%)	Absolute Frequency (Firm-Year)
Defensive Business Strategy (Dummy) - STRATEGYD	6%	52
Aggressive Business Strategy (Dummy) - STRATEGYP	7%	60
Agency Problems (Dummy) – APD	50%	402
Cash Dividend Payment (Dummy) - DIVD	76%	614
Loss-Making Firm (Dummy) – LOSS	11%	90

The results of the frequency distribution of the qualitative variables in Table (4) indicate that during the research period, respectively, only 6% of the year-companies under study (equivalent to 52 year-companies) had a defensive business strategy, and only 7% of the sample year-companies (equivalent to 60 year-companies) had an aggressive business strategy. Also, during the research period, 76% of the year-companies under study (i.e; 614 year-companies) paid cash dividends. Finally, 11% of the year-companies under study (equivalent to 90 year-companies) were loss-making. However, due to the use of the median, 50% of the sample year-companies were identified as companies with a high level of agency problems.

Before testing the hypotheses, appropriate regression models were selected.Before testing the hypotheses, the process of selecting an appropriate regression model was carried out. According to the results presented in Tables (5) and (6), the probability values of the Chow and

Hausman tests for all hypotheses were less than the 5% significance level. Thus, the use of the Pooled OLS model is rejected, and the panel data approach is confirmed. Furthermore, the results of the Hausman test indicate the inconsistency of the random effects model with the consistent estimator, and consequently, the fixed effects model was chosen as the more suitable option for estimating the research relationships. Based on this, the research hypotheses were tested using panel regression models based on fixed effects.

Table 5. Chow test results

Hypothesis Model	Test Statistic	p-value	Result
Hypothesis Model 1	12.19	0	Combined
Hypothesis Model 2	11.37	0	Combined

Table 6. Hausman test results

Hypothesis Model	Test Statistic	p-value	Result
Hypothesis Model 1	399.25	0	Fixed effects
Hypothesis Model 2	398.53	0	Fixed effects

To the results of the modified Wald test, as shown in Table No. (7), because the probability of this test statistic is less than 5%, the presence of heteroscedasticity among the error terms is confirmed at a 95% confidence level. Therefore, to address this issue, the Estimated Generalized Least Squares (EGLS) estimator has been used for all three hypothetical models of this research.

Table 7. Heterogeneity of variance test (parent adjusted)

Hypothesis Model	Test Statistic	p-value	Result
Hypothesis Model 1	64258.33	0	Presence of heterogeneity
Hypothesis Model 2	60359.07	0	Presence of heterogeneity

Considering the values obtained from the VIF test, as shown in Table (8), since all values of the variance inflation factor are less than 5, we

conclude that there is no collinearity problem between the research variables.

Table 8. VIF test to check collinearity

Variable Name	Hypothesis 1	Hypothesis 2
	Variance Inflation Factor	Variance Inflation Factor
Overall Business Strategy	2.44	2.46
Defensive Strategy	1.65	2.37
Aggressive Strategy	1.67	2.62
Overall Business Strategy * Agency Problems	–	1.35
Defensive Strategy * Agency Problems	–	1.79
Aggressive Strategy * Agency Problems	–	2.11
Accrual Quality	1.05	1.05
Market-to-Book Ratio	1.25	1.25
Firm Size	2.17	2.19
Quick Ratio	2.30	2.33
Financial Leverage	2.88	2.91
Cash Dividend Payment	1.19	1.19
Operating Cash Flow Volatility	1.24	1.26
Sales Volatility	1.89	1.90
Tangible Asset Ratio	1.37	1.39
Loss Status	1.39	1.43
Hiring Volatility	1.19	1.19
Labor Intensity	1.89	1.91
Firm Age	1.12	1.12

To test the first hypothesis, regression models of the impact of various business strategy measures on the inverse measure of investment efficiency in the companies' workforce are presented in Table (9).

Table 9. The impact of business strategy on the efficiency of investment in labor

Statistics / Independent Variables / Variables	Overall (General) Business Strategy			Defensive Business Strategy			Aggressive Business Strategy		
	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)
C	-0.37	-1.27	0.2057	-0.52	-2.07	0.0387	-0.61	-2.38	0.0178

Statistics / Independent Variables / Variables	Overall (General) Business Strategy			Defensive Business Strategy			Aggressive Business Strategy		
	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)
STRATEGY(-1)	0.04	1.13	0.2572	-	-	-	-	-	-
STRATEGYD(-1)	-	-	-	-0.0010	-0.06	0.9493	-	-	-
STRATEGYP(-1)	-	-	-	-	-	-	0.04	2.12	0.0348
AQ(-1)	-0.06	-1.65	0.0997	-0.06	-1.6400	0.1014	-0.06	-1.58	0.1149
MTB(-1)	-0.0002	-0.17	0.8612	-0.0001	-0.11	0.9102	-0.0002	-0.13	0.8944
SIZE(-1)	-0.01	-0.70	0.4847	-0.01	-0.7400	0.4623	-0.01	-0.84	0.4009
QUICK(-1)	0.0010	0.2400	0.8070	0.0010	0.21	0.8315	0.0010	0.17	0.8628
LEV(-1)	0.02	0.60	0.5494	0.02	0.55	0.5798	0.02	0.44	0.6587
DIVD(-1)	0.02	0.78	0.4330	0.02	0.78	0.4360	0.02	0.73	0.4663
SDCF(-1)	0.04	2.15	0.0318	0.04	2.14	0.0325	0.03	1.96	0.0511
SDSALES(-1)	0.0020	0.06	0.9485	-0.01	-0.27	0.7853	-0.01	-0.43	0.6672
TANGIBLE(-1)	0.02	0.65	0.5153	0.02	0.70	0.4837	0.03	0.75	0.4507
LOSS(-1)	0.01	0.35	0.7238	0.01	0.40	0.6901	0.01	0.63	0.5305
SDNETHIRE(-1)	-0.23	-3.17	0.0016	-0.25	-3.5500	0.0004	-0.28	-3.94	0.0001
LABINT(-1)	8.30	0.20	0.8408	8.75	0.21	0.8334	13.81	0.33	0.7379
AGE(-1)	0.19	1.82	0.0692	0.21	2.05	0.0404	0.24	2.35	0.0189

Independent variable — Overall Business Strategy

R-squared	Adjusted R-squared	p-value of the F-statistic	Durbin–Watson statistic
0.3790	0.3200	0.0000	2.2360

Independent variable — Defensive Business Strategy

R-squared	Adjusted R-squared	p-value of the F-statistic	Durbin–Watson statistic
0.3770	0.3200	0.0000	2.2270

Independent variable — Aggressive Business Strategy

Statistics / Independent Variables / Variables	Overall (General) Business Strategy			Defensive Business Strategy			Aggressive Business Strategy		
	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)
R-squared	Adjusted R-squared			p-value of the F-statistic			Durbin–Watson statistic		
0.3820	0.3210			0.0000			2.2210		

The results in Table (9) show that among the different measures of business strategy, only the effect of aggressive business strategy on the inverse measure of the efficiency of investment in the workforce of companies was positive (0.04) and significant according to the probability of the t statistic (0.0348). This shows that an aggressive business strategy had an inverse effect on the efficiency of investment in the workforce of companies. In other words, in companies with an aggressive strategy, the efficiency of investment in the workforce was significantly low. This indicates that companies with an aggressive strategy generally had a higher risk in the field of investment in the workforce. In other words, one of the important and negative consequences of aggressive strategy was the low level of efficiency of investment in the workforce of companies.

The results also show that the effect of the control variables of operating cash flow volatility and company age on the inverse measure of the efficiency of investment in the companies' workforce was positive and significant, and on the contrary, the effect of the control variable of employment volatility on the inverse measure of the efficiency of investment in the companies' workforce was negative and significant. This indicates that companies with high levels of operating cash flow risk and companies with long stock market history had lower levels of efficiency in investing in the companies' workforce. However, in companies with high levels of employment volatility, the level of efficiency in investing in the companies' workforce was significantly higher. The results of the F-statistic also show that the models were generally significant and, according to the Durbin-Watson statistic, did not have the problem of autocorrelation. The results of the adjusted

coefficient of determination show that, throughout the entire research period, about 32% of the changes in labor investment efficiency were influenced by business strategy, especially aggressive business strategy, as well as control variables, especially operating cash flow volatility, employment volatility, and firm age.

Considering the positive and significant effect of aggressive business strategy on the inverse measure of labor investment efficiency, there is insufficient evidence to reject the first hypothesis of the study regarding aggressive business strategy.

To test the second hypothesis, regression models of the moderating role of agency problems in the effect of business strategy on the inverse measure of labor investment efficiency of companies are presented in Table (10).

Table 10. The moderating role of agency problems in the impact of business strategy on labor investment efficiency

Statistics / Independent Variables / variables	Overall Business Strategy			Defensive Business Strategy			Aggressive Business Strategy		
	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)
C	-0.4300	-1.4900	0.1381	-0.5000	-2.0100	0.0448	-0.6000	-2.3700	0.0183
STRATEGY(-1)	0.0004	0.0900	0.9267	-	-	-	-	-	-
STRATEGYD(-1)	-	-	-	-0.0100	-0.6500	0.5147	-	-	-
STRATEGYP(-1)	-	-	-	-	-	-	0.0500	1.9200	0.0551
APD(-1)	0.1700	1.8700	0.0623	-	-	-	-	-	-
APD(-1)	-	-	-	0.0003	0.3300	0.7421	-	-	-
APD(-1)	-	-	-	-	-	-	0.0100	0.7400	0.4615
STRATEGY (-1)*APD(-1)	0.0600	1.8200	0.0695	-	-	-	-	-	-
STRATEGYD (-1)*APD(-1)	-	-	-	0.0300	1.1200	0.2623	-	-	-

Statistics / Independent Variables / variables	Overall Business Strategy			Defensive Business Strategy			Aggressive Business Strategy		
	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)
STRATEGYP(-1)*APD(-1)	-	-	-	-	-	-	-0.0100	-0.3500	0.7292
AQ(-1)	-0.0700	-1.7600	0.0782	-0.0700	-1.7300	0.0836	-0.0600	-1.5800	0.1137
MTB(-1)	-0.0001	-0.1000	0.9195	-0.0001	-0.0400	0.9674	-0.0001	-0.0700	0.9416
SIZE(-1)	-0.0100	-0.7200	0.4693	-0.0100	-0.7800	0.4377	-0.0100	-0.8900	0.3733
QUICK(-1)	0.0010	0.1900	0.8493	0.0010	0.2000	0.8431	0.0010	0.1700	0.8630
LEV(-1)	0.0200	0.6000	0.5466	0.0200	0.5600	0.5729	0.0200	0.4500	0.6504
DIVD(-1)	0.0100	0.6300	0.5271	0.0100	0.6600	0.5121	0.0200	0.7600	0.4496
SDCF(-1)	0.0300	1.9900	0.0466	0.0300	2.0000	0.0462	0.0300	1.8400	0.0661
SDSALES(-1)	0.0020	0.0900	0.9320	-0.0100	-0.2400	0.8133	-0.0100	-0.5100	0.6132
TANGIBLE(-1)	0.0200	0.6500	0.5151	0.0300	0.7200	0.4703	0.0200	0.7000	0.4849
LOSS(-1)	0.0030	0.2400	0.8084	0.0050	0.3300	0.7420	0.0100	0.6000	0.5503
SDNETHIRE(-1)	-0.2500	-3.3800	0.0008	-0.2600	-3.6400	0.0003	-0.2900	-3.9500	0.0001
LABINT(-1)	11.0000	0.2700	0.7905	12.3700	0.3000	0.7672	15.6900	0.3800	0.7055
AGE(-1)	0.1800	1.7500	0.0800	0.2100	2.0300	0.0430	0.2400	2.3600	0.0187

STRATEGY

R-squared	Adjusted R-squared	F-statistic p-value	Durbin–Watson	Wald statistic	Wald degrees of freedom	Wald p-value
0.3830	0.3210	0.0000	2.2430	0.9180	520.0000	0.3589

STRATEGYD

Statistics / Independent Variables / variables	Overall Business Strategy			Defensive Business Strategy			Aggressive Business Strategy		
	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)	Regression Coefficients	t-statistic	p-value (for t-statistic)
R-squared	Adjusted R-squared		F-statistic p-value	Durbin–Watson		Wald statistic	Wald degrees of freedom		Wald p-value
0.3790	0.3200		0.0000	2.2240		1.0420	520.0000		0.2981
				STRATEGYP					
R-squared	Adjusted R-squared		F-statistic p-value	Durbin–Watson		Wald statistic	Wald degrees of freedom		Wald p-value
0.3830	0.3210		0.0000	2.2220		-1.2550	520.0000		0.2102

The results in Table (9) show that the interaction effects of different measures of business strategy in agency problems on the inverse measure of the efficiency of investment in the workforce of companies were not significant according to the probability of t-statistics. This shows that agency problems do not have a moderating role in explaining the relationship between business strategy and the efficiency of investment in the workforce of companies. In other words, the effect of business strategy on the efficiency of investment in the workforce of companies was independent of the level of agency problems. The results related to the F-statistic also show that the models were generally significant and, according to the Durbin-Watson statistic, did not have the problem of autocorrelation. In addition, the results of the adjusted coefficient of determination show that during the research period, about 32% of the changes in the efficiency of investment in the workforce of companies were influenced by business strategy, the interactive effects of business strategy on agency problems, as well as control variables, especially operating cash flow fluctuations, employment fluctuations, and the age of the company. Given the lack of significance of the effect of the interactive effects of business strategy on agency problems on the inverse measure of investment efficiency in the workforce, the second hypothesis of the research is rejected.

To examine the second hypothesis in detail and scientifically, the results of the Wald test are also given in Table (10). The results of this test also indicate that there is no significant difference between the regression coefficients (1. Regression coefficient of the effect of business strategy on investment efficiency and 2. Regression coefficient of the interactive effects of agency problems in business strategy on investment efficiency. Therefore, based on the Wald results, the second hypothesis of the research is rejected.

Conclusion

The value of a company is often shaped more by its investment in human labor and the value of hiring its workforce than by the value of its physical capital. Consequently, understanding the efficiency of labor investment and the factors influencing it becomes essential. Firms must continually adapt to dynamic and rapidly evolving environments to sustain and enhance their competitive advantage. This adaptation requires an accurate assessment of existing conditions and future goals so that companies can design and implement the most suitable business strategies. It was also emphasized that business strategy can help explain cross-sectional differences in labor investment efficiency among firms. Nevertheless, even with a defined strategy, managers' pursuit of personal benefits, particularly in firms affected by severe agency problems, may drive labor investment below optimal levels. In other words, agency conflicts can result in suboptimal labor investment. Accordingly, this study analyzed how agency problems moderate the relationship between business strategy and labor investment efficiency in listed companies from 2011 to 2022. Due to data constraints, the final period considered was 2017 to 2022, and because the regression models required time lags, estimations were ultimately conducted for 2018 to 2022.

The findings show that among different strategy measures, only the aggressive strategy exhibited a positive and significant association with the inverse measure of labor investment efficiency. This indicates that aggressive strategies reduce labor investment efficiency. Thus, the first hypothesis regarding the adverse effect of aggressive strategy was not

rejected. Conversely, neither the overall strategy score nor the defensive strategy demonstrated a relationship with labor investment efficiency. The absence of significance for the overall strategy score likely stems from the fact that most firms (about 87%) followed an analyzer strategy. Moreover, agency problems did not influence the relationship between business strategy and labor investment efficiency.

The negative impact of aggressive strategies suggests that such firms face greater labor-related risk. Their difficulty in predicting optimal labor demand, due to environmental uncertainty and strategic experimentation, contributes to inefficient labor investment. The failure to confirm the moderating role of agency problems further indicates that managerial self-interest or investor reactions to information asymmetry did not explain differences in labor investment efficiency. This may be partly due to using a dummy variable for agency problems and the low number of aggressively oriented firms in the sample.

The findings regarding the negative effect of aggressive strategy align with previous studies such as Habib and Hasan (2019, p.32) and Rezaei et al. (2023, pp.63-34). However, results diverge regarding the role of overall strategy and defensive strategy, likely because prior research examined over- and underinvestment separately, while the present study used absolute residuals as a general inefficiency metric. The second hypothesis concerning the moderating role of agency problems was inconsistent with Habib and Hasan (2019, p.63-64).

Based on the results, shareholders should consider firms' strategic orientations when making investment decisions, as aggressive strategies may signal reduced labor investment efficiency. Managers should also recognize that workforce-related investments significantly shape firm value. Suggestions for future research include examining financially constrained versus unconstrained firms, applying instrumental variable approaches to strategy determinants, testing longer time lags, and analyzing industry-level differences. Major limitations relate to inconsistent employee classifications, varying definitions of labor investment efficiency and business strategy, unconsidered economic or

political factors, and the small number of firms following defensive or aggressive strategies.

Ethical considerations

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