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Do Exchange Rates Affect the Profitability of Multinational Companies? Evidence from China and the USA

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Abstract

The impact of exchange rates on profitability of Multinational Companies is a puzzling and interesting question towards different regional data and relevant issues. This essay has discussed the relationship between exchange rates and profitability. Three perspectives regarding open economy and exchange rates have been employed by us to observe this issue theoretically. First perspective: from the perspective of international trade; Second perspective: from the perspective of decision-making; Third perspective: from the perspective of risk. The data that we collected came from Top 30 Multinational Companies in China and the USA. The required data elements are the value of each company's rate of ROE, ROCE, EPS and the average annual exchange rates, Gross Domestic Product (GDP) annual growth rates, lending interest rates of China and the USA. From the previous literature and our results, it is reasonable to conclude that the impact of exchange rate changes on profitability is not significant for Top30 MNCs based on China and the USA. Many multinational companies will hedge foreign exchange rate risk by using various financial instruments. The article also reveals the multinational company profitability varies from the domestic regimes and company individuality.

Keywords

Exchange rate, Trade, Decision-making, Risk

1. Introduction

The impacts of exchange rates on profitability of Multinational Companies (MNCs) have been observed by a range of researchers; nonetheless, different approaches and dimensions bring to various conclusions and it still remains to be a puzzling and interesting question towards different regional data and relevant issues. This essay aims to analyse whether exchange rates affect MNCs on the basis of literature and data from China and the USA. It has been well-organised with the following structure: first, theoretical analyses from perspectives of trade, decision-making and risk will be made; and then, this paper will select Top 30 MNCs in China and the USA as samples to examine the relationship between exchange rates and profitability via a model; finally, the implications of models and discussion will be explored soundly and reasonably.

2. Theoretical analysis

Whether exchange rates affect MNCs has aroused heated discussion. This question can be explored from two aspects: whether exchange rates affect profitability or not; how it exerts the impacts. Empirically, exchange rates do

affect the profitability of MNCs. Three perspectives regarding open economy and exchange rates have been employed by us to observe this issue theoretically.

2.1 From the perspective of international trade

International trade determines large extent of the profitability of multinational companies if firms focus on foreign market. Even those companies benefit mostly from domestic market, the volume of international trade still be a decisive indicator to indicate the performance of operating activities in MNCs. Straightforwardly, the volume of international trade directly matters with the profitability of MNCs.

After the period of stability of exchange rate under Bretton-Woods systems, volatility of exchange rates generated a fierce debate about how it affects the international trade in reality. The factors affecting international trade business may include the following aspects: policy factors, cultural environment factors and market environment factors (Zhengyan, 2018).

The impact of exchange rate changes on enterprise profits is heterogeneous in different types of enterprise ownership, industry competition and import intermediate trade intensity (Shuo & Dandan, 2019). Mundell (1961) says trade flows stabilize real exchange rate fluctuations, thus reducing real exchange volatility. Broda (2003) procedures a model of two-sided trade to evaluate the effect on trade of exchange rate volatility and exchange rate regimes such as fixed exchange rate and currency boards by disaggregate data. The result indicates that real exchange rate volatility depresses trade in differentiated goods.

But Broll and Eckwert (1999) have the opposite thought. They assume industries are able to react flexibly to changes of international exchange rate so they can simply reallocate their products in different markets. Based on previous assumption, they estimate that positive correlations between volumes of industry-specific export and exchange rate volatility in countries where firms get profit from a large domestic market. The market structure makes the export no longer crucial. The larger uncertainty of the exchange rate will add the value of the export as firms have domestic markets. Hence, it stimulates the firm's production activity. However, change of exchange rate brings higher risk exposure for firms. This may decrease the production and volume of international trade. The net impact depends on the degree of relative risk aversion of the firm.

2.2 From the perspective of decision-making

In order to examine how the exchange rate influence MNCs, Sung and Lapan (2000), Xie and Du (2007) built the model called "two countries-two corporations" to testify the influence of exchange rate on MNCs. $V_{i,j}\left(\sigma_e^2\right)=E\left[\Pi_{i,j}(e)\right]$, $U_{i,j}\left(\sigma_e^2\right)=E\left[\pi_{i,j}(e)\right]$ have been adopted to calculate to the relationship between exchange rate and value in the model. When exchange rates change, the variation of the exchange rate will affect the strategy of multinational and domestic enterprises. We can get conclusion regarding exchange rates and profitability as follows:

1. Generally, multinational companies' decision-making will be conducted either in domestic investment or in two countries at the same time. And the host companies get higher return than multinational companies when they choose not to produce.

2. When domestic firms in host country produce products, as the increase of the variations on exchange rate, the change of profit on domestic firms in host country shows (Sung & Lapan, 2000): (1) when multinational firms only produce at home, profit increases; (2) when multinational firms only produce at foreign country, profit remains unchanged; (3) when the multinational firms produce in both countries, the profit decreases.

2.3 From the perspective of risk

"Exchange rates are the amount of one country's currency needed to purchase one unit of another currency (Brealey, 1999, p. 625)". People will not pay too much attention to the exchange rate fluctuations when they are intending to exchange some money for the trips. However, for MNCs, their transactions will involve large amounts of money; the waves of a foreign currency could indicate "getting a surplus or a deficit on the balance sheets" (StudyMode, 2002). Therefore, the exchange rate risk can influence the multinational company profitability.

Exchange rate risk mainly includes the following: one is transaction risk, which refers to the change of actual cash flow payment caused by the uncertainty of exchange rate for the foreign currency transactions or the creditor's rights and debts held by enterprises. It can be divided into cash flow risk and exchange risk. The other is economic risk,

which refers to the change of international competitiveness of enterprises caused by unexpected exchange rate changes in the process of production and operation, which affects the future income and cash flow of enterprises, and further affects the internal value of enterprises (Jinfu, 2020). Transaction risk is a kind of liquidity risk, which is mainly reflected in the exchange rate changes during the period of goods and debt settlement. Economic risk is more focused on macroeconomic analysis, from the perspective of the whole enterprise to predict the future cash flow changes in a certain period. Because of the fluctuation of foreign exchange rate, it is a potential possibility that the company's future earnings become very uncertain. Potential economic risk is directly related to the company's overseas operation effect, and will cause changes in the enterprise's operation, business, product and other decisions, such as product quantity, market positioning, etc., resulting in changes in revenue (Ye, 2020).

Another type of exchange rate risk that MNCs cannot neglect is translation risk. It is the possibility of changes in the company balance sheets caused by the changes of foreign exchange rate. It may impact the result of the company's financial report. Therefore, the translation risk can influence the profit figures on accounting.

3. Methodology and Data

3.1 Methodology

To access the impact of exchange rate uncertainty on the profitability of MNCs, we employ ordinary least squares (OLS) methods (Gujarati & Porter, 2009) to estimate the significance of the hypothesized independent variables on profitability of multinational firms. We track a similar analysis of methodology adopted by Lee et al. (2012), Oskooee et al. (2009), and Faff et al. (2005). EPS, ROE and ROCE regarded as the main indicators to measure the profitability of MNCs are involved in a multi-factor experiment, with the experimental factors like exchange rate, GDP and interest rate corresponding to the factors hypothesized to influence profitability. We estimate the impact of exchange rate changes on profitability in China & USA with regression models:

1. $\hat{EPS} = C_1 + \alpha_1 EX + \alpha_2 GDP + \alpha_3 IR + \varepsilon_i$
2. $\hat{ROE} = C_2 + \beta_1 EX + \beta_2 GDP + \beta_3 IR + \varepsilon_i$
3. $\hat{ROCE} = C_3 + \gamma_1 EX + \gamma_2 GDP + \gamma_3 IR + \varepsilon_i$

3.2 Economic Approach to Measuring Profitability

In this study, we decide to measure foreign operations' profitability by Return on equity (ROE), Return on capital employed (ROCE) and Earnings per Share (EPS). According to these important indicators (Appendix II), the listed companies are measured and the profitability of a company's capital investment is examined.

	Advantage	Disadvantage
ROE	1.Comparison ROE connect earnings data and become relevant measurements that can be compared across sectors. 2.Ease of Calculation Investors can easily collect the information from a company's financial statements including balance sheet and net income.	1.Subjectivity As net income is defined as revenues minus expenses, expenses are subject to many manipulations on the company's accounting policies like depreciation. 2.The complementation between two indicators is not strong. Asset size of listed companies are not equal, it should not assess its effectiveness and management degree by the enterprise income indicators on absolute value.

ROCE	3.Comparison ROCE can be used to compare performance with other divisions and companies. Also it is fair to divisions with different sizes of investment	1.Ignores the time value of money ROCE does not take the time value of money into account. 2.No general agreement about how capital employed should be calculated. Therefore, the method permit the decision maker to choose a definition of ROCE that suits their preconception of a project's desirability most.
EPS	1.Ease of Calculation Investors can easily collect the information from a company's financial statements including balance sheet and net income. 2.Avoid the subjective factors EPS can reflect the company's profitability and investment risk objectively without the influence of behavioral factors like risk averse and confidence.	Ignores the time value of money EPS does not take the time value of money into account, which might lead to one-sided pursuit of profit maximization and a variety of short-term behavior of enterprises

Lee and Suh (2009) use return on equity (ROE) as measurement to examine the impact of exchange rate changes on Multinational companies' profitability before accessing the effects of financial hedging. While several analytic forecasting models on earning per share done by Johnson and Schmitt (1974) indicated that econometric factors should substantially improve so that investors could rely on judgment and experience to predict the firm's profit.

3.3 Data

According to the regression model that has been established in this article, the required data elements are the value of each company's rate of ROE, ROCE, EPS and the average annual exchange rates, Gross Domestic Product(GDP) annual growth rates, lending interest rates of China and the USA.

Based on the formulas of ROE and ROCE, there are six kinds of data about company's financial situation required to be collected totally. To ensure the accuracy of the data, all the figures are gathered from the annual report which downloaded from each company's official website.

In the analysis of Chinese MNCs' profitability, in order to be more close to reality situation, the purchasing power parity (PPP) of Chinese Yuan (RMB) is used instead of the exchange rates, which are acquired from the International Monetary Fund (IMF) database. Since Canada is the largest trading partner of the United States, the exchange rate between the U.S. dollar and the Canadian dollar will be more representative in the analysis of American MNCs. The USD-to-CAD annual rates are obtained from Bank of Canada's website.

The Chinese GDP annual growth rates and lending rates are collected from the database of China's National Bureau of Statistics. However, the United States does not have fixed lending rates; therefore the U.S. prime lending rate is used in the regression model which is got from the database of Royal Bank of Canada. The figure of U.S. GDP annual growth is found in report of the U.S. Department of Commerce.

4. Empirical Results and Discussion

4.1 Empirical Results

Six models have been regressed and their results have been presented in Figures 1-6 and as follows.

$$\hat{EPS} = -1.447 + 0.349EX + 6.925GDP + 15.351IR \quad (1)$$
$$Se: (8.278) \quad (1.110) \quad (48.452) \quad (58.011)$$
$$t: [-0.175] \quad [0.314] \quad [0.143] \quad [0.265]$$

$$\hat{ROE} = -0.180 + 0.027EX + 2.014GDP + 0.535IR \quad (2)$$
$$Se: (0.267) \quad (0.036) \quad (1.561) \quad (1.869)$$
$$t: [-0.676] \quad [0.769] \quad [1.291] \quad [0.286]$$

$$\hat{ROCE} = 0.040 - 0.014EX + 0.341GDP + 1.485IR \quad (3)$$
$$Se: (0.345) \quad (0.046) \quad (1.999) \quad (2.378)$$
$$t: [0.117] \quad [-0.307] \quad [0.170] \quad [0.624]$$

$$\hat{EPS} = 1534.487 - 1422.075EX - 1882.373GDP + 369.2418IR \quad (4)$$
$$Se: (995.395) \quad (1021.426) \quad (2676.332) \quad (3374.216)$$
$$t: [1.542] \quad [-1.392] \quad [-0.703] \quad [0.109]$$

$$\hat{ROE} = 0.752 - 0.349EX - 0.315GDP - 2.370IR \quad (5)$$
$$Se: (1.719) \quad (1.764) \quad (4.622) \quad (5.83)$$
$$t: [0.438] \quad [-0.197] \quad [-0.068] \quad [-0.407]$$

$$\hat{ROCE} = -24.895 + 25.893EX + 6.619GDP - 37.404IR \quad (6)$$
$$Se: (19.634) \quad (20.148) \quad (52.791) \quad (66.556)$$
$$t: [-1.268] \quad [1.285] \quad [0.125] \quad [-0.562]$$

Figures 1-3[(1) (2) (3)] and figures 4-6 [(4) (5) (6)] shows the relationship between profitability (EPS, ROE, and ROCE) and independent variables (including EX, GDP and IR) in terms of MNCs in China and the USA.

First, we have identified whether these models are explanatory for the interaction of profitability and possible factors. Despite that the results are not as good as what were expected through F-statistic test, they still can reveal some essential findings. Only model (2) (6) show a relatively proper relationship towards the data, which are significant at the level of 5% and 10% respectively. Goodness of fit R^2 and adjusted R^2 could also amply confirm this considering how volatile exchange rates and macroeconomic transformations during the global financial crisis. Most main variables in model (2) (5) (6) are significant at the level of 10% via t-test. Additionally, residuals' normality, homoscedasticity and serial correlation have been examined and Figure 7 depicts the results. Model (1)-(5) display the serial correlation except for model (6) so that they have been remedied and new regressions are exhibited. The corrected models generically report better results than the previous.

4.2 Discussion

Apparently, these models are not adequately good and appropriate to account for the impacts of exchange rate on profitability in the light of the following factors. Allowing for the simplicity and visibility, it is assumed that their relationship could be linear and all the research is based on it. However, that might be nonlinear but models of nonlinear relation are abstruse to explore due to randomness of some negative data and availability of more accurate indicators. All the analyses, therefore, are still founded on the linear perspective. Although models are not amply cogent and coherent, a variety of interesting findings are able to be observed and explained across literature.

In terms of similarity, first of all, the adoption of ROE exerts a largely persuasive and influential outcome compared with EPS and ROCE both in China and the USA when profitability is examined exactly as Lee and Suh (2012) did. More importantly, in model (2) (5) (6), the coefficients of EX indicate exchange rate has slight influence on the profitability while GDP and interest rate incorporate more significant and vitally interrelated relationship on performances of MNCs, which can be supported from other researchers. Lee and Suh (2012) believe that profitability disparity varies from different industries; however, Hirschey and Wichern (1984, p. 375) maintain variations "cannot be explained by differences in uncontrolled industry-specific influences". Apart from exchange rate vibration posing subtle impact on MNCs (Harvey, 2005), numerous factors also influence the profitability. Due to the role of environmental factors in the process of internationalization of multinational companies, the success of internationalization can only be achieved by formulating appropriate internationalization strategies according to the national conditions of various countries. The economic environment, political environment and cultural environment in the international environment also have an impact on the operation of enterprises (Sihan, 2018). Despite exchange rates changes existing in the violability of profitability, varied accounting processing methods and standards and risk management measures (Faff, et al., 2005) have been employed by individual companies, which enables to weaken the effects on profitability allowing for the uniformity and consistence of one corporation.

On the other hand, diversity is reflected on China and the USA individually. Although weak-correlation variables will be given priority to formulate models, EX, GDP and IR are selected to embody the relationship. From Figure 9, the correlation of independent variables (EX, GDP and IR) is particularly strong and Chen and Zhang (2007) have identified this while in the USA, the correlation is relatively weak, which is conjectured to be attributed to two primary reasons: different exchange rate regimes and distinctive types of companies. Specifically, China has adopted managed floating currency regime and this relatively pegged exchange rates system contributes to financial industries smooth and sustainable growth along with economic growth. Under the circumstance, MNCs would not enduringly suffer from vulnerability of financial shocks. Nevertheless, free floating exchange rates system in the USA makes the correlation of each variable lower and more volatile. To what extent exchange rates affect the profitability hinges on what kind of regime one economy holds. Cukierman et al. (2004, p. 1206) argue that the optimal regime is given by "the policy maker who can trade off the loss from nominal exchange rate uncertainty against the cost of adopting a given regime" and less flexible regime might lead to more currency attacks. In addition, Top 30 MNCs exhibit totally different types in China and the USA. Over 70% of MNCs of China are state-owned shareholding corporations while those who in the USA are private ones. Private ones could have more incentives and strategies to develop for the sake of shareholders' benefits. Different types of companies may affect the management, goals, innovativeness, entrepreneurship and how they take advantage of information (Charlebois & Sapp, 2007) and implement actions to tackle emergencies. Therefore, the rise of net effective exchange rate has different effects on the profits of enterprises of different trade types, different profit margin levels and different types of export products (Guo Ding, 2017).

5. Conclusion

This paper has identified whether the changes of exchange rate will influence the MNCs' profitability. From the pervious literature and our results, it is reasonable to conclude that the impact of exchange rate changes on profitability is not significant for Top30 MNCs based on China and the USA. Many multinational companies will hedge foreign exchange rate risk by using various financial instruments. The article also reveals the multinational company profitability varies from the domestic regimes and company individuality. However, the samples containing 30 multinational companies respectively in China and USA from 2007 to 2011 are not sufficiently strong to convince exchange rates influence MNCs profitability and the scope and scale of date should be further to minimize the deviation. Moreover, independent variables chosen for the model can be more subdivided since the collection among them has correlation, which would drift the results' accuracy.

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Appendix I

(The model built by Sung and Lapan, 2000)

A multinational company and a host company produce the same product, but the former's product can be sold in home country and host country while latter only produce and sell the product at host country. The initial exchange between the two countries as e_0. TN-Cs cost function are:

$TC_h = F + cq \quad TC_f = e_0 F_f + ec_f q_f \quad c = E(e)c_f, \quad F \langle e_0 F_f$

TC_h : cost of domestic production

F : fixed cost of domestic production

c : Variable cost of domestic production per unit of product

q : Domestic production

TC_f : cost of production at host country

F_f : fixed cost of production at host country

C_f : Variable cost of production per unit of product at host country

q_f : host country production

Assumed the variable cost is same in two countries, $c = E(e)c_f$ and the fixed cost in home country is lower than foreign country, so $F \langle e_0 F_f$

Demand function at home country: $P = A - BQ$

Cost function of the host company: $C = G + dY$

Demand function at host country: $P = a - bQ$

Multinationals and host enterprise decision-making order as follow:

First, firms make decision, multinational firms decide where to produce while host firms decide whether to produce; Second, government macro-control may affect the volatility of the exchange rate; Third, firms make production and marketing decision.

$$\prod_{ij} = \left(A - BQ_{ij}\right)Q_{i,j} + e\left[a - b\left(Y_{i,j} + y_{i,j}\right)\right]Y_{i,j} - c_{i,j}\left(Q_{i,j} + Y_{i,j}\right)$$

$$\pi_{ij} = \left[a\text{-}b\left(Y_{i,j} + y_{i,j}\right)\right]y_{i,j} - dy_{i,j}$$

$$c_{h,j} = c, c_{f,j} = ec_f, c_{b,j} = \min\left(c, ec_f\right)$$

If the host firms enter to the market:

$$Q_{h,s} = \frac{A-c}{2B}, Y_{h,s} = \frac{a+d-2\left(c/e\right)}{3b}, y_{h,s} = \frac{a+\left(c/e\right)-2d}{3b}$$

$$\prod_{h,s} = \frac{\left(A-c\right)^2}{4B} + \frac{e\left[a+d-2\left(c/e\right)\right]^2}{9b} - F, \pi_{h,s} = \frac{\left[a+\left(c/e\right)-2d\right]^2}{9b} - G$$

$$Q_{f,s=} \frac{A-ec_f}{2B}, Y_{f,s} = \frac{a+d-2c_f}{3b}, y_{f,s} = \frac{a+c_f-2d}{3b}$$

$$\prod_{f,s} = \frac{\left(A-ec_f\right)^2}{4B} + \frac{e\left(a+d-2c_f\right)^2}{9b} - e_0 F_f, \pi_{f,s} = \frac{\left(a+c_f-2d\right)^2}{9b} - G$$

$$Q_{b,s} = \frac{A-ec_m}{2B}, Y_{b,s} = \frac{a+d-2c_m}{3b}, y_{b,s} = \frac{a+c_m-2d}{3b}$$

$$c_m = \min\left[\left(\frac{c}{e}\right), c_f\right]$$

$\prod_{b,s} = \frac{(A-ec_m)^2}{4B} + \frac{e(a+d-2c_m)}{9b} - F - e_0 F_f$, $\pi_{b,s} = \frac{(a+c_m-2d)^2}{9b} - G$

Similarly, if the host firm does not produce, can get:

$$Q_{h,n} = \frac{A-c}{2B}, Y_{h,n} = \frac{a-(c/e)}{2b}, \quad \prod_{h,n} = \frac{(A-ec_m)^2}{4B} + \frac{e\left(a-c/e\right)^2}{4b} - F \tag{9}$$

$$Q_{f,n} = \frac{A-ec_f}{2B}, Y_{f,n} = \frac{a-c_f}{2b}, \prod_{f,m} = \frac{(A-ec_f)^2}{4B} + \frac{e(a-c_f)^2}{4b} - e_0 F_f \tag{10}$$

$$Q_{b,n} = \frac{A-ec_m}{2B}, Y_{b,n} = \frac{a-c_m}{2b}, \prod_{b,n} = \frac{(A-ec_m)^2}{4B} + \frac{e(a-c_m)^2}{4b} - F - e_0 F_f \tag{11}$$

Assumed that there two companies: one multinational company in its home country and a host country, but the other domestic company producing and selling products in home country. For the multinational firms they have three choices: 1. produce at home; 2. produce in foreign countries; 3. produce in both countries. For the domestic firms they can choose whether produce or not. Therefore, it has six different situations.

Assume $i = h, f, b$ (produce at home, foreign and both), $j = s, n$ (produce and not produce) representing the choice for multinational and domestic firms. $\prod_{i,j}$ and π_{ij} represent the profit level of multinational and domestic firms. In order to examine the influence of exchange rate to different company decision, the value functions:

$V_{i,j}(\sigma_e^2) = E\left[\prod_{i,j}(e)\right]$, $U_{i,j}(\sigma_e^2) = E\left[\pi_{i,j}(e)\right]$ have been adopted.

Exchange rates influencing the different payoff function

Domestic firms / Multinational firms	Produce	Not produce
produce at home	$\left[V_{h,s}(\sigma_e^2), U_{h,s}(\sigma_e^2)\right]$	$\left[V_{h,n}(\sigma_e^2), 0\right]$
produce at foreign	$\left[V_{f,s}(\sigma_e^2), U_{f,s}(\sigma_e^2)\right]$	$\left[V_{f,n}(\sigma_e^2), 0\right]$
Produce in both countries	$\left[V_{b,s}(\sigma_e^2), U_{b,s}(\sigma_e^2)\right]$	$\left[V_{b,n}(\sigma_e^2), 0\right]$

When the exchange rate does not change, $V_{h,s}(0) > V_{f,s}(0) > V_{b,s}(0), V_{h,n}(0) > V_{f,n}(0) > V_{b,n}(0)$.

Hence, the best strategy for multinational firm is to produce at home; for the host firms, $U_{h,s}(0) = U_{f,s}(0) = U_{b,s}(0) > 0$, the best strategy for the host firm is to produce products.

Some explanations about the formula: (1) if multinational firm only produce at home, according to formula (6) and (9), $Q_{h,n}$ and $Q_{h,s}$ are independent with e, therefore the domestic sales would not be affected by exchange rate.(2) If multinational firm produce in both countries, the sale will be higher than the former one.

Appendix II ROE, EPS and ROCE

According to the definition from Ross, Westerfield and Jordan (2008, pp. 64-65) and Irala (2005),

1. "**Return on equity (ROE)** is a measure of how the stockholders fared during the year, ROE is usually measured as follows:

Return on equity=Net Income/Total Equity"

ROE=earrings after tax/net assets

2. "**Earnings per Share (EPS)**=(Net Income-Dividends on Preferred Stock)/Average Outstanding shares"

3. **"Return on capital employed (ROCE)** is the ratio of net operating profit to the net operating assets or capital."

The Formula:

Return on capital employed (ROCE)=Earnings before Interest and Tax/(Total Assets-Current Liabilities)

Source:

Irala, Lokanandha Reddy. (2005). EVA: The Right Measure of Managerial Performance? *Indian Journal of Accounting & Finance*, 119(2), pp. 1-10.

Ross, Westerfield and Jordan. (2008). *Fundamentals of Corporate Finance* (European Edition), 8th Edition. McGraw-Hill Irwin.

Comparison of ROE, EPS and ROCE

	Advantage	Disadvantage
ROE	1. Comparison ROE connect earnings data and become relevant measurements that can be compared across sectors. 2. Ease of Calculation Investors can easily collect the information from a company's financial statements including balance sheet and net income.	1. Subjectivity As net income is defined as revenues minus expenses, expenses are subject to many manipulations on the company's accounting policies like depreciation. 2. The complementation between two indicators is not strong. Asset size of listed companies are not equal, it should not assess its effectiveness and management degree by the enterprise income indicators on absolute value.
ROCE	3. Comparison ROCE can be used to compare performance with other divisions and companies. Also it is fair to divisions with different sizes of investment	1. Ignores the time value of money ROCE does not take the time value of money into account. 2. No general agreement about how capital employed should be calculated. Therefore, the method permit the decision maker to choose a definition of ROCE that suits their preconception of a project's desirability most.
EPS	1. Ease of Calculation Investors can easily collect the information from a company's financial statements including balance sheet and net income. 2. Avoid the subjective factors EPS can reflect the company's profitability and investment risk objectively without the influence of behavioral factors like risk averse and confidence.	Ignores the time value of money EPS does not take the time value of money into account, which might lead to one-sided pursuit of profit maximization and a variety of short-term behavior of enterprises

Appendix Ⅲ Figures in Empirical Results

Figure 1

Dependent Variable: EPS
Method: Least Squares
Date: 03/02/13 Time: 22:29
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.447084	8.278382	-0.174803	0.8615
EX	0.349014	1.110301	0.314342	0.7537
GDP	6.924667	48.45186	0.142918	0.8866
IR	15.35086	58.01070	0.264621	0.7917

R-squared	0.001321	Mean dependent var	1.479641
Adjusted R-squared	-0.019200	S.D. dependent var	3.162869
S.E. of regression	3.193088	Akaike info criterion	5.186159
Sum squared resid	1488.589	Schwarz criterion	5.266442
Log likelihood	-384.9619	Hannan-Quinn criter.	5.218776
F-statistic	0.064375	Durbin-Watson stat	0.459810
Prob (F-statistic)	0.978607		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	211.4599	Prob. F(1,145)	0.0000
Obs*R-squared	88.98332	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/03/13 Time: 10:55
Sample: 1 150
Included observations: 150
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.063322	5.299956	0.389309	0.6976
EX	-0.243309	0.710775	-0.342314	0.7326
GDP	-6.189709	31.01148	-0.199594	0.8421
IR	-8.697480	37.13091	-0.234238	0.8151
RESID(-1)	0.770663	0.052997	14.54166	0.0000

R-squared	0.593222	Mean dependent var	1.49E-15
Adjusted R-squared	0.582001	S.D. dependent var	3.160780
S.E. of regression	2.043535	Akaike info criterion	4.300004
Sum squared resid	605.5249	Schwarz criterion	4.400359
Log likelihood	-317.5003	Hannan-Quinn criter.	4.340775
F-statistic	52.86498	Durbin-Watson stat	1.852524
Prob(F-statistic)	0.000000		

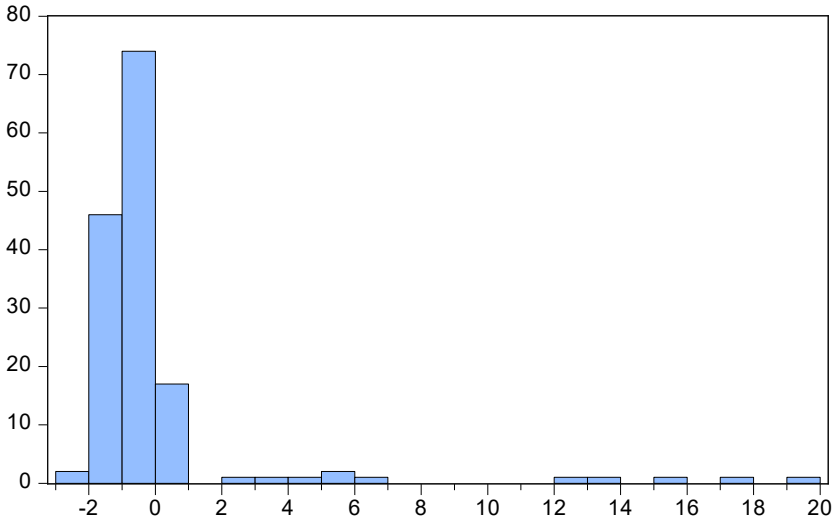
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.149306	Prob. F(3,146)	0.9300
Obs*R-squared	0.458781	Prob. Chi-Square(3)	0.9278
Scaled explained SS	4.763261	Prob. Chi-Square(3)	0.1900

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/03/13 Time: 10:59
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.722990	121.9059	-0.071555	0.9431
EX	2.694736	16.35009	0.164815	0.8693
GDP	-116.8211	713.4932	-0.163731	0.8702
IR	345.1715	854.2550	0.404061	0.6868

R-squared	0.003059	Mean dependent var	9.923924
Adjusted R-squared	-0.017427	S.D. dependent var	46.61640
S.E. of regression	47.02083	Akaike info criterion	10.56536
Sum squared resid	322799.9	Schwarz criterion	10.64565
Log likelihood	-788.4022	Hannan-Quinn criter.	10.59798
F-statistic	0.149306	Durbin-Watson stat	0.515479
Prob (F-statistic)	0.929996		



Series: Residuals
Sample 1 150
Observations 150

Mean	1.49e-15
Median	-0.785575
Maximum	19.08108
Minimum	-2.658919
Std. Dev.	3.160780
Skewness	4.408085
Kurtosis	22.91824
Jarque-Bera	2965.382
Probability	0.000000

Figure 2

Dependent Variable: ROE
Method: Least Squares
Date: 03/02/13 Time: 22:30
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.180238	0.266658	-0.675916	0.5002
EX	0.027486	0.035764	0.768530	0.4434
GDP	2.014311	1.560699	1.290646	0.1989
IR	0.534833	1.868602	0.286221	0.7751

R-squared	0.053201	Mean dependent var	0.163063
Adjusted R-squared	0.033746	S.D. dependent var	0.104634
S.E. of regression	0.102854	Akaike info criterion	-1.684715
Sum squared resid	1.544516	Schwarz criterion	-1.604431
Log likelihood	130.3536	Hannan-Quinn criter.	-1.652098
F-statistic	2.734610	Durbin-Watson stat	1.018293
Prob(F-statistic)	0.045831		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	31.77991	Prob. F(1,145)	0.0000
Obs*R-squared	26.96565	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/06/13 Time: 03:08
Sample: 1 150
Included observations: 150
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.029704	0.242391	0.122546	0.9026
EX	-0.003623	0.032508	-0.111436	0.9114
GDP	-0.087145	1.418421	-0.061438	0.9511
IR	-0.120288	1.698287	-0.070829	0.9436
RESID(-1)	0.424384	0.075281	5.637367	0.0000

R-squared	0.179771	Mean dependent var	1.91E-16
Adjusted R-squared	0.157144	S.D. dependent var	0.101813
S.E. of regression	0.093472	Akaike info criterion	-1.869553
Sum squared resid	1.266856	Schwarz criterion	-1.769199
Log likelihood	145.2165	Hannan-Quinn criter.	-1.828782
F-statistic	7.944976	Durbin-Watson stat	1.905940
Prob(F-statistic)	0.000008		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.739710	Prob. F(3,146)	0.5300
Obs*R-squared	2.245792	Prob. Chi-Square(3)	0.5230
Scaled explained SS	5.481459	Prob. Chi-Square(3)	0.1398

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/06/13 Time: 03:09
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006712	0.060960	-0.110110	0.9125
EX	-0.000812	0.008176	-0.099303	0.9210
GDP	-0.083496	0.356788	-0.234021	0.8153
IR	0.466943	0.427178	1.093089	0.2762

R-squared	0.014972	Mean dependent var	0.010297
Adjusted R-squared	-0.005268	S.D. dependent var	0.023451
S.E. of regression	0.023513	Akaike info criterion	-4.636207
Sum squared resid	0.080719	Schwarz criterion	-4.555924
Log likelihood	351.7156	Hannan-Quinn criter.	-4.603591
F-statistic	0.739710	Durbin-Watson stat	1.234049
Prob(F-statistic)	0.529992		

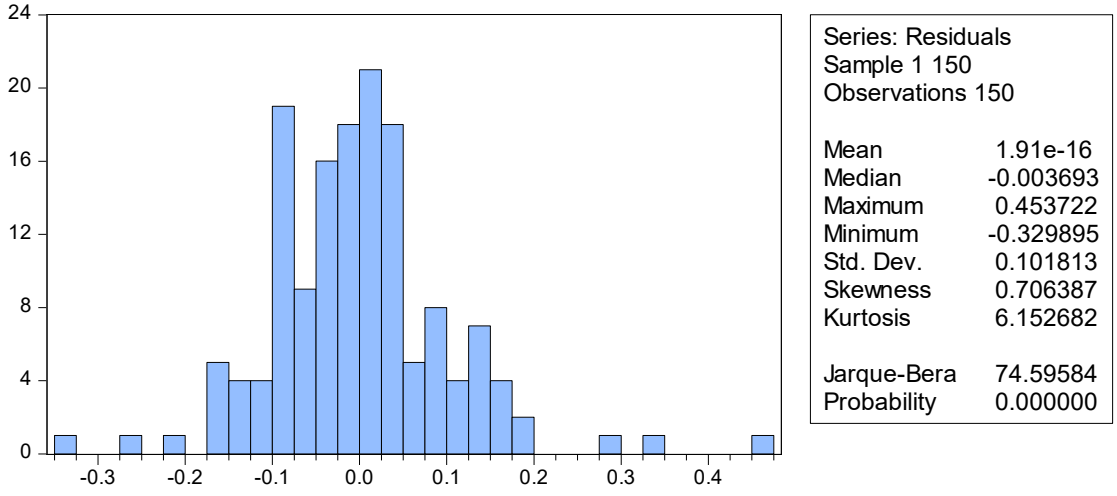


Figure 3

Dependent Variable: ROCE
Method: Least Squares
Date: 03/02/13 Time: 22:31
Sample: 1 150
Included observations: 145

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.040238	0.345381	0.116503	0.9074
EX	-0.014160	0.046128	-0.306985	0.7593
GDP	0.340643	1.999032	0.170404	0.8649
IR	1.484631	2.377817	0.624367	0.5334

R-squared	0.040074	Mean dependent var	0.115940
Adjusted R-squared	0.019650	S.D. dependent var	0.131593
S.E. of regression	0.130294	Akaike info criterion	-1.210853
Sum squared resid	2.393678	Schwarz criterion	-1.128736
Log likelihood	91.78685	Hannan-Quinn criter.	-1.177486
F-statistic	2.662092	Durbin-Watson stat	1.152913
Prob(F-statistic)	0.092443		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	31.85909	Prob. F(1,140)	0.0000
Obs*R-squared	26.87998	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/06/13 Time: 03:11
Sample: 1 150
Included observations: 145
Presample and interior missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.018082	0.312856	-0.057796	0.9540
EX	0.002833	0.041784	0.067811	0.9460
GDP	0.044318	1.810703	0.024476	0.9805
IR	0.044266	2.153796	0.020553	0.9836
RESID(-1)	0.433696	0.076837	5.644386	0.0000

R-squared	0.185379	Mean dependent var	-2.02E-17
Adjusted R-squared	0.162104	S.D. dependent var	0.128929
S.E. of regression	0.118018	Akaike info criterion	-1.402092
Sum squared resid	1.949940	Schwarz criterion	-1.299447
Log likelihood	106.6517	Hannan-Quinn criter.	-1.360384
F-statistic	7.964773	Durbin-Watson stat	2.052174
Prob(F-statistic)	0.000008		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.977427	Prob. F(3,141)	0.4053
Obs*R-squared	2.954032	Prob. Chi-Square(3)	0.3988
Scaled explained SS	30.68054	Prob. Chi-Square(3)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/06/13 Time: 03:11
Sample: 1 150
Included observations: 145

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.287078	0.205857	-1.394548	0.1653
EX	0.044129	0.027493	1.605069	0.1107
GDP	1.994682	1.191480	1.674121	0.0963
IR	-1.055613	1.417247	-0.744833	0.4576

R-squared	0.020373	Mean dependent var	0.016508
Adjusted R-squared	-0.000471	S.D. dependent var	0.077640
S.E. of regression	0.077659	Akaike info criterion	-2.245786
Sum squared resid	0.850354	Schwarz criterion	-2.163670
Log likelihood	166.8195	Hannan-Quinn criter.	-2.212420
F-statistic	0.977427	Durbin-Watson stat	1.948203
Prob(F-statistic)	0.405322		

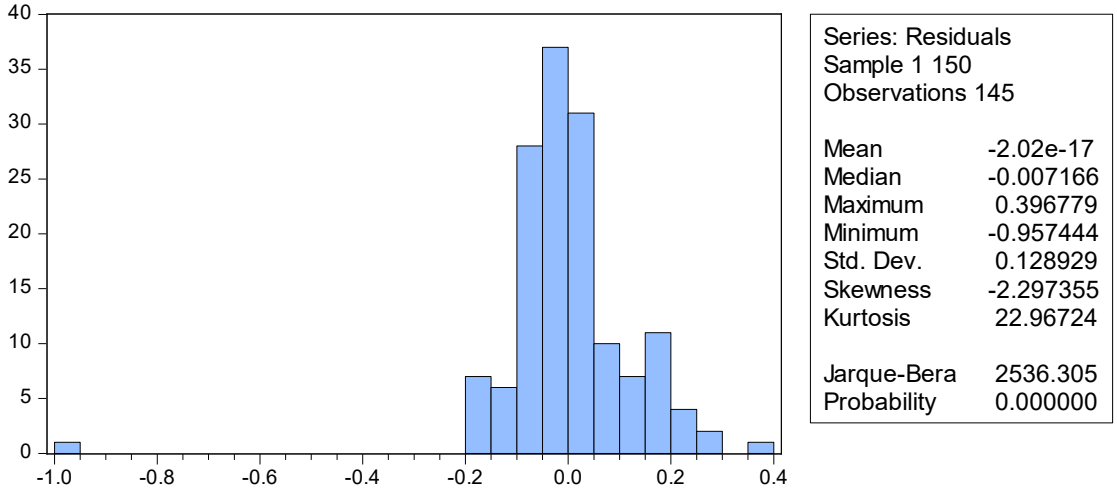


Figure 4

Dependent Variable: EPS
Method: Least Squares
Date: 03/02/13 Time: 22:44
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1534.487	995.3952	1.541586	0.1253
EX	-1422.075	1021.426	-1.392245	0.1660
GDP	-1882.373	2676.332	-0.703340	0.4830
IR	369.2418	3374.216	0.109430	0.9130

R-squared	0.018741	Mean dependent var	53.20236
Adjusted R-squared	-0.001422	S.D. dependent var	432.9421
S.E. of regression	433.2497	Akaike info criterion	15.00681
Sum squared resid	27404979	Schwarz criterion	15.08709
Log likelihood	-1121.511	Hannan-Quinn criter.	15.03943
F-statistic	0.929488	Durbin-Watson stat	1.005843
Prob(F-statistic)	0.428199		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	47.66716	Prob. F(1,145)	0.0000
Obs*R-squared	37.11101	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/06/13 Time: 03:13
Sample: 1 150
Included observations: 150
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-171.0211	866.8531	-0.197290	0.8439
EX	188.7381	889.5789	0.212166	0.8323
GDP	280.0137	2330.120	0.120171	0.9045
IR	-671.5595	2938.891	-0.228508	0.8196
RESID(-1)	0.497922	0.072119	6.904141	0.0000

R-squared	0.247407	Mean dependent var	-6.67E-13
Adjusted R-squared	0.226646	S.D. dependent var	428.8660
S.E. of regression	377.1472	Akaike info criterion	14.73591
Sum squared resid	20624802	Schwarz criterion	14.83627
Log likelihood	-1100.193	Hannan-Quinn criter.	14.77668
F-statistic	11.91679	Durbin-Watson stat	1.675275
Prob(F-statistic)	0.000000		

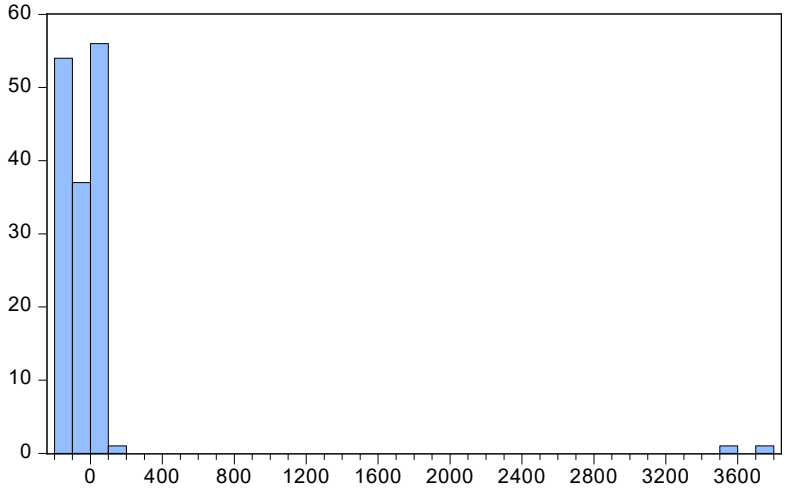
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.001990	Prob. F(3,146)	0.3939
Obs*R-squared	3.026023	Prob. Chi-Square(3)	0.3876
Scaled explained SS	99.29054	Prob. Chi-Square(3)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/06/13 Time: 03:13
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5691312.	3505181.	1.623686	0.1066
EX	-5316786.	3596844.	-1.478181	0.1415
GDP	-7253294.	9424426.	-0.769627	0.4428
IR	2064830.	11881953	0.173779	0.8623

R-squared	0.020173	Mean dependent var	182699.9
Adjusted R-squared	0.000040	S.D. dependent var	1525675.
S.E. of regression	1525644.	Akaike info criterion	31.34004
Sum squared resid	3.40E+14	Schwarz criterion	31.42032
Log likelihood	-2346.503	Hannan-Quinn criter.	31.37265
F-statistic	1.001990	Durbin-Watson stat	1.007141
Prob(F-statistic)	0.393853		



Series: Residuals
Sample 1 150
Observations 150

Mean	-6.67e-13
Median	-30.01671
Maximum	3727.778
Minimum	-142.0318
Std. Dev.	428.8660
Skewness	8.231155
Kurtosis	70.26956
Jarque-Bera	29976.26
Probability	0.000000

Figure 5

Dependent Variable: ROE
Method: Least Squares
Date: 03/02/13 Time: 22:46
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.751987	1.718863	0.437491	0.6624
EX	-0.348670	1.763813	-0.197680	0.8436
GDP	-0.312168	4.621530	-0.067546	0.9462
IR	-2.370229	5.826647	-0.406791	0.6848

R-squared	0.003967	Mean dependent var	0.286161
Adjusted R-squared	-0.016499	S.D. dependent var	0.742046
S.E. of regression	0.748142	Akaike info criterion	2.283857
Sum squared resid	81.71861	Schwarz criterion	2.364140
Log likelihood	-167.2893	Hannan-Quinn criter.	2.316474
F-statistic	0.193843	Durbin-Watson stat	0.562240
Prob(F-statistic)	0.900460		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	155.1711	Prob. F(1,145)	0.0000
Obs*R-squared	77.54132	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/06/13 Time: 03:15
Sample: 1 150
Included observations: 150
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.238528	1.198916	0.198953	0.8426
EX	-0.257823	1.230286	-0.209563	0.8343
GDP	-0.378689	3.223273	-0.117486	0.9066
IR	0.770665	4.064068	0.189629	0.8499
RESID(-1)	0.719228	0.057738	12.45677	0.0000

R-squared	0.516942	Mean dependent var	-1.95E-16
Adjusted R-squared	0.503616	S.D. dependent var	0.740572
S.E. of regression	0.521766	Akaike info criterion	1.569571
Sum squared resid	39.47482	Schwarz criterion	1.669926
Log likelihood	-112.7179	Hannan-Quinn criter.	1.610342
F-statistic	38.79277	Durbin-Watson stat	1.646465
Prob(F-statistic)	0.000000		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.456252	Prob. F(3,146)	0.7133
Obs*R-squared	1.393195	Prob. Chi-Square(3)	0.7071
Scaled explained SS	20.52971	Prob. Chi-Square(3)	0.0001

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/06/13 Time: 03:15
Sample: 1 150
Included observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.688050	7.043179	0.523634	0.6013
EX	-2.879531	7.227363	-0.398421	0.6909
GDP	-12.21924	18.93709	-0.645254	0.5198
IR	-3.900847	23.87515	-0.163385	0.8704

R-squared	0.009288	Mean dependent var	0.544791
Adjusted R-squared	-0.011069	S.D. dependent var	3.048745
S.E. of regression	3.065572	Akaike info criterion	5.104650
Sum squared resid	1372.068	Schwarz criterion	5.184933
Log likelihood	-378.8487	Hannan-Quinn criter.	5.137267
F-statistic	0.456252	Durbin-Watson stat	0.469296
Prob(F-statistic)	0.713281		

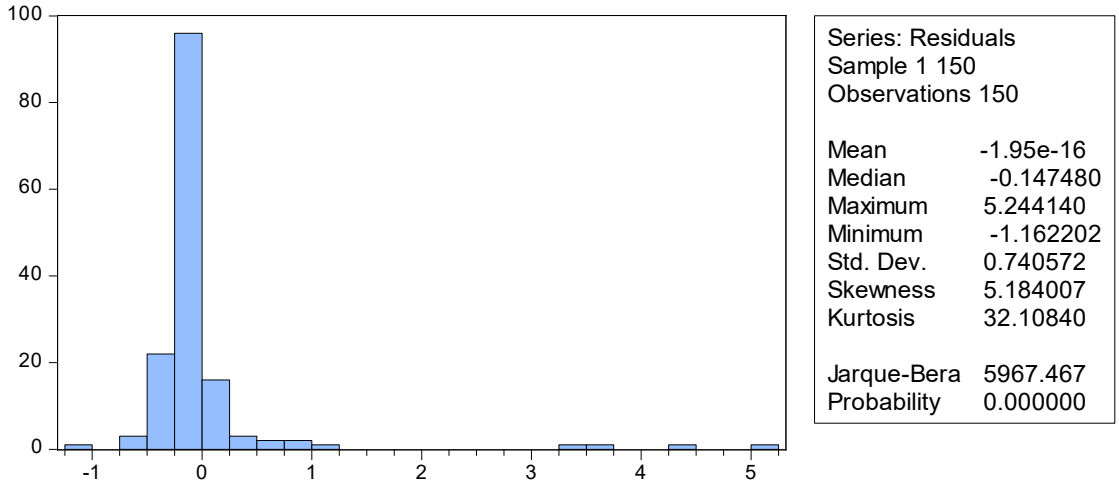


Figure 6

Dependent Variable: ROCE
Method: Least Squares
Date: 03/02/13 Time: 22:46
Sample: 1 150
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-24.89453	19.63415	-1.267920	0.2070
EX	25.89292	20.14760	1.285161	0.2009
GDP	6.618251	52.79061	0.125368	0.9004
IR	-37.40394	66.55637	-0.561989	0.5750

R-squared	0.022462	Mean dependent var	0.966815
Adjusted R-squared	0.000899	S.D. dependent var	8.259784
S.E. of regression	8.256070	Akaike info criterion	7.087930
Sum squared resid	9270.126	Schwarz criterion	7.171977
Log likelihood	-492.1551	Hannan-Quinn criter.	7.122084
F-statistic	2.741693	Durbin-Watson stat	1.958494
Prob(F-statistic)	0.090311		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.136034	Prob. F(3,136)	0.3369
Obs*R-squared	3.422573	Prob. Chi-Square(3)	0.3309
Scaled explained SS	209.7793	Prob. Chi-Square(3)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/06/13 Time: 03:17
Sample: 1 150
Included observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2289.870	1798.562	-1.273167	0.2051
EX	2367.333	1845.596	1.282693	0.2018
GDP	343.4852	4835.818	0.071029	0.9435
IR	-3658.356	6096.813	-0.600044	0.5495

R-squared	0.024447	Mean dependent var	66.21519
Adjusted R-squared	0.002927	S.D. dependent var	757.3965
S.E. of regression	756.2870	Akaike info criterion	16.12287
Sum squared resid	77787933	Schwarz criterion	16.20692
Log likelihood	-1124.601	Hannan-Quinn criter.	16.15703
F-statistic	1.136034	Durbin-Watson stat	2.019739
Prob(F-statistic)	0.336877		

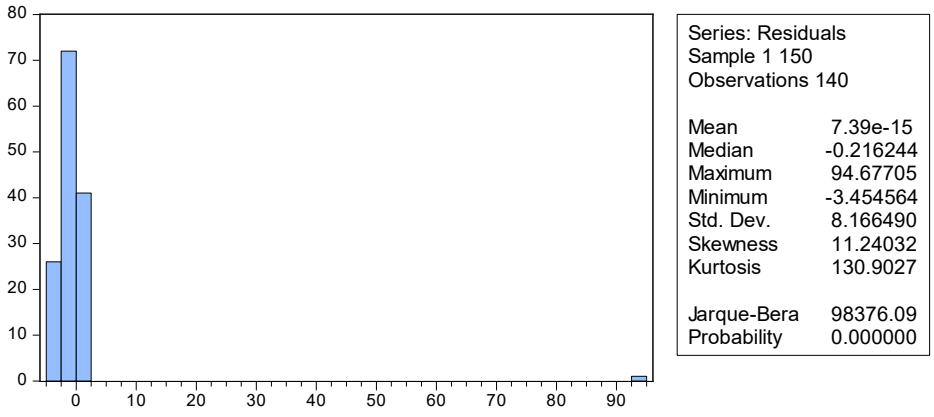


Figure 7

Models	Autocorrelated	Heteroskedasticity	Normally distributed
(1)	+	-	-
(2)	+	-	-
(3)	+	-	-
(4)	+	-	-
(5)	+	-	-
(6)	-	-	-

Note: "+"means yes; "-"means no.

Figure 8

Model	C	EX	GDP	IR	R^2	Adjusted R^2
(1)	-1.447	0.349	6.925	15.351	0.0013	-0.0192
(2)	-0.180	0.027	2.014	0.535	0.0532	0.0337
(3)	0.040	-0.014	0.341	1.485	0.0401	0.0197
(4)	1534.487	-1422.075	-1882.373	369.242	0.0187	-0.0014
(5)	0.752	-0.349	-0.312	-2.370	0.0040	-0.0165
(6)	-24.895	25.895	6.619	-37.404	0.0225	0.0009

Figure 9

Group: UNTITLED Workfile: CHINA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Correlation

	EX	GDP	IR
EX	1.000000	-0.945338	-0.747845
GDP	-0.945338	1.000000	0.815273
IR	-0.747845	0.815273	1.000000

Group: UNTITLED Workfile: USA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Correlation

	EX	GDP	IR
EX	1.000000	-0.493620	0.148431
GDP	-0.493620	1.000000	0.570296
IR	0.148431	0.570296	1.000000