ENTERPRISE INEFFICIENT INVESTMENT BEHAVIOR ANALYSIS BASED ON REGRESSION ANALYSIS

WEI LI*
Dalian Maritime University
Dalian 116025, China

YUN TENG
Dalian Commodity Exchange
Dalian 116023, China

Abstract. Inefficient investment will affect enterprises survival and long-term development, and ultimately lead to the decline in corporate value. In order to promote the efficiency of the enterprise investment, in this paper, we aim to effectively analyze enterprise inefficient investment behavior, which has great significance in both enterprise management and social resources allocation. Firstly, we propose and analyze some typical enterprise investment theories, such as 1) MM enterprise investment theory, 2) Jorgensen investment theory, and 3) Tobin’s q theory. Secondly, we propose a novel enterprise inefficient investment behavior analysis method based on regression analysis. Finally, to demonstrate the effectiveness of the proposed method, we conduct a series of experiments based on the CCER database. Experimental results show that the economy fluctuates across states due to the aggregate cash-flow shock driving the level of aggregate liquidity. Furthermore, we also can see that the particular sample path starts with a series of positive shocks, which can increase the capital value and decrease the cash value.

1. Introduction. As the most crucial financial decision, investment plays an important role on the increase of enterprise and the assignment of social resources [8]. In the perfect capital market, investment decisions highly rely on the net present value of the project, and business investment spending rely on the investment opportunities of the enterprise [7, 24]. Inefficient investment refers to the management, which does not rely on the shareholder value maximization decision criteria for the selection of investment projects [22]. That is to say, the goal of the inefficient investment is to maximize the private benefit of managers. Inefficient investment refers to the inconsistent behavior between the actual investment expenditure and the level of the optimal investment, and there are mainly two forms of inefficient investment, that is, underinvestment and overinvestment [6].

Jensen et al. believes that the lack of investment refers to the actual investment expenditure is lower than the optimal level of investment, and it can also be understood as to give up the investment in NPV which is greater than or equal to zero project behavior [2, 30]. On the other hand, excessive investment refers to the actual business investment spending is higher than the optimal investment level, and

2010 Mathematics Subject Classification. Primary: 58F15, 58F17; Secondary: 53C35.
Key words and phrases. Inefficient investment, regression analysis, overinvestment and underinvestment, NP equilibrium, CCER database.
* Corresponding author: Wei Li.
can also be understood as an investment in NPV is less than zero project behavior [5, 25].

Investment behavior of enterprises significantly influences the healthy operation of the capital market. Unfortunately, many enterprises, particularly, some state-owned enterprises have the phenomenon of inefficient investment and then leading great business losses [4, 19, 21]. In nowadays, inefficient investment has been key factors which may hinder business development. In addition, domestic and foreign scholars study on how to prevent inefficient investment behavior of enterprises [1, 10, 14].

The paper is organized as follows. In section 2, we introduce related works about the applications of regression analysis. Section 3 introduces the enterprise investment theory. Section 4 discusses how to analyze the enterprise inefficient investment behavior. In section 5, experimental results show the effectiveness of the proposed method. In the end, we conclude the whole paper in section 6.

2. Related works. In statistical modeling, regression analysis refers to a statistical tool to grasp the relationships among variables. Regression analysis contains several techniques for modeling and analyzing several variables, only if the aim is set at the relationship between a dependent variable and one or more independent variables. Applications of regression analysis are listed as follows.

Yu et al. studied on the regression analysis of mixed recurrent event and panel count data in the presence of a terminal event. Particularly, an estimating equation-based method is presented to calculate the regression parameters of interest. Furthermore, the asymptotic properties of the proposed estimator are constructed [29].

Yoon et al. aimed to analyze postoperative femoral version between three kinds of nails and to delineate any significant differences in femoral version (DFV) and revision rates. In addition, this work is different from the femoral version (DFV) between the uninjured limb and the injured limb [28].

Yildiz et al. proposed a review of different electricity load forecasting models with a particular focus on regression models. Moreover, a comparison between the models is proposed to predict day ahead hourly electricity loads exploiting real building and Campus data [27].

Ye et al. utilized the CFD techniques to establish a set of required numerical experiments, and each simulation condition is obtained via the Box-Behnken design (BBD) approach. In addition, the developed equation illustrate that the warm air spreading distance in IJV has a maxima and will not exceed 12 m for any nozzle configuration and supply condition [26].

Verma et al. aimed to testify visual field progression and rate of glaucomatous VF loss in patients with primary angle-closure glaucoma based on the pointwise linear regression trend analysis [23].

Ribaroff et al. investigated metabolic parameters in the offspring of HFD fed mothers to detect factors explaining these inter-study differences based on a meta-regression analysis. Particularly, a total of 171 papers were used in this work, which provided data from 6047 offspring [20].

Qu et al. proposed a novel method to identify dentofacial anatomic traits related with lower incisor cancellous bone thickness and then to obtain their separate contributions. Furthermore, a consecutive sample of cone beam computed tomography data taken in a university hospital within the same setting are reviewed [18].

Phung et al. utilized systematic review and meta-regression analysis to solve this problem exploiting a case study in cardiovascular risk from arsenic exposure
in Vietnam. In this work, a systematic review and meta-analysis is not able to provide the endpoint answer for a chemical risk assessment. Therefore, random-effects meta-regression are used to describe the linear relationship between arsenic concentration in water, and then the no-observable-adverse-effect level are detected from the regression function [17].

Apart from the above works, regression analysis have also been used in other areas, such as Soil organic carbon distribution [16], Pharmacological treatments [15], Patients treatment [13], Pooled biomarker assessments [12], Dependent censoring [11], Purpose Colorectal perforations [9], Patient characteristics analysis [3].

3. Enterprise investment theory. In this section, we discuss three famous enterprise investment theories, which are used to compare the proposed model.

3.1. MM enterprise investment theory. No matter what financing method is adopted, the marginal capital cost of a company is equal to the average cost of capital. Meanwhile, it is equal to the capitalization rate of the non-leverage flow of a company. This theory is represented by the following three theoretical models:

1) Enterprise value model

$$ V_L = V_U = \frac{EBIT}{K_{WACC}} = \frac{EBIT}{K_{SU}} $$ (1)

2) Risk compensation model

$$ K_{SL} = K_{SU} + \frac{D}{S} \cdot (K_{SU} - K_d) $$ (2)

3) Investment return model

$$ IRR \geq K_d = K_{SU} = K $$ (3)

where $EBIT$ is profit before tax payment, $K_{WACC}$ is the weighted average cost of capital, $K_{SU}$ refers to the source of capital in a certain risk level which is all the expected return of equity capital, $K_d$ is the debt interest rate, $K$ is the average cost of capital in a particular group of Companies, $D$ refers to the Debt market value, $S$ is the stock market value, $IRR$ is Intrinsic rate of return, and $L, U$ denote the enterprise be in debt and not be in debt respectively.

3.2. Jorgensen investment theory. Jorgensen has proposed an investment theory in 1963, and he introduced production function into enterprise investment theory. In this model, it is assumed that the relationship between Wage labor $(N)$ and Existing capital stock $(K)$ is represented as follows.

$$ Y = \Phi (N, K) $$ (4)

where $P,W,S$ refer to the price for a unit of output, labor, and capital respectively. Net income at time $t$ is represented as follows.

$$ R_t = pY_t - SI_t - WN_t $$ (5)

Suppose that the opportunity cost per unit capital is represented $r$, and the value of the enterprise is represented as follows.

$$ V = \int_0^\infty R_t e^{-rt} dt $$ (6)
Suppose that the total investment of the enterprise is \( I = \frac{dK}{dt} + K \). According to the goal of enterprise value maximization, the optimization problem is described as follows.

\[
max V = \int_0^\infty [pY_t - SI_t - WN_t] \, dt
\]  

(7)

Subject to \( Y = \Phi (N, K) = 0 \) and \( \frac{dK}{dt} = 1 - \delta K \) where \( \delta \) refers to the depreciation per unit of asset.

Afterwards, the simultaneous equations are solved to obtain the optimal capital stock:

\[
K^* = \Phi \left( Y, p, r, \delta, S, \frac{dS}{dt} \right)
\]  

(8)

3.3. **Tobin’s q theory.** Tobin’s q (also known as Kaldor’s v) is the ratio between a physical asset’s market value and its replacement value. It was first introduced by Nicholas Kaldor in 1966. In the Tobin’s q theory, the q value is defined as the ratio between the stock market value of an enterprise’s capital assets and the cost of producing and purchasing these assets.

According to the Tobin’s q theory, the relationship between q value of an enterprise and the investment is described as follows.

\[
\frac{\Delta K}{K} = \Phi \left( q - 1 \right) + g
\]  

(9)

where \( K \) is the existing capital stock of an enterprise, \( \frac{\Delta K}{K} \) is the capital growth rate, \( g \) is the natural growth rate of investment, and \( \Phi () \) is belonged to the Monotonically increasing function. Based on the above definition, the following relationships can be obtained.

When \( q > 1 \), the market value of the enterprise assets is higher than the replacement cost, and the enterprise investment may increase as well.

When \( q < 1 \), the market value of the enterprise assets is lower than the replacement cost, and the enterprise investment may decrease.

4. **The proposed method.** In the Inefficient investment behavior, company managers maximize shareholder or enterprise value as the goal and the abuse of decision-making power, and the enterprise funds blind investment does not bring profit to the project or give up the net present value can increase the enterprise value for investment opportunities. Then, it may result in the company’s actual capital stock and capital stock agreement (marginal profit equals marginal cost). In particular, there are three typical forms of inefficient investment behavior, namely, 1) over investment, 2) asset substitution and 3) lack investment.

(1) Excessive investment

For the internal management decision-making of enterprise managers in order to achieve the maximum, it will lead to internal job consumption, empire building, and so on. The enterprise’s idle capital are invested to the net present value, and then enterprise investment may exceed or deviate from their own production and operation ability and growth opportunities. Afterwards, the formation of excessive investment is obtained.

(2) Asset substitution

When the enterprise managers and shareholders interests are the same, enterprises will face the conflict between shareholders and creditors. In this case, the heavy debt burden of corporate shareholders debt funds to invest in high-risk projects intention is higher, because companies will enjoy the success of the project
benefits, and the creditors will bear most of the losses caused by the failure of the project. Furthermore, the investment behavior of the shareholders and creditors will achieve asset substitution, which is also a kind of excessive investment.

(3) Lack investment
It means the internal investors and business decision-makers outside the enterprise for the enterprise value of existing assets and project future earnings and other aspects of the information is not exactly the same. It also can produce information asymmetry which is caused by the financing cost increasing. Lack investment can lead to internal business decision makers active passive or give up the net present value, which is greater than or equal to zero investment projects.

We suppose that the central planner is able to select $y^*$ (also represented as $y^r$), and we focus on the case $2\varepsilon R^L < \left[ \frac{(1 - \pi)}{\pi} \frac{1 - R^L}{(R^H - 1)} \right]^\frac{4}{3}$

Assume that the central planner chooses $x^f_C = x^{CP}$ in a neighborhood of the equilibrium. Afterwards, the market clearing conditions should satisfy the following equations:

\[ p^L_f = (x^{CP})^\frac{1}{2} \quad \text{(10)} \]
\[ p^L_s = (x^{CP})^\frac{3}{4} \quad \text{(11)} \]

Next, $q^H, q^L$ are computed as follows.

\[ q^H = \frac{1 - R^L}{R^H - R^L} \quad \text{(12)} \]
\[ q^L = \frac{R^H - 1}{R^H - R^L} \quad \text{(13)} \]

Then, the utility of a financial advisor is estimated as follows.

\[ \pi \cdot \left( x^H_f + \frac{1}{2} \right) + (1 - \pi) \cdot \left( \frac{x^L_f}{p^L_s} + \frac{1}{2} \cdot (p^L_f)^2 \right) \quad \text{(14)} \]

Inspired by the above analysis, the utility of a secretary is computed as follows.

\[ \pi \cdot \left( x^H_s + \frac{1}{2} \right) + (1 - \pi) \cdot \left( \frac{1}{2} \cdot \left( \frac{p^L_s}{p^L_f} \right)^2 \right) \quad \text{(15)} \]

The central planner maximizes the expected utility of an agent, and welfare function satisfies the following condition:

\[ x^{CP} = \left( \frac{(1-\pi)}{\pi} \cdot \frac{1 - R^L}{R^H - 1} \right)^\frac{4}{3} \quad \text{(16)} \]

That is to say, the NP equilibrium is nearly inefficient when the sufficiently high aggregate uncertainty happens:

\[ 2\varepsilon R^L < \left( \frac{1 - \pi}{\pi} \cdot \frac{1 - R^L}{R^H - 1} \right)^\frac{4}{3} \quad \text{(17)} \]

Regression analysis refers to an effective statistical technique to construct an adequate functional relationship between response and several associated design variables based on the experimental data. In terms of the statistical principles of regression analysis, the second-order polynomial correlation between input and output
variables can be illustrated as follows.

\[ L = \beta_0 + \sum_{i=1}^{n} \beta_i x_i + \sum_{i=1}^{n} \beta_i x_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} x_i x_j + e \]  

where \( x_i, x_j \) refers to the values of the design variables, parameter \( \beta_0 \) denotes the constant coefficient, \( \beta_i, \beta_{ii}, \beta_{ij} \) mean the linear, quadratic and interaction parameters. In addition, parameter \( n \) and \( e \) refer to the number of the independent variables and error term respectively.

5. Experiment. In this section, we test the effectiveness of the proposed method in enterprise inefficient investment. Particularly, the data of this experiment are collected from the CCER database, in which, samples are chosen from 2004 to 2007 using the Shenzhen Stock Exchange listed companies. The final sample observations of this experiment 1405, and descriptive statistic result of different variables are listed as follows.

Table 1. Descriptive statistic of different variables

| Variable   | Minimum | Maximum | Average | Standard deviation |
|------------|---------|---------|---------|--------------------|
| Age(t-1)   | 3       | 17      | 8.81    | 2.25               |
| Size(t-1)  | 15.68   | 25.74   | 22.09   | 1.09               |
| Growth(t-1)| -1.17   | 185.21  | 0.485   | 5.17               |
| Lev(t-1)   | 0.0077  | 54.27   | 0.963   | 2.08               |
| TBQ(t-1)   | 0.0001  | 15.92   | 0.674   | 0.591              |
| Cash(t-1)  | 0       | 0.854   | 0.257   | 0.126              |
| Ret(t-1)   | -0.925  | 6.38    | 0.254   | 0.683              |
| IVV1(t)    | 0       | 0.624   | 0.054   | 0.147              |
| IVV1(t-1)  | 0       | 0.552   | 0.051   | 0.068              |
| IVV2(t)    | -1.39   | 1.22    | 0.008   | 0.163              |
| IVV2(t-1)  | -1.27   | 1.05    | 0.027   | 0.129              |

Afterwards, we illustrate the regression results by our proposed method in Table. 2 as follows.

Where \( IVV_t \) is the Capital investment, TBQ(t-1) is the Enterprise growth opportunities, Lev(t-1) is the asset-liability ratio at the end of \( t-1 \) year, Cash(t-1) is the cash holdings, Size(t-1) refers to the enterprise scale, Age(t-1) is Company listing years at the end of t-1 year, and Ret(t-1) denotes the stock return. In addition, ∗∗ ∗ refers to the significance on 1% level, ∗∗ is the significance on 5% level, and ∗ represents the significance on 10% level.

Next, we test the price of capital, the value of cash, and the value of capital using the proposed method (shown in Fig. 1 to Fig. 4)

From the above figures, function \( p(c), v(c), q(c) \) are used to illustrate the price of capital, the value of cash, and the value of capital. In addition, the cash to capital refers to the relative scarcity of liquid assets in the economy which is compared with the illiquid capital.

It can be observed from Fig. 1 to Fig. 4 that the economy fluctuates across states due to the aggregate cash-flow shocking drive the level of aggregate liquidity. Furthermore, we also can see that the particular sample path starts with a series of positive shocks, which can increase the capital value \( v \) and decrease the cash
value \( q \). Therefore, it can be conclude that the price of capital increases along this path, the reason is that these states the probability that the economy may slip into a downturn. On the other hand, if the price hike goes to the cost of constructing capital \( h \), investment will be triggered.

6. Conclusion. This paper effectively analyzes the enterprise inefficient investment behavior, which is a key issue in both enterprise management and social resources allocation. After analyzing existing enterprise investment theories, we propose a novel enterprise inefficient investment behavior analysis method based on regression analysis. In the end, experimental results reveal several rules in enterprise inefficient investment behaviors.

In the future, we will extend the proposed research in the following aspects:
1) We will try other databases to test the effectiveness of the proposed algorithm.
2) More related works and methods will be compared with our method.

Acknowledgments. We would like to thank reviewers for their valuable comments.

REFERENCES

[1] S. N. Awondo, E. G. Fonsah and D. J. Gray, Incorporating structure and stochasticity in muscadine grape enterprise budget and investment analysis, *Horttechnology*, 27 (2017), 212–222.

[2] S. S. Chen and I. J. Chen, Inefficient investment and the diversification discount: evidence from corporate asset purchases, *Journal of Business Finance & Accounting*, 38 (2011), 887–891.

---

| Variable | IVV1(t) | IVV1(t) | IVV1(t) | IVV2(t) | IVV2(t) |
|----------|---------|---------|---------|---------|---------|
| Constant | -0.072  | -0.081  | -0.080  | -0.395  | -0.386  |
|          | (-2.134**)| (-2.336**)| (-2.317**)| (-3.819**)| (-3.742**)|
| Age\(_{t-1}\) | 6.954E-5 | 0.001   | 0.000   | -0.001  | -0.021  |
|          | (0.115)  | (0.782) | (0.659) | (-0.581)| (-0.883)|
| Size\(_{t-1}\) | 0.004   | 0.004   | 0.004   | 0.017   | 0.017   |
|          | (0.115)  | (0.782) | (0.659) | (-0.588)| (-0.883)|
| Growth\(_{t-1}\) | 0.000   | -9.78E-5| 0.000   | 0.000   | 0.017   |
|          | (-0.415) | (-0.355)| (-0.372)| (0.463) | (-0.883)|
| TBQ\(_{t-1}\) | -0.011  | -0.013  | -0.014  | -0.049  | -0.946  |
|          | (-1.968**)| (-1.742**)| (-1.696**)| (-3.741)| (-3.691)|
| Lev\(_{t-1}\) | 0.000   | 0.000   | 0.003   | -0.002  | 0.016   |
|          | (-0.338) | (-0.416)| (1.524) | (-0.957)| (-3.752**)|
| Cash\(_{t-1}\) | 0.052   | 0.066   | 0.064   | 0.268   | 0.165   |
|          | (3.749***)| (4.125***)| (4.121***)| (3.654***)| (3.627***)|
| Ret\(_{t-1}\) | 0.005   | 0.008   | 0.003   | 0.028   | 0.028   |
|          | (2.025***)| (1.028) | (1.114) | (3.457***)| (3.364***)|
| IVV1\(_{t-1}\) | 0.475   | 0.472   | 0.453   | 0.136   | 0.135   |
|          | (19.965***)| (18.527***)| (18.508***)| (3.652***)| (3.827***)|
| IVV2\(_{t-1}\) | 0.136   | 0.274   | 0.283   | 0.097   | 0.106   |
|          | (3.652***)| (3.827***)| (8.508***)| (3.827***)| (8.72***)|

| Adj-\( R^2 \) | 0.258   | 0.274   | 0.283   | 0.097   | 0.106   |
|**| 73.88***| 27.71***| 28.54***| 7.96***| 8.72***|
Figure 1. Price of capital

Figure 2. Marginal value of cash

[3] J. N. Cooper, D. L. Lodwick, B. Adler, C. Lee, P. C. Minneci and K. J. Deans, Patient characteristics associated with differences in radiation exposure from pediatric abdomen-pelvis CT scans: A quantile regression analysis, Computers in Biology and Medicine, 85 (2017), 7–12.
Figure 3. Marginal value of capital

Figure 4. Cash to capital ratio

[4] J. J. Cordes, Using cost-benefit analysis and social return on investment to evaluate the impact of social enterprise: Promises, implementation, and limitations, Evaluation and Program Planning, 64 (2017), 98–104.

[5] W. Dobson and S. China, State-owned enterprises and Canada’s foreign direct investment policy, Canadian Public Policy-Analyse De Politiques, 43 (2017), S29–S44.
[6] C. Fumagalli, M. Motta and T. Ronde, Exclusive dealing: Investment promotion may facilitate inefficient foreclosure, *Journal of Industrial Economics*, 60 (2012), 599–608.

[7] O. Hart and L. Zingales, Liquidity and inefficient investment, *Journal of the European Economic Association*, 13 (2015), 737–769.

[8] Z. G. He and P. Kondor, Inefficient investment waves, *Econometrica*, 84 (2016), 735–780.

[9] C. W. Hsu, J. H. Wang, Y. H. Kung and M. C. Chang, What is the predictor of surgical mortality in adult colorectal perforation?, *The Clinical Characteristics and Results of a Multivariate Logistic Regression Analysis, Surgery Today*, 47 (2017), 683–689.

[10] X. Y. Ji, H. Ye, J. X. Zhou and W. L. Deng, Digital management technology and its application to investment casting enterprises, *China Foundry*, 13 (2016), 301–309.

[11] S. W. Li, T. Hu, P. J. Wang and J. G. Sun, Regression analysis of current status data in the presence of dependent censoring with applications to tumorigenicity experiments, *Computational Statistics & Data Analysis*, 110 (2017), 75–86.

[12] Y. Liu, C. McMahan and C. Gallagher, A general framework for the regression analysis of pooled biomarker assessments, *Statistics in Medicine*, 36 (2017), 2363–2377.

[13] M. Mainou, A. V. Madenidou, A. Liakos, P. Paschos, T. Karagiannis, E. Bekiari, E. Vlachaki, Z. Wang, M. H. Murad, S. Kumar and A. Tsapas, Association between response rates and survival outcomes in patients with newly diagnosed multiple myeloma, *A systematic review and meta-regression analysis, European Journal of Haematology*, 98 (2017), 563–568.

[14] N. Matthews and S. Motta, Chinese state-owned enterprise investment in mekong Hydropower: Political and economic drivers and their implications across the water, *Energy, Food Nexus, Water*, 7 (2015), 6209–6284.

[15] R. Meister, A. Jansen, M. Harter, Y. Nestoriuc and L. Kriston, Placebo and nocebo reactions in randomized trials of pharmacological treatments for persistent depressive disorder, *A Meta-Regression Analysis, Journal of Affective Disorders*, 215 (2017), 288–298.

[16] A. Olaya-Abril, L. Parras-Alcantara, B. Lozano-Garcia and R. Obregon-Romero, Soil organic carbon distribution in Mediterranean areas under a climate change scenario via multiple linear regression analysis, *Science of the Total Environment*, 592 (2017), 134–143.

[17] D. Phung, D. Connell, S. Rutherford and C. Chu, Cardiovascular risk from water arsenic exposure in Vietnam: Application of systematic review and meta-regression analysis in chemical health risk assessment, *Chemosphere*, 177 (2017), 167–175.

[18] X. H. Qu, Z. J. Liu, Y. L. Wang, Y. Fang, M. Y. Du and H. He, Dentofacial traits in association with lower incisor alveolar cancellous bone thickness: A multiple regression analysis, *Angle Orthodontist*, 87 (2017), 409–415.

[19] R. Rajan, H. Servaes and L. Zingales, The cost of diversity: The diversification discount and inefficient investment, *Journal of Finance*, 55 (2000), 35–80.

[20] G. A. Ribaroff, E. Wastnedge, A. J. Drake, R. M. Sharpe and T. J. G. Chambers, Animal models of maternal high fat diet exposure and effects on metabolism in offspring: a meta-regression analysis, *Obesity Reviews*, 18 (2017), 673–686.

[21] D. S. Scharfstein and J. C. Stein, The dark side of internal capital markets: Divisional rent-seeking and inefficient investment, *Journal of Finance*, 55 (2000), 2537–2564.

[22] S. H. Seog and Y. S. Baik, Inefficient investment, information asymmetry, and competition for managers, *Journal of Public Economic Theory*, 14 (2012), 971–995.

[23] S. Verna, M. E. Nongpiur, E. Atalay, X. Wei, R. Husain, D. Goh, S. A. Perera and T. Aung, Exposure in Vietnam: Application of systematic review and meta-regression analysis in chemical health risk assessment, *Chemosphere*, 177 (2017), 167–175.

[24] R. S. Yoon, M. J. Gage, D. K. Galos, D. J. Donegan and F. A. Liporace, Trochanteric entry femoral nails yield better femoral version and lower revision rates: A large cohort multivariate
regression analysis, *Injury-International Journal of the Care of the Injured*, 48 (2017), 1165–1169.

[29] G. L. Yu, L. Zhu, Y. Li, J. G. Sun and L. L. Robison, Regression analysis of mixed panel count data with dependent terminal events, *Statistics in Medicine*, 36 (2017), 1669–1680.

[30] Y. F. Zhang, M. Zhang, Y. Liu and R. Nie, Enterprise investment, *Local Government Intervention and Coal Overcapacity: The Case of China, Energy Policy*, 101 (2017), 162–169.

Received September 2017; revised January 2018.

E-mail address: 13332267609@189.cn
E-mail address: 18040118636@189.cn