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TRADE CREDIT AND PERFORMANCE OF FOOD PRODUCTION COMPANIES IN VIETNAM

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ABSTRACT

Trade credit (TR) plays an important role in financial structure and impacts on company performance. The issues related to TR have long been researched, with the first studies conducted by Nadiri (1969); Schwartz (1974); Lewellen, McConnell, and Scott (1980); Ferris (1981); Emery (1984). This study applies panel regression models, such as Pooled OLS, Fixed Effects, Random Effects, and FGLS, to evaluate the impact of TR on the performance of Food Production Companies in Vietnam. Company performance is measured by the Data Envelopment Analysis model (DEA). In addition, the Bayesian analysis method is used to test the robustness of the estimators from the models evaluating the effect of TR on company performance. Using annual data from the financial statements of 35 Vietnamese Food Production companies in the period 2008-2020, provided by Thomson Reuters, the results reveal a non-linear relationship between TR and company performance with an inverted U shape. Specifically, when TR, or accounts receivable on total assets, increases, company performance will also increase. However, when the increase in accounts receivable on total assets exceeds a certain limit, company performance will decrease. Based on the results, some policy implications are suggested to manage the accounts receivables effectively in Vietnamese Food Production Companies.

Contribution/Originality: This study contributes to the existing literature by analyzing the nonlinear effects of TR on company performance. Further, this study uses the Bayesian inference method instead of the frequency inference method to assess influencing factors.

1. INTRODUCTION

Theoretically, trade credit (TR) plays an important role in financial structure and affects company performance. The issues related to TR have long been the subject of research, with the earliest contributions offered by Nadiri (1969); Schwartz (1974); Lewellen et al. (1980); Ferris (1981); Emery (1984). These papers provided a stepping stone for later studies, such as Mian and Smith Jr (1992); Lee and Stowe (1993); Emery and Nayar (1998); Wilner (2000). To this day, company TR is studied extensively. The empirical evidence shows that TR impacts on company performance by increasing company value.

From the seller's point of view, an increase in receivables helps the company improve its competitiveness and consume more products, thereby increasing revenue and profitability. However, this does not mean that maintaining a large quantity of receivables is better for a company, because credit activities can expose the company to the risk of losing capital when customers do not fulfill their debt repayment obligations. Therefore, the provision of TR can lead to problems of liquidity and opportunity, which can negatively affect the company's profitability if

not effectively managed. In addition, expanding TR causes sellers to bear additional expenses for costly credit management activities. The receivables can be seen as a tradeoff between company cost and profit (Abuhommous & Almanaseer, 2021; Burkart & Ellingsen, 2004; Cheng & Pike, 2003; Gallego Herrero, Saurina Salas, & García-Herrero, 2002; Kwon, Han, & Lee, 2020; Le, Phan, & Cao, 2021; Martínez-Sola, García-Teruel, & Martínez-Solano, 2013). Effective management of TR requires a careful balance between the benefits of providing credit and the different expenses associated with holding receivables.

This paper examines the effects of TR investment on company performance in the Food Production industry. TR investment is a particularly relevant question in the Food Production industry because its expense is lower here than in other industries (Fafchamps, Pender, & Robinson, 1995; Martínez-Sola., García-Teruel, & Martínez-Solano, 2014; Tran, Pham, Le, & Pham, 2020). Because food products are soft (uncomplicated), highly perishable, high revenue, and easy to quality control, researchers argue that in commercial transactions cash sales are more significant than credit sales (Long, Malitz, & Ravid, 1993). This raises the question whether trade credit is related to the profit of Food Production companies and, if so, what the nature of the relationship is. This question has so far gone largely unanswered in the empirical literature on TR because few industry-level studies have been conducted, particularly involving the food industry. Previous research has failed to test the relationship between TR and profit in different industries or control for the differences between industries in their econometric models, assuming that industry plays no, or only a slight, role in TR activities (Abuhommous, 2017; Afrifa, 2016; Martínez-Sola et al., 2014). However, more recent papers by Giannetti, Burkart, and Ellingsen (2011); Nguyen (2011); Li, Lu, Ng, and Yang (2016) show that different industries differ in the TR activities they carry out, and that the role of lending is important in industry-level studies. To examine the relationship between TR and the performance of Vietnamese Food Production companies, this study uses a sample of 35 Food Production companies listed in the period from 2008 – 2020, all of which invest in TR.

Therefore, this study will produce a great deal of practical information: first, it will contribute more empirical evidence about the effects of TR on Food Production companies' operational performance in Vietnam. Secondly, it provides more practical findings about the TR threshold for optimizing company performance. Finally, the research tests the changes in operating performance of Vietnamese Food Production companies when the TR exceeds the optimum value. Thus, the research can help managers and executives in Vietnamese Food Production companies more clearly see the importance of TR in increasing operational efficiency and seek the optimal TR threshold to maximize operational efficiency. From there, managers and executives of Vietnamese Food Production companies can plan appropriate financial strategies to find optimal receivables, contributing to the maximization of their businesses' operational efficiency.

2. LITERATURE REVIEW

2.1. Trade Credit Boosts Business Performance

The relationship between TR and operational performance is based on the convertible cost theory proposed by Emery (1984) and later developed by Bhattacharya (2008). Collectively, these theories describe transaction (or operational) cost theory, finance, and trade. As illustrated in Figure 1, TR helps a company increase operational efficiency via two specific pathways.

First, from a transaction cost perspective, firms can increase their profits by saving on the transaction costs of economic exchanges by using TR (Emery, 1984). Providing trade credit can reduce storage costs due to high inventory holding; it can also reduce the number of banking transactions and associated costs (Emery, 1984; Ferris, 1981; Schwartz, 1974). According to transaction cost theory, when transactions between a seller and a buyer occur frequently, both parties can reduce transaction costs by agreeing to a recurring payment schedule. The goal in this case is not funding but the reduction of transaction costs. This works as long as it saves on transaction costs rather than holding receivables.

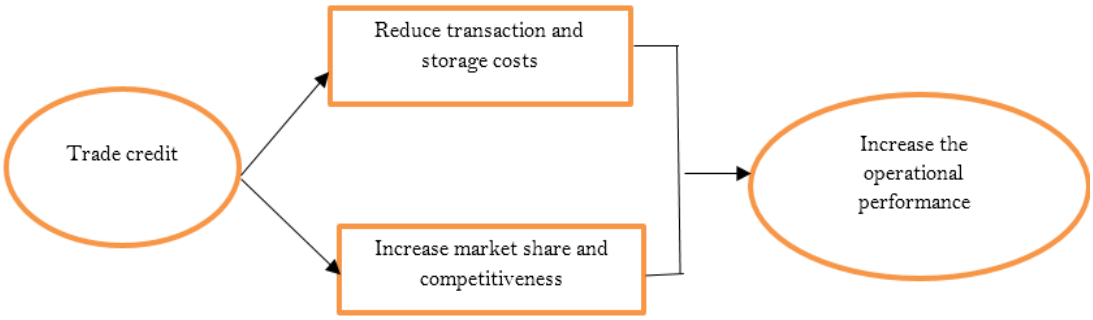

Figure-1. Transaction cost theory.

Source: Emery (1984) and Bhattacharya (2008).

Mian and Smith Jr (1992) found that when the provision of goods and credit is made, overall costs are reduced and business efficiency is increased. Sellers, in general, especially those with large inventories, can save on storage and related costs by making sales on attractive credit terms. This can happen when the marginal cost of holding inventory is greater than the cost of holding accounts receivable. Companies with products subject to high demand volatility can use trade credit, which in this case may be considered the least expensive solution. Sellers can loosen credit terms when demand falls and tighten them when demand increases. This hypothesis of Emery (1984) is supported by the empirical findings of Long et al. (1993), who concluded that firms with high sales demand would extend more credit than other firms. This theory was valid until the 1990s, but with the revolutionary improvement in information technology and payments during the last two decades, transaction costs have dropped so much that the hypothesis no longer holds. The drop in transaction costs should have caused the level of trade credit to decrease during this period, but this did not happen. However, the advantage of saving on inventory costs by making a credit sale can still offer significant benefits. Another aspect is the difficulty of implementing a variable credit policy in response to changing needs. The market can react strongly against such policies, as it often favors a uniform policy.Second, companies can also improve their operational efficiency by extending TR to stimulate demand during periods of low demand, thereby increasing transaction volumes. From a financial perspective, firms can increase profits by investing in TR to generate additional profits (Emery, 1984). Similar to investing in marketable securities, companies with idle funds (excess liquidity) can invest in receivables to earn interest. When buyer companies have difficulty raising money from financial markets in times of tight monetary policy, providing TR to customers can boost sales and profits (Meltzer, 1960). From a commercial point of view, companies promote various trade programs by using trade credits. According to marketing/competition theory, offering TR can be a way to increase sales and profits (Cheng & Pike, 2003; Nadiri, 1969; Wilner, 2000). Providing TR can enhance a company's competitiveness and profitability by increasing their market share (Nadiri, 1969; Wilner, 2000) and product differentiation (commodities associated with credit) (Cheng & Pike, 2003). TR can also facilitate corporate profitability by helping to attract, retain, and build long-term commercial relationships with customers, creating a steady or growing demand in them for enterprise products (Cheng & Pike, 2003; Long et al., 1993; Wilner, 2000). This is related to the theory of developing long-term relationships with customers through investment in TR. From the viewpoint of quality assurance theory, TR can increase the sales and profits of a business by assuring quality, through the mechanism of allowing customers to verify the quality and quantity of purchased goods before payment (Long et al., 1993). Especially for new companies or products entering the market, the provision of TR signals product quality, stimulating demand for the product.

2.2. Trade Credit Hinders Business Performance

While there are benefits to investing in TR, such investment does not always boost a company's performance. There are administrative costs in providing TR, such as supervisory costs, enforcement costs, and receivables management costs (Martínez-Sola et al., 2013; Nadiri, 1969). Investing in TR exposes companies to financial risks,

such as late or delayed payments and the risk of default. There is also an opportunity cost of selling for credit instead of selling for cash (Nadiri, 1969). That is, funds used to finance customer purchases could be turned into alternative short-term investments. Thus, firm profitability can be a decreasing function of TR investment if the investment costs exceed the benefits (Cheng & Pike, 2003; Martínez-Sola. et al., 2014). The optimal level of TR investment is when the costs and benefits of investing in TR are balanced (Emery, 1984; Nadiri, 1969). In summary, if the costs of investing in TR outweigh the benefits, the relationship is likely to be negative.

In addition, Fisman (2001) argued that a common measure of working capital management was the cash conversion cycle, i.e., the time lag between spending on raw materials and collecting semi-finished goods. The longer the time lag, the greater the investment in working capital. A longer cash conversion cycle can increase profits because it leads to higher sales. However, corporate profits can also decline with the cash conversion cycle if the cost of investing in working capital is higher and increases more quickly than the benefits of holding more inventory, and/or the cost of working capital grants more TR to customers.

3. METHODOLOGY

3.1. Research Method

To provide empirical evidence about the impact of TR on the operational performance of Vietnamese Food Production companies, this study uses 3 models proposed by Martínez-Sola et al. (2013) as below:

The first model tests whether TR has an impact on the performance of Vietnamese Food Production companies through a first-order linear model between independent variables and the dependent variable V_{it} for company performance. The second model investigates the non-linear relationship (inverted U shape) between receivables and company performance to examine whether there is an optimal receivables level to optimize company performance.

The third model investigates whether company performance decreases when TR exceeds the optimal value (where company performance is highest) to help managers examine and maintain a TR threshold that optimizes company performance.

Models (1) and (2) are described as follows:

$$V_{it} = \beta_0+\beta_1(REC_{it}) + \beta_2(GROWTH_{it}) + \beta_3(SIZE_{it}) + \beta_4(LEV_{it}) + \varepsilon_{it} \quad (1)$$

$$V_{it} = \beta_0+\beta_1(REC_{it}) + \beta_2(REC_{it}^2) + \beta_3(GROWTH_{it}) + \beta_4(SIZE_{it}) + \beta_5(LEV_{it}) + \varepsilon_{it} \quad (2)$$

Table-1. Variable Descriptions.

Independent variables	Notation	Measure	Expected sign
Accounts receivable	REC_1	$\frac{\text{Accounts receivable}}{\text{Revenue}}$	+/-
	REC_2	$\frac{\text{Accounts receivable}}{\text{Total Asset}}$	+/-
Accounts receivable squared	$(REC_1)^2$	$\left(\frac{\text{Accounts receivable}}{\text{Revenue}}\right)^2$	-
	$(REC_2)^2$	$\left(\frac{\text{Accounts receivable}}{\text{Total Asset}}\right)^2$	-
Opportunity Growth	GROWTH	$\frac{\text{Revenue year t - Revenue year (t-1)}}{\text{Revenue year (t-1)}}$	+
Company Size	SIZE	SIZE = Ln (Total Asset)	+/-
Financial Leverage	LEV	$\frac{\text{Total Debits}}{\text{Equity Capital}}$	+/-

Note: (+): Positive relationship, (-): Negative relationship.

In which dependent variable V_{it}, which represents the company performance of firm i in year t, is measured by the two variables of technical efficiency (TE) and scale efficiency (SE). The two efficiency ratios are obtained from the DEA method in the first research content. Equation 1 describes a linear relationship between TR and company performance, while Equation 2 describes a nonlinear relationship between these variables.

The independent variables in the model are presented in Table 1.

After regressing the model, if the result shows a non-linear relationship between holding receivables and company performance, we can conclude that there is an optimal receivable to maximize company performance. The research is continued to consider how company performance decreases when the receivables exceed the optimal value, as shown in Figure 2. Evaluating this impact has important ramifications, as companies may be required to deviate from the optimal receivable at times, for reasons related to the maturity of loans and procedures.

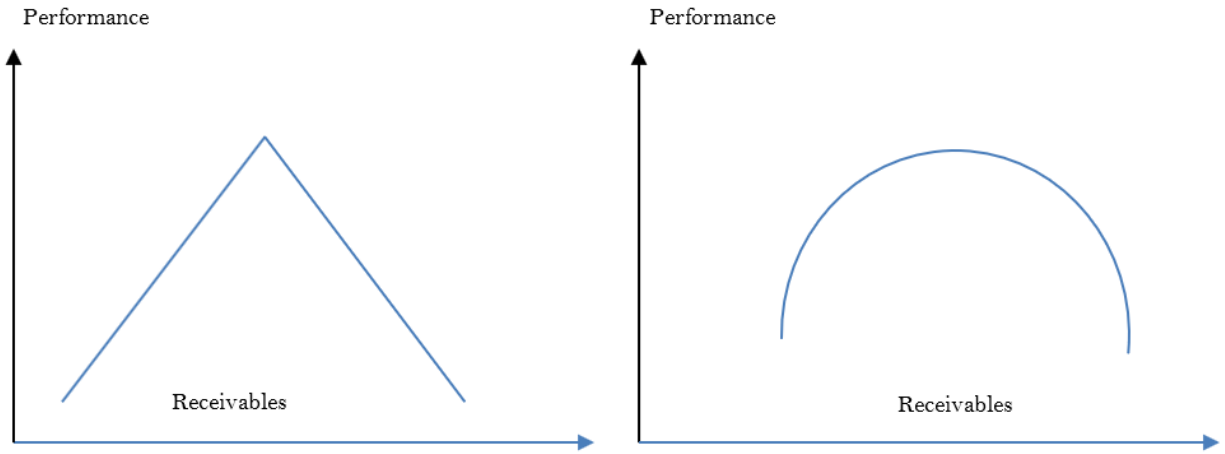

Figure-2. Consequences of deviation from the optimal receivables position.

To estimate how the receivables affect company performance when they deviate from the optimal position, this study uses Equation 3 below:

$$V_{it} = \beta_0+\beta_1(DEVIATION_{it}) + \beta 2\ (GROWTH_{it}) + \beta 3(SIZE_{it}) + \beta 4(LEV_{it}) + \varepsilon_{it} \quad (3)$$

In Equation 3, $DEVIATION_{it}$, the deviation from the optimal receivables level, is calculated by subtracting the optimal receivables from the value of the receivables. Specifically:

$$DEVIATION_{it} = REC_{it} - REC^{*}$$

where REC^{*} is the optimal receivables level obtained from model (2).

3.2. Data

Research data is collected from the annual financial statements of 35 Vietnamese Food Production companies for the period 2008-2020, provided by Thomson Reuters. Thomas Reuters is a website that allows access to their database for the purpose of multidisciplinary research that deeply explores specialized areas in academic sciences, and includes audited financial reports and performance indicators to arrive at ratings based on informative transparency.

To evaluate the performance of Vietnamese Food Production companies, this study uses the Data Envelopment Analysis model (DEA), which is commonly used to evaluate company performance. Using STATA software to analyze the panel data of 35 Vietnamese Food Production companies in the period from 2008 to 2020, this study estimates the models by using Pooled OLS, Fixed Effects, and Random Effects Models. Because the measurement

opportunity growth (GROWTH) is used, the number of observations for each company is reduced by 1. Therefore, the real-time for investigation in this study is 2009-2020.

4. RESEARCH RESULTS

4.1. Result of Operational Performance of Vietnamese Food Production Companies

The DEA result of 35 Vietnamese Food Production companies during 2008-2020 is presented in Table 2.

Table-2. DEA estimators of technical efficiency.

Firm	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
VNM	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
VHC	0.887	0.914	0.882	0.884	0.756	0.866	0.782	0.783	0.787	0.789	0.759	0.768	0.697
ABT	0.966	0.801	0.813	0.915	0.801	1.000	0.849	0.904	0.726	0.655	0.905	0.771	0.695
ACL	0.874	0.812	0.822	0.874	1.000	0.795	0.736	0.732	0.637	0.641	0.849	0.799	0.692
AGF	0.904	0.756	0.787	0.837	0.908	0.845	0.714	0.660	0.616	0.532	0.533	0.677	0.632
ANV	0.802	0.651	0.789	0.805	0.737	0.728	0.745	0.716	0.591	0.732	0.718	0.753	0.632
BBC	0.906	0.946	1.000	1.000	0.984	1.000	1.000	0.961	0.911	1.000	1.000	1.000	1.000
CAN	0.969	0.968	1.000	1.000	1.000	1.000	1.000	0.902	0.824	0.821	0.818	0.904	0.872
FMC	1.000	0.718	0.999	0.865	1.000	0.905	0.859	0.836	0.853	0.850	0.947	1.000	0.952
ICF	0.783	0.833	0.816	0.832	0.865	0.851	0.783	0.798	0.616	0.552	0.550	0.639	0.594
KDC	0.926	0.975	0.927	1.000	1.000	1.000	1.000	1.000	0.878	0.648	0.618	0.649	0.696
LAF	0.831	0.884	0.981	0.723	0.885	1.000	0.919	0.929	0.904	0.842	0.846	1.000	1.000
LSS	0.939	0.859	1.000	0.995	0.725	0.867	0.877	0.798	0.681	0.754	0.649	0.811	0.882
NSC	1.000	1.000	1.000	0.990	1.000	1.000	1.000	0.973	0.891	0.917	0.922	0.852	0.862
SAF	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SGC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SJ1	0.809	0.857	1.000	0.917	0.883	0.785	0.748	0.750	0.654	0.647	0.631	0.665	0.672
SSC	1.000	1.000	1.000	1.000	0.893	0.854	0.950	0.914	0.809	0.864	0.981	0.838	0.761
TAC	1.000	1.000	1.000	1.000	1.000	1.000	0.955	0.878	1.000	0.868	0.874	0.958	0.879
TNA	0.868	0.682	0.780	0.756	0.752	0.781	0.745	0.782	0.853	0.855	0.784	0.879	0.835
TS4	0.789	0.822	0.839	0.874	1.000	0.926	0.801	0.734	0.595	0.700	0.673	0.823	0.569
TSC	0.850	0.846	0.900	0.876	1.000	0.925	0.957	0.701	0.690	0.666	0.642	0.608	0.630
DHC	0.746	0.805	0.875	0.871	0.881	0.981	1.000	1.000	1.000	1.000	1.000	1.000	0.991
AAM	0.805	0.806	0.842	0.899	0.785	0.766	0.747	0.653	0.556	0.559	0.646	0.609	0.513
MSN	0.988	0.957	1.000	1.000	1.000	0.974	1.000	0.913	0.770	0.885	0.980	0.774	0.929
BLF	0.776	0.772	0.807	0.913	0.835	0.753	0.786	0.746	0.654	0.770	0.873	0.910	0.911
DBC	0.837	0.773	0.805	0.782	0.744	0.758	0.837	0.845	0.894	0.899	0.943	0.955	1.000
HHC	1.000	1.000	1.000	1.000	0.964	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HNM	1.000	1.000	1.000	1.000	0.839	0.982	1.000	1.000	0.762	1.000	0.977	0.890	0.916
VDL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.921	0.961	0.909	0.913	0.937	1.000
SPD	0.813	0.835	0.842	0.849	0.864	0.941	0.909	0.945	0.812	0.835	0.844	0.913	0.854
SPM	0.951	1.000	1.000	1.000	0.855	0.793	0.833	0.730	0.672	0.726	0.773	0.800	0.776
CMX	0.906	0.760	0.848	0.786	0.767	0.618	0.825	0.931	0.729	1.000	1.000	1.000	0.934
MCF	1.000	0.916	1.000	1.000	1.000	0.860	1.000	1.000	1.000	1.000	1.000	1.000	1.000
IDI	0.827	0.764	0.756	0.830	0.731	0.706	0.752	0.705	0.554	0.613	0.620	0.722	0.661

The table demonstrates that in the period from 2008 to 2020 the performance of the 35 Vietnamese Food Production companies fluctuated significantly over time. The technical efficiency of Vietnam Dairy Products Joint Stock Company (VNM), Safoco foodstuff joint-stock company (SAF), and Sa Giang Import and Export Company (SGC) are the highest among the 35 companies, reaching the maximum value of 1. In contrast, the average technical efficiency of Mekong Fisheries Joint Stock company (AAM) is the lowest at 0.707.

However, Table 3 shows that the average technical efficiency of the 35 Vietnamese Food Production companies during 2008-2020 is higher than 50%. That means that company performance in this industry is comparatively higher than in other industries. According to the General Statistics Office of Vietnam (2019), the Food Processing industry accounts for more than 26% of the four key industries and accounts for 17.67% of all industry in the city.

This shows that the industry retains a relatively high position among the four key industries and represents the strength of Vietnam, with many large, reputable, stable, and highly competitive brands compared to foreign enterprises.

In recent years, many Vietnamese Food Production companies have focused on investing in modern machinery and technology to meet the increasing demand of consumers. According to an official survey, food and beverages account for the highest proportion of the monthly expenditure of consumers in the city, with 35%. Food and beverage products are increasingly diversified and numerous in business, and online business is dominating and creating a dynamic business environment that attracts diverse types of investment companies.

Table-3. Statistical Description of Technical Efficiency (TE) by DEA model.

Firm	Technical Efficiency (TE)		
	Average value	Maximum value	Minimum value
VNM	1.000	1.000	1.000
VHC	0.812	0.914	0.697
ABT	0.831	1.000	0.655
ACL	0.789	1.000	0.637
AGF	0.723	0.908	0.532
ANV	0.723	0.805	0.591
BBC	0.978	1.000	0.906
CAN	0.929	1.000	0.818
FMC	0.906	1.000	0.718
ICF	0.732	0.865	0.550
KDC	0.871	1.000	0.618
LAF	0.903	1.000	0.723
LSS	0.834	1.000	0.649
NSC	0.954	1.000	0.852
SAF	1.000	1.000	1.000
SGC	1.000	1.000	1.000
SJ1	0.771	1.000	0.631
SSC	0.913	1.000	0.761
TAC	0.955	1.000	0.868
TNA	0.796	0.879	0.682
TS4	0.780	1.000	0.569
TSC	0.792	1.000	0.608
DHC	0.935	1.000	0.746
AAM	0.707	0.899	0.513
MSN	0.936	1.000	0.770
BLF	0.808	0.913	0.654
DBC	0.852	1.000	0.744
HHC	0.997	1.000	0.964
HNM	0.951	1.000	0.762
VDL	0.972	1.000	0.909
SPD	0.866	0.945	0.812
SPM	0.839	1.000	0.672
CMX	0.854	1.000	0.618
MCF	0.983	1.000	0.860
IDI	0.711	0.830	0.554

4.2. Result of the Impact of TR on the Performance of Vietnamese Food Production Companies

This study uses STATA software with the panel data of 35 Vietnamese Food Production companies in the period 2008-2020 to estimate models, using Pooled OLS, Fixed Effects, and Random Effects models. Because the measurement opportunity growth (GROWTH) is used, the number of observations for each company is reduced by 1. Table 4 presents the estimated result of the model, with the independent variable TR measured by accounts receivables on revenue (REC_1).

Table-4. Estimators of model with REC_1

TE	Model (1)	Model (2)	Model (3)
REC_1	-0.1765362***	-0.1911081***	-0.1899699***
GROWTH	0.0413652**	0.0094233	0.0121408
SIZE	-0.0123877***	-0.0401902***	-0.0279469***
LEV	-0.0210497***	-0.0151438***	-0.0164679***
_CONS	1.170044***	1.744119***	1.49216***
Breusch and Pagan Lagrangian Multiplier p-value		0.000	
Wooldridge p-value		0.000	
Hausman p-value		0.7850	

Note: Estimations of the linear effect models of TR and performance of Vietnamese Food Production companies by using Pooled OLS (model 1), fixed effects (model 2), and random effects (model 3). Breusch and Pagan Lagrangian Multiplier, Wooldridge, Hausman p-value are p-values of Breusch and Pagan Lagrangian Multiplier, Wooldridge, Hausman tests.
***; **; * significance level respectively 1%; 5% and 10%

The estimation results of the fixed effects model shows that the regression coefficients of variables REC_1, SIZE, and LEV are statistically significant at 1%. Thus, accounts receivable on revenue (REC_1), company size (SIZE), and leverage (LEV) affect the performance of Vietnamese Food Production companies. In addition, the estimation results of the random effects model also show that the regression coefficients of variables (REC_1), SIZE, and LVE are statistically significant at 1%. Therefore, accounts receivable on revenue (REC_1), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies.

The Hausman Test gives a p-value of 0.785, which is higher than the statistically significant level at 10%. This reveals that the estimations of the random effects model (REM) are better than those of the fixed effects model (FEM). However, the model estimated by the random effects model (REM) has heteroskedasticity and autocorrelation.

This study continues estimating models using the FGLS method to correct the heteroskedasticity and autocorrelation. The results of this approach are shown in Table 5.

Table-5. Estimators of model with REC_1 using the FGLS method.

TE	Coefficient	Std. Error	t-statistic	P>t
REC_1	-0.1108652***	0.037126	-2.99	0.003
GROWTH	0.0073678	0.0099939	0.74	0.461
SIZE	0.0435612***	0.0004728	92.13	0.000
LEV	-0.0214278***	0.0033702	-6.36	0.000

Note: ***; **; * significance level respectively 1%; 5% and 10%

The estimators of the linear effects model of relating TR to the performance of Vietnamese Food Production companies show that the regression coefficients of variables REC_1, SIZE, and LEV are statistically significant at 1%. Therefore, accounts receivable on revenue (REC_1), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies.

Thus, when TR is measured by accounts receivable on revenue (REC_1), the results demonstrate the existence of a linear relationship between TR and the performance of Vietnamese Food Production companies. Specifically, when TR increases, the performance of Vietnamese Food Production companies decreases. This finding is supported by Raheman and Nasr (2007); Falope and Ajilore (2009); Mansoori and Muhammad (2012), and Daniel and Jagongo (2013).

Next, this study estimates the model with the independent variable TR calculated as accounts receivable on total assets (REC_2), as shown in Table 6. The estimation results of the fixed effects model show that the regression coefficients of the variables SIZE and LEV are statistically significant at 1%. Thus, company size (SIZE) and leverage (LEV) affect the performance of Vietnamese Food Production companies. Additionally, the estimation results of the random effects model also reveals that the regression coefficients of variables SIZE and -LEV are statistically significant at 1%, and the regression coefficient of accounts receivables on total assets (REC_2) is

significant at 5%. Therefore, accounts receivable on total assets (REC_2), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies.

Table-6. The estimators of the model with REC_2.

TE	Model (1)	Model (2)	Model (3)
REC_2	-0.2308461***	-0.0677901	-0.0992298**
GROWTH	0.0502443***	0.0172521	0.0206725
SIZE	-0.018174***	-0.0456138***	-0.0326229***
LEV	-0.0192923***	-0.0156179***	-0.0164202***
_CONS	1.298342***	1.833973***	1.572099***
Modified Wald p-value	0.000		
Wooldridge p-value	0.000		
Hausman p-value	0.0988		

Note: Estimations of the linear effect models of TR and performance of Vietnamese Food Production companies, using Pooled OLS (model 1), fixed effects (model 2), and random effects (model 3). Modified Wald, Wooldridge, Hausman p-value is p-values of Modified Wald, Wooldridge, Hausman tests.
***; **; * significance level respectively 1%; 5% and 10%

The Hausman Test provides a p-value of 0.0988, which is less than the significance level at 10%. This demonstrates that the estimators of the fixed effects model (FEM) are better than those of the random effects model (REM). However, the model estimated using the fixed effects model (FEM) has heteroskedasticity and autocorrelation.

This study continues estimating the models using the FGLS method to correct the heteroskedasticity and autocorrelation. Table 7 presents the results of this approach.

Table-7. Estimators of model with REC_2, using the FGLS method.

TE	Coefficient	Std. Error	t-statistic	P>t
REC_2	-0.0009447	0.045238	-0.02	0.983
GROWTH	0.0118958	0.0097377	1.22	0.222
SIZE	0.0426816***	0.0004682	91.15	0.000
LEV	-0.021666***	0.0033491	-6.47	0.000

Note: ***; **; * significant level respectively 1%; 5% and 10%

The estimators from the linear effects model relating TR to the performance of Vietnamese Food Production companies show that the regression coefficients of variables SIZE and LEV are statistically significant at 1%. Therefore, company size (SIZE) and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies.

Thus, when TR is measured by accounts receivable on total assets (REC_2), the results show that there is no linear relationship between TR and the performance of Vietnamese Food Production companies.

4.3. The Estimators of a Non-Linear Effect Model Relating TR to Performance of Vietnamese Food Production Companies.

The estimators from a non-linear effect model relating TR to the performance of Vietnamese Food Production companies, with the independent variable TR calculated as accounts receivable on total revenue (REC_1), are presented in Table 8. The estimators of the fixed effects model show that the regression coefficients of the variables SIZE and LEV are statistically significant at 1%, and the regression coefficients of REC_1 are significant at 10%. Therefore, accounts receivable on total revenue (REC_1), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies. The regression coefficient of variable REC_1^2 (REC12) is not statistically significant at 10%.

In addition, the estimators of the random effects model also demonstrate that the regression coefficients of the variables REC_1, SIZE and LEV are statistically significant at 1%. Thus, accounts receivable on total revenue (REC_1), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food

Production companies. However, the regression coefficient of variable REC_1^2 (REC12) is not statistically significant at 10%.

Table-8. The estimators from the model with REC_1

TE	Model (1)	Model (2)	Model (3)
REC_1	-0.5141162***	-0.1328743*	-0.2090474***
REC12	0.2998191***	-0.0555793	0.0185724
GROWTH	0.0405879**	0.0092331	0.0131032
SIZE	-0.011333***	-0.0412587***	-0.0254696***
LEV	-0.019984***	-0.0152983***	-0.0167432***
_CONS	1.186729***	1.759829***	1.443298***
Modified Wald p-value	0.000		
Wooldridge p-value	0.000		
Hausman p-value	0.000		

Note: Estimators from the non-linear effect models relating TR and performance of Vietnamese Food Production companies, using Pooled OLS (model 1), fixed effects (model 2), and random effects (model 3). Modified Wald, Wooldridge, Hausman p-value is p-values of Modified Wald, Wooldridge, Hausman tests. ***; **; * significance level respectively 1%; 5% and 10%

The Hausman test gives a p-value of 0.000, less than the significant level of 10%. It shows that the estimators from the fixed effects model (FEM) are better those of the random effects model (REM). However, the model estimated by the fixed effects model (FEM) demonstrates heteroskedasticity and autocorrelation.

This study continues estimating models, using the FGLS method to correct the heteroskedasticity and autocorrelation. Table 9 presents the results of this approach.

Table-9. The estimators of model with REC_1, using the FGLS method.

TE	Coefficient	Std. Error	t-statistic	P>t
REC_1	-0.1702548**	0.0678005	-2.51	0.012
REC12	0.0420981	0.0505087	0.83	0.405
GROWTH	0.0076815	0.0103715	0.74	0.459
SIZE	0.0439639***	0.0005377	81.76	0.000
LEV	-0.021421***	0.0034093	-6.28	0.000

Note: ***; **; * significant level respectively 1%; 5% and 10%

The estimators from the non-linear effects model relating TR to the performance of Vietnamese Food Production companies show that the regression coefficients of variables SIZE and LEV are statistically significant at 1%, and the regression coefficient of variable REC_1 is statistically significant at 5%. Thus, accounts receivable on total revenue (REC_1), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies. However, the regression coefficient of variable REC_1^2 (REC12) is not statistically significant at 10%. Therefore, there does not exist a non-linear impact of TR on the performance of Vietnamese Food Production companies, when the independent variable TR is represented by accounts receivable on revenue (REC_1).

Next, this study estimates a non-linear effect model relating TR to the performance of Vietnamese Food Production companies, with the independent variable TR represented by accounts receivable on total assets (REC_2). The results are shown in Table 10. The estimators of the fixed effects model show that the regression coefficients of the variables REC_2, SIZE and LEV are statistically significant at 1%. Therefore, accounts receivable on total assets (REC_2), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies. In addition, the regression coefficient of variable REC_2^2 (REC22) is statistically significant at 10%.

In addition, the estimators of the random effects model demonstrate that the regression coefficients of the variables SIZE and LEV are statistically significant at 1%, and the regression coefficient of variable REC_2 is statistically significant at 5%. Therefore, accounts receivable on total assets (REC_2), company size (SIZE), and

leverage (LEV) have an impact on the performance of Vietnamese Food Production companies. Also, the regression coefficient of variable REC_2^2 (REC22) is statistically significant at 1%.

Table-10. The estimators of model with REC_2

TE	Model (1)	Model (2)	Model (3)
REC_2	-0.1205013	0.386751***	0.314409**
REC22	-0.1980882	-0.8272892***	-0.7500217***
GROWTH	0.0497979***	0.0167252	0.0199771
SIZE	-0.0172925***	-0.0431921***	-0.0302566***
LEV	-0.0192774***	-0.0155642***	-0.0163625***
_CONS	1.269217***	1.739413***	1.482565***
Modified Wald p-value	0.000		
Wooldridge p-value	0.000		
Hausman p-value	0.0060		

Note: The estimators from the non-linear effect models relating TR and performance of Vietnamese Food Production companies, using Pooled OLS (model 1), fixed effects (model 2), and random effects (model 3). Modified Wald, Wooldridge, Hausman p-value is p-values of Modified Wald, Wooldridge, Hausman tests.
***; **; * significance level respectively 1%; 5% and 10%

The Hausman test gives a p-value of 0.0060, which is less than the significant level of 1%. This demonstrates that the estimators from the fixed effects model (FEM) are better than those of the random effects model (REM). However, the model estimated by the fixed effects model (FEM) has heteroskedasticity and autocorrelation.

This study continues estimating models, using the FGLS method to correct the heteroskedasticity and autocorrelation. Table 11 shows the results of this approach.

Table-11. The estimators of model with REC_2, using the FGLS method.

TE	Coefficient	Std. Error	t-statistic	P>t
REC_2	0.2224843**	0.1021671	2.18	0.029
REC22	-0.44098**	0.1867215	-2.36	0.018
GROWTH	0.0158017	0.0101355	1.56	0.119
SIZE	0.0418431***	0.0005545	75.46	0.000
LEV	-0.0220765***	0.003416	-6.46	0.000

Note: ***; **; * significance level respectively 1%; 5% and 10%

The estimators from the non-linear effects model relating TR to the performance of Vietnamese Food Production companies show that the regression coefficients of variables SIZE and LEV are statistically significant at 1%, and the regression coefficient of variable REC_2 is statistically significant at 5%. Thus, accounts receivable on total assets (REC_2), company size (SIZE), and leverage (LEV) have an impact on the performance of Vietnamese Food Production companies. Additionally, the regression coefficient of variable REC_2^2 (REC22) is statistically significant at 5%. This proves the existence of a non-linear relationship between TR and the performance of Vietnamese Food Production companies, when the independent variable TR is represented by accounts receivable on total assets (REC_2).

Furthermore, the regression coefficient of REC_2^2 (REC22) is -0.44098. This result demonstrates that the non-linear relationship between TR and the performance of Vietnamese Food Production companies has an inverted U shape. Specifically, when TR increases, the increase in accounts receivable on total assets will cause the company performance to increase. However, when accounts receivable on total assets exceeds a certain limit, company performance will begin to decrease. The tipping point of accounts receivable on total assets is calculated as $-\frac{0.2224843}{2'(-0.44098)} = 25.23\%$. Thus, when receivables exceed 25.23% of the total assets, the performance of

Vietnamese Food Production companies will decrease. The discovery of a non-linear relationship with an inverted U shape is supported by the research of Martínez-Sola et al. (2013), and Bui and Le (2017).

Next, this study evaluates the effects of receivables deviating from the optimal position in relation to company performance. The results are described in Table 12.

Table-12. The estimators of model with variable deviation.

TE	FEM	REM	FGLS
DEVIATION	-0.0677901	-0.0992298**	-0.1246617***
GROWTH	0.0172521	0.0206725	0.0296122***
SIZE	-0.0456138***	-0.0326229***	-0.0307456***
LEV	-0.0156179***	-0.0164202***	-0.0222597***
_CONS	1.816869***	1.547063***	1.539836***
Modified Wald p-value	0.000		
Wooldridge p-value	0.000		
Hausman p-value	0.0988		

Note: The estimators from the models using the variable DEVIATION to estimate the impact of TR on performance of Vietnamese Food Production companies, using Pooled OLS (model 1), fixed effects (model 2), and random effects (model 3). Modified Wald, Wooldridge, Hausman p-value is p-values of Modified Wald, Wooldridge, Hausman tests.
***; **; * significance level respectively 1%; 5% and 10%

The estimation result using a fixed effects model reveals that the regression coefficient of the variable DEVIATION is insignificant at 10%.

In contrast, the estimators using the random effects model show that the regression coefficient of the variable DEVIATION is significant at 5%. Thus, when the receivables level deviates from the optimal position, it will impact on the performance of Vietnamese Food Production companies.

The Hausman test gives a p-value of 0.0988, which is less than the significant level of 10%. This demonstrates that the estimators from the fixed effects model (FEM) are better than those of the random effects model (REM). However, the model estimated by the fixed effects model (FEM) has heteroskedasticity and autocorrelation.

This study continues estimating models using the FGLS method to correct the heteroskedasticity and autocorrelation. Table 13 shows the results of this approach.

Table-13. The estimators of model with variable DEVIATION, using the FGLS method.

TE	Coefficient	Std. Error	t-statistic	P>t
DEVIATION	-0.1246617***	0.0420873	-2.96	0.003
GROWTH	0.0296122***	0.0099309	2.98	0.003
SIZE	-0.0307456***	0.0057023	-5.39	0.000
LEV	-0.0222597***	0.003348	-6.65	0.000
_CONS	1.539836***	0.1145017	13.45	0.000

Note: ***; **; * significant level respectively 1%; 5% and 10%

The estimation results of the model expressing the effects of TR deviation on the performance of Vietnamese Food Production companies shows that the regression coefficient of DEVIATION is statistically significant at 1%. Therefore, when the receivables level deviates from the optimal position, it will impact on the performance of Vietnamese Food Production companies. Specifically, if the receivables level deviates from the optimal position by 1%, the company performance will strongly decrease by 12.47%.

4.4. The Results of Testing the Robustness of the Effect of TR on the Performance of Vietnamese Food Production Companies

Based on the results of analyzing the non-linear effects of TR on the performance of Vietnamese Food Production companies, the robustness of the estimators was next tested by the Bayesian method. The estimated model is based on a non-linear contribution of TR:

$$V_{it} = \beta_0 + \beta_1(REC_{it}) + \beta_2(REC_{it}^2) + \beta_3(GROWTH_{it}) + \beta_4(SIZE_{it}) + \beta_5(LEV_{it}) + \varepsilon_{it}$$

The prior distributions from the FGLS model are used for the regression coefficients, as this represents the most suitable method. Specifically:

$$b_1 = normal(0.2224843, 0.1021671' \ 0.1021671)$$
$$b_2 = normal(-\ 0.44098, 0.1867215' \ 0.1867215)$$

The Metropolis-Hastings algorithm is used to create an MCMC chain (Markov Chain Monte Carlo) with a size of 27500; 2500 are removed in the Burn-in phase, resulting in an MCMC sample size of 25000. The results of model estimation using the Bayesian method are shown in Table 14.

Table-14. The estimators by the Bayesian method.

	Mean	Std. Dev.	MCSE	Median	Equal-tailed [95% Cred. Interval]	
te						
rec2	0.255152	0.0735538	0.003937	0.2559782	0.1076242	0.400579
rec22	-0.6103925	0.1226947	0.005337	-0.6110306	-0.8513599	-0.3637003
growth	0.0069303	0.0156244	0.000138	0.0068735	-0.0238277	0.0376087
size	0.0414.854.	0.0005549	0.000028	0.0415008	0.0403978	0.0425588
lev	-0.0196369	0.0043842	0.00009	-0.0196822	-0.028192	-0.0110345
_cons	0.0099237	0.0260239	0.002064	0.010471	-0.0416965	0.0585699
id						
U0:sigma2	0.0133849	0.003658	0.000044	0.0128047	0.0079973	0.022108
e. te						
sigma2	0.0086115	0.0006275	5.5e-06	0.0085785	0.0074753	0.0099213

The result of the Bayesian analysis reveals that the average of 25000 regression coefficient estimators of the receivable on total assets (REC_2) is 0.255152. Moreover, the 95% confidence interval of this regression coefficient is (0.1076242; 0.400579), which affirms that the value of this regression coefficient is firmly in the positive value domain.

Furthermore, in Figure 3, the testing result of the regression coefficients of the receivables on total assets (REC_2) using the MCMC method shows that MCMC is converging. Specifically, the Trace chart shows 25000 coefficient estimators of variable REC_2. The trace chart reveals that the MCMC chain is not trending; rather, the estimators are distributed in a horizontal line fluctuating around the mean value of 0.255152. The autocorrelation chart shows a decreasing correlation to 0. The distribution chart of coefficient estimators of variable REC_2 has a normal distribution. The density functions of an MCMC half chain, front, back and overall are nearly identical. Thus, the results of Bayesian analysis demonstrate that the regression coefficient of the variable REC_2 is reliable.

In addition, Bayesian analysis also finds that the average of 25000 coefficient estimators of the square of accounts receivable on total asset (REC_2^2) is -0.6103925. Moreover, the 95% confidence interval of this regression coefficient is (-0.8513599, -0.3637003), which affirms that the value of this regression coefficient is firmly in the negative value domain.

Further, in Figure 4, the testing result of the regression coefficients of the square of accounts receivable on total asset (REC_2^2) using the MCMC method reveals that MCMC is converging. Specifically, the Trace chart shows 25000 coefficient estimators of variable REC_2^2. The trace chart illustrates that the MCMC chain is not trending; rather, the estimators are distributed in a horizontal line fluctuating around the mean value of -0.6103925. The autocorrelation chart shows a decreasing correlation to 0. The distribution chart of coefficient estimators of variable REC_2^2 has a normal distribution. The density functions of an MCMC half-chain, front, back, and overall are nearly identical. Thus, the results of Bayesian analysis demonstrate that the regression coefficient of the variable REC_2^2 (-0.6103925) is reliable.

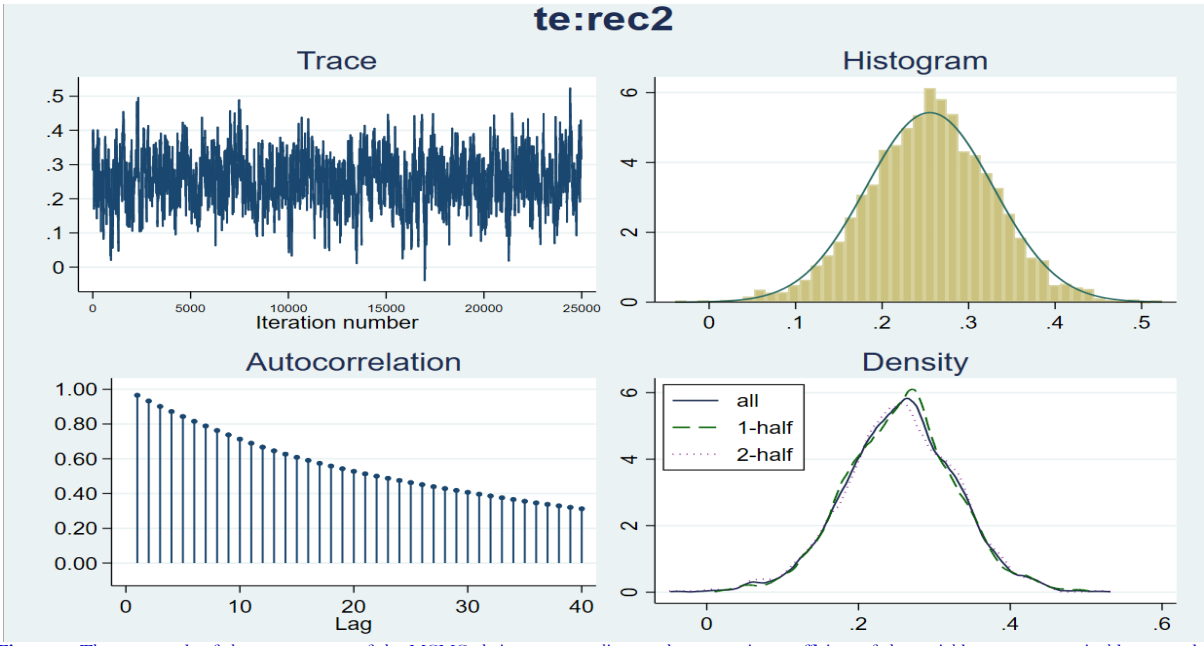

Figure-3. The test result of the convergence of the MCMC chain corresponding to the regression coefficient of the variable accounts receivable on total assets (REC_2).

Therefore, the robustness test confirms that the relationship between TR (calculated as accounts receivable on total assets) and the performance of Vietnamese Food Production companies is non-linear and has an inverted U shape, because the regression coefficient of the square of accounts receivable on total assets (REC_2^2) has a negative sign and the regression coefficient of accounts receivable on total assets (REC_2^2) has a positive sign.

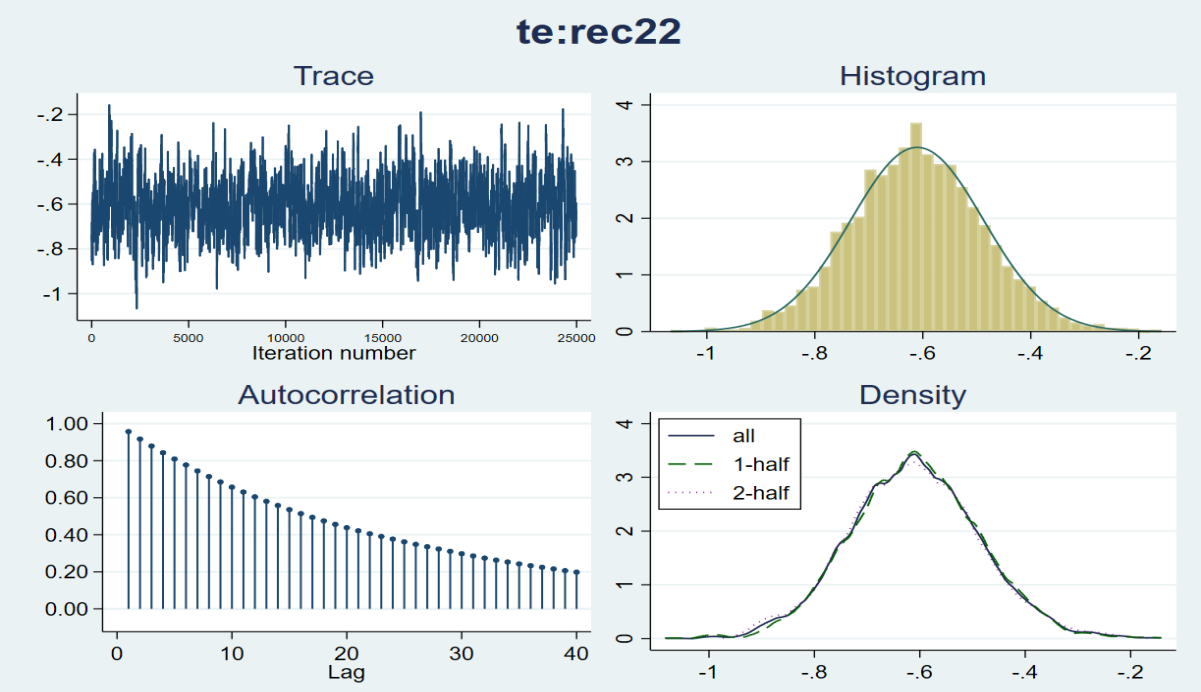

Figure-4. The test result of the convergence of the MCMC chain corresponding to the regression coefficient of the square of accounts receivable on total assets (REC_2^2).

5. CONCLUSION

This study of the impact of trade credit on the performance of Vietnamese Food Production companies was constructed to meet 3 purposes: (i) Testing the linear effect of TR on the performance of Vietnamese Food Production companies; (ii) Testing the hypothesis whether there is an optimal level of TR that optimizes the

performance of Vietnamese Food Production companies; (iii) Based on the research results, to propose management implications to optimize the performance of Vietnamese Food Production companies.

Regarding the first purpose, to test the linear effect of TR on the performance of Vietnamese Food Production companies, this study has estimated a model, using Pooled OLS, fixed effects, random effects, and FGLS models. The results indicate that when TR is measured as accounts receivable on total revenue (REC_1), a linear relationship exists between TR and the performance of Vietnamese Food Production companies. Specifically, if TR increases, the performance of Vietnamese Food Production companies decreases accordingly. This finding is consistent with the results of Raheman and Nasr (2007); Falope and Ajilore (2009); Mansoori and Muhammad (2012) and Daniel and Jagongo (2013).

Regarding the second purpose, when TR is measured as accounts receivable on total assets (REC_2), there is a non-linear relationship between TR and the performance of Vietnamese Food Production companies. This non-linear relationship has an inverted U shape. Specifically, when TR or accounts receivable on total assets increases, the company performance will also increase. However, when the increase in accounts receivable exceeds a certain limit, it causes the company performance to decrease. The tipping point of accounts receivable on total assets is calculated as $-\frac{0.2224843}{2'(-0.44098)} = 25.23\%$. Thus, when the receivables exceed 25.23% of the total assets, the performance of Vietnamese Food Production companies will decrease. The finding of a non-linear relationship with an inverted U shape is consistent with the research of Martínez-Sola et al. (2013), and Bui and Le (2017).

Furthermore, when the receivable deviates from the optimal position, it impacts on the performance of Vietnamese Food Production companies. Specifically, when the receivable deviates from the optimal position by 1%, the company performance will strongly decrease by 12.47%.

Based on these conclusions, the research thus recommends some policies to manage the receivable for Vietnamese Food Production companies. The main solution proposed is to focus on increasing the scale of TR investment to take optimal advantage of the benefits of TR investment, control costs associated with TR, and set up indicators to measure the performance of receivables.

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