

# The Impact of Dividend Policy on the Valuation of Company Shares

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## ABSTRACT

The objective of this study is to analyze determinants of dividend policy to share price of the business. The data used in the study is panel data that were mainly collected from annual reports of 44 enterprises whose shares are listed the HCM City Stock Exchange in 2006-2013. Through estimation by using a fixed-effects model and random effects showed that stock prices of firms have favorable correlation with dividend shares, the ratio of retained profits, profit after tax and profit per share (EPS).

Key words: share price, dividend policy, FEM, REM, HOSE.

## 1. INTRODUCTION

Dividend policy is the decision which relates to the distribution of the enterprise's profits for shareholders. Both investors and businesses are interested in this issue due to the fact that it relates directly to earnings. In current time, there are two different points of view about the impact of dividend policy.

First of all, several studies support the point that dividend policy does not have effects on the stock prices. The argument of this study based on the theory of dividends are irrelevant in calculating the valuation of a company of Miller & Modigliani (1961). However, this theory believes in the existence of perfect capital markets which are irrational. Managers show shareholders only positive information about business results that lead to the asymmetrical information between investors and business – imperfect capital markets.

The second outlook is proposed by confirming the existence of the relationship between the dividend policy and the market price of the shares. Some studies support this point namely researches of Myron Gordon (1959), studies of Merton & Rock (1985), and those of Miller & Scholes (1978). Besides, practical study of Kanwal Iqbal Khan, Aamir & Arslan (2009) illustrates that the dividends and extraordinary income can explain the variation in stock prices. Additionally, the analysis of Kanwal, Arslan, Nasir & Maryam Khan (2011) which applied a fixed and random effects model could partly explain the impact of dividend policy on stock prices.

There are a number of studies on the impact of dividend policy in Vietnam such as Phung Tat Huu (2015), Nguyen Thi Minh Hue (2015) ... These studies could explain the effect of dividend policy on the prices of stock in some ways. While the views of investors and managers themselves are considered, consequently the final result is not the same. In order to have a more comprehensive information about this issue, we are examining the topic “The impact of dividend policy on the valuation of company shares”

## **2. RATIONALE - METHODOLOGY**

### **2.1 Conception**

According to Law on Enterprises (2014):

- Dividend: The value of the dividend is determined at the annually General Meeting of Shareholders (GMS), and it is announced all to the shareholders either by cash that they would receive based on the number of shares they have owned, or the percentage of the earnings of the company. Dividend includes ordinary shares and preference shares.

- Ordinary shares: the most popular share among kinds of company shares. The shareholders who own this kind of shares are unrestrained to transfer while they are still likely to remain full voting rights for the company's decisions at the General Meeting of Shareholders. Furthermore, shareholders may gain dividends followed the business results and the value of shares they hold.

Ordinary shares may not be converted into other kinds of shares. Preference shares may be converted into ordinary shares pursuant to a resolution of the General Meeting of Shareholders. This kind of shares may be issued in a series after gaining permission from competent authorities. Owners of ordinary shares, who will be the last person to be shared after the liquidation of assets in case the company goes bankrupt, shall be ordinary shareholders.

Ordinary shareholders have the following rights:

- The right of receiving dividends

The dividend is a part of the company profits which are being used to pay for the owner. Dividends may be paid either in cash (common form) or in new shares. Ordinary shares do not contain stipulations about a minimum or a maximum dividend rate that shareholders receive. The matter of paying dividend or not or even the rate of dividend payment depends on the business results and the company's policy. When companies have to liquidate assets, ordinary shareholders

are the last to receive the left (if possible) after the company accomplished carrying out all obligations such as tax liabilities and preference shares.

- The right of purchasing new shares

When the company releases a batch of new shares to raise the capital, the existing shareholders holding ordinary shares have the right to buy new shares in advance before the issue are offered to the public in a limited period of time. The amount of new shares for purchase within the corresponding rights of shares the owners are permitted to hold. Thus, this gives the shareholders the right to maintain their ownership in the company after the increase in capital. Each share holding gives the shareholders a right to buy in advance. The amount of rights required to purchase a new share will be specified in each of the offering, coming with the purchase price, the period of time in purchase right and the releasing date of new shares. This kind of shares has lower price than that in the current market. When the shareholders use their rights to buy new shares, the company will raise more capital; in contrast to this, the shareholders may bring shares on the market for sale.

- The right of voting

Ordinary shareholders have the right to vote and stand for election in management positions in the company; they also have the right to participate in the General Meeting of Shareholders and vote for decisions about significant issues in business. In case the shareholders are unable to attend the meeting, they may authorize other people to vote on their behalf in accordance with their designation or even authorized people can decide by themselves. Depending on the regulations, each shareholder may either vote for each candidate by the maximum number of shares they hold or use the entire of the number of shares to dominate (the total number of shares multiply by the number of candidates) to elect one (or more) candidate.

The second way is beneficial for small shareholders. Although less votes, they can accumulate stocks to increase the value of their vote.

In addition to the basic economic rights above, ordinary stocks exist other legal rights such as the right of examining the company's documents in need, the right of requesting to convene the Generally Extraordinary Meeting of Shareholders, etc.

- Preference shares are kind of securities that have the same features as both ordinary stocks and bonds. Similarly to ordinary stocks, owners of preference shares are considered shareholders of the company. However, unlike ordinary stocks, preference shares pay a certain dividend for holders. Like bonds, par value

of preference shares are different from that of ordinary stocks which only contains nominal value, the par value of preference shares is really important and significant in the fixed dividend, dividend of preference shares is determined according to a fixed proportion of the face value.

It is evident that the greatest benefit of owning preference stocks is the investors who have the greater ability to revoke the company's assets than ordinary holders. Preference shareholders are entitled to receive dividends first and when the company goes bankrupt, they are also the ones who are prepaid the remaining assets, then ordinary shareholders. Furthermore, ordinary shares cannot be converted into preference shares, while preference stocks may be converted into ordinary shares by the General Meeting of Shareholders. Owners of preference shares shall be preference shareholders.

- Dividend policy is determination of dividing the net profit after tax into retaining for reinvestment and using for dividend for shareholders. No matter what the dividing method is, this will reduce retained earnings of the company to be continued to invest to provide cash flow to shareholders in the future. Shareholders only definitely gain the income from dividends which were already divided. Thus, there are many forms of dividend which suit the multiple interests of holders.

## **2.2 Theoretical foundations**

- Dividend Irrelevance Theory:

Much like their work on the capital-structure irrelevance proposition, Modigliani and Miller also theorized that, with no taxes or bankruptcy costs, dividend policy is also irrelevant. This is known as the "dividend-irrelevance theory", indicating that there is no effect from dividends on a company's capital structure or stock price.

MM's dividend-irrelevance theory says that investors can affect their return on a stock regardless of the stock's dividend. For example, suppose, from an investor's perspective, that a company's dividend is too big. That investor could then buy more stock with the dividend that is over the investor's expectations. Likewise, if, from an investor's perspective, a company's dividend is too small, an investor could sell some of the company's stock to replicate the cash flow he or she expected. As such, the dividend is irrelevant to investors, meaning investors care little about a company's dividend policy since they can simulate their own.

- Tax Preference Theory:

Taxes are important considerations for investors. Remember capital gains are taxed at a lower rate than dividends. As such, investors may prefer capital gains to dividends. This is known as the "tax Preference theory".

Additionally, capital gains are not paid until an investment is actually sold. Investors can control when capital gains are realized, but, they can't control dividend payments, over which the related company has control. Capital gains are also not realized in an estate situation. For example, suppose an investor purchased a stock in a company 50 years ago. The investor held the stock until his or her death, when it is passed on to an heir. That heir does not have to pay taxes on that stock's appreciation.

- Bird-in-the-Hand Theory:

The bird-in-the-hand theory, however, states that dividends are relevant. Remember that total return ( $k$ ) is equal to dividend yield plus capital gains. Myron Gordon and John Lintner (Gordon/Litner) took this equation and assumed that  $k$  would decrease as a company's payout increased. As such, as a company increases its payout ratio, investors become concerned that the company's future capital gains will dissipate since the retained earnings that the company reinvests into the business will be less.

Gordon and Lintner argued that investors value dividends more than capital gains when making decisions related to stocks. The bird-in-the-hand may sound familiar as it is taken from an old saying: "a bird in the hand is worth two in the bush." In this theory "the bird in the hand" is referring to dividends and "the bush" is referring to capital gains.

### **2.3 Empirical evidences from previous studies relating to the impact of dividend policy on stock prices**

There have been many studies as premises, theoretical basis that explain for the relationship between the dividend policy and volatility of stock prices:

Phung Tat Huu (2015) studied the impact of dividend policy on share prices of enterprises. The study used two methods for processing data table format: a fixed-effects model (FEM) and random-effects model (REM). The author took dependent variable was the dummy one, independent variables: dividend shares, ratio of retained earnings, profit after tax, EPS and ROE respectively. Both models presented the result of the dividend policy which affected business rates as follows: the majority of the independent variables impact positively on the stock price, ROE variable impact negatively.

Nguyen Thi Minh Hue (2015) studied the impact of the announced dividends on the stock price of the companies listed on the HCM City Stock Exchange. Event study methodology was applied to 20 large market capitalization companies listed on the HCM City Stock Exchange in 2006-2013. Research results performed that with the announced increase in dividend, stock prices tended to adjust from the date of notification of dividends until a few days after the announcement. Meanwhile with the reduced dividend announcement, stock prices tended to fall within a few days before the dividend announcement. In terms of the stable dividend information, the market response generally positively which was recorded through the value of cumulatively abnormal income and the positive average.

Nazir, Nawaz, Anwar, & Ahmed (2010) studied the impact of dividend policy on share prices. Through estimation by using a fixed-effects model and random effects showed: dividend shares, ratio of retained earnings, profit after tax, EPS impact positively on the stock price; ROE variable impact negatively, and explain most of the changes in price shares.

Baskin (1989) studied 2,344 companies list on New York Exchange. The study is during 20 years from 1967-1986. Author used the regression come to relationship between dividend policy and price shares volatility. The dependent variable is price and independent variables other: dividend payout ratio, dividend yield, size, asset growth, ratio of long-term debts on sum asset, income volatility. He found negatively between raio of dividend yield and price shares. The income volatility and raio of long-term debts variables impact positively on the stock price. Beside, to studied the impact of business work to price shares, he added 5 dummies representing 6 sectors that is the most of raio in data. The study showed that the dividend policy direct effects to price shares volatility.

Black & Scholes (1974) created 25 portfolios of common stock in New York Stock Exchange for studying the impact of dividend policy on share price from 1936 to 1966. They used capital asset pricing model for testing the association between dividend yield and expected return. Their findings showed no significant association between dividend yield and expected return. They reported that there is no evidence that difference dividend policies will lead to different stock prices. Their findings were consistent with dividend irrelevance hypothesis.

### **3. RESEARCHING METHODS**

#### **3.1 Methods of collecting data**

Using secondary data obtained on Ho Chi Minh Stock Exchange (HOSE), financial statements of the company, the official economic magazines, General

Statistics Office (GSO) and other published data. Unit is collected in units of 1.000 dong.

Determining sample size and sample size:

Criteria for sampling is to focus on the listed companies on HOSE which provides sufficiently necessary information to use for researching purposes, the dividend of the company in particular. Forty four companies were selected randomly based on company matching criteria and the time five years required to collect, the total sample size is 220.

- Determining sample size: According to statistical theory, when samples were selected based on the overall, we have three main factors affecting the decision to select the sample size is: volatility of data (V), reliability (1-  $\alpha$ ) and the error rate.

+ The formula of determining sample size:

$$n = p(1 - p) \left( \frac{Z_{\alpha/2}}{MOE} \right)^2$$

Including:

- n : sample size
- p: frequency of the elements in the sampling unit as the target sample ( $0 \leq p \leq 1$ ).
- V = p(1-p): data volatility
- Z: the value of the normal distribution table with the reliability Z
- MOE: tolerance with small sample sizes.

+ The most unfavorable case is the volatility of the data at the maximum level:

$$V = p(1 - p) \rightarrow \max \rightarrow V' = 1 - 2p = 0 \rightarrow p = 0,5 \quad (1)$$

+ Tolerance with the small sample size is at 10% (2)

+ Researchers actually use reliability at 95% (or  $\alpha=5\%$ ):

$$\rightarrow Z_{\alpha/2} = Z_{2,5\%} = 1,96 \quad (3)$$

Combining (1), (2) and (3) we have a sample size n = 96 observations.

To conclude: the article applies data of 220 observations which therefore satisfy the requirements of the sample size.

### 3.2 Data analysis methods

- Descriptive statistical methods are used to collect data and assess the situation, propose overviews about dividend policy which is being applied by listed companies.

- This study applied the approach data table to measure the relationship between the dividend policy and stock prices, fixed effects model and random effects model - the two panel data models are applied. These two models will be run on Stata.

+ FEM model is used to control all the stability of the companies including researches in a certain time, this method performs better results in terms of statistics.

+ REM model is applied on the different features of samples such as the other characteristics of the company scale, capital, nature of business, income, ...this method therefore is well-suited to explain the differences between enterprises.

- While using the variables, which were in the model based on previous studies of Kanwal Iqbal Khan & Aamir & Arslan & Nasir & Maryam Iqbal Khan (2011), need noting:

+ *Handling values of relevant variables in the model*

The ratio of retained earnings (RR<sub>i</sub>):

$$\frac{\text{Retaining earning}}{\text{Profir after tax}}$$

A financial ratio to evaluate the use of the profit after tax for the reinvestment of business. This ratio generates that every single one unit in profit after tax in corresponding to that in retaining for reinvestment. The larger ratio is, the stronger in reinvestment is.

Earning per share (EPS<sub>i</sub>):

$$\frac{\text{Net profit – preference stock dividend}}{\text{The average amount of ordinary shares in circulation}}$$

Return on equity (ROE<sub>i</sub>):  $\frac{\text{Net profit}}{\text{Equity}}$

This ratio indicates the amount of net profits gaining from the use of certain equity. In terms of theory, the higher ROE is, the more efficient business enterprise is.

+ *The model used*

Using regression models based on research by Kanwal Iqbal Khan & Aamir & Arslan & Nasir & Maryam Iqbal Khan (2011)

$$P_i = \alpha_0 + \alpha_1SD_i + \alpha_2RR_i + \alpha_3PAT_i + \alpha_4EPS_i + \alpha_5ROE_i + \epsilon$$

*Including:*

$P_i$ : Price of share

$SD_i$ : Dividend shares

$RR_i$ : Ratio of retained earnings

$EPS_i$ : Profit per share

$PAT_i$ : Profit after tax

$ROE_i$ : Return on equity

Expectations in the regression model

Variable	Expectation
SD	+
RR	+
EPS	+
PAT	+
ROE	+

The stock price is expected to have a positive correlation with all the explanatory variables. Positive correlation indicates that either increases or decreases in the explanatory variables that leads to increases or decreases in stock price.

#### 4. RESEARCH RESULTS AND DISCUSSION

Collected data include 44 companies listed on Ho Chi Minh stock market in past 5 years (2011-2015). Statistics are as follows:

Table 4.1: Statistics describing the variables in research

Variable	Price (P)	Dividend shares (SD)	The ratio of retained earnings (RR)	Earning Per Share (EPS)	Profit after tax (PAT)	Return on Equity (ROE)
Mean	21.56	1.07	0.27	2079191	1.43e+08	0.12
Greatest value	99.5	5.00	2.69	2.06e+07	2.95e+09	0.9
Least value	2.7	0	-18.84	-4884000	-5.17e+07	-0.67
Standard deviation	17.66	0.97	1.67	2249798	3,23e+08	0.12
Observations	220	220	220	220	220	220

Source: Calculation from collected results

Statistical results show that the dependent price variable (P) oscillates from 2.7 đến to 99.5 at average prices 21.56 and standard deviation at 17.66. The two variables: Earning per share (EPS) and Profit after tax (PAT) are the most volatile variables in the research stage (2011–2015). Return on Equity (ROE) contains high difference between the largest value and the smallest one, specifically the largest up to 0.9 and the smallest at -0.67. Comparing to previous research results obtained from scientific articles “The impact of dividend policy on share prices of the enterprises” Phung Tat Huu (2015), the study remained the price variable (P) in the range from 3.3 to 87.0 with the average value at 23.6595, standard deviation at 16.34729 –the input collected data are quite similar to the current research of the group.

When considering the correlation between the variables in the model, the stock price ( $P_i$ ) correlates with most of the remaining independent variables, this means all the variables in the model can affect share prices. In particular, Earning per share ( $EPS_i$ ) is the highest correlation at 0.6071. Following this, the dividend shares at 0.4772, ROE at 0.453, profit after tax at 0.3411 and the proportion of retained earnings at 0.1651.

Applying FEM model and REM model simultaneously with Accreditation Hausman, test results are illustrated on the table below.

Table 4.2: Estimated results

Price (P)				
Variables	FEM		REM	
	Beta	p-value	Beta	p-value
Dividend shares (SD)	2.02	0.057	3.61	0.000
The ratio of retained earnings (RR)	0.85	0.091	0.91	0.066
Earning Per Share (EPS)	1.72e-06	0.020	3.54e-06	0.000
Profit after tax (PAT)	1.84e-08	0.005	1.68e-08	0.000
Return on Equity (ROE)	-11.83	0.331	-25.82	0.024
R-square	17.31%		16.23%	
F-(Hausman)	0.0001			

Source: Calculation from collected results

Accreditation Hausman illustrates Prob (chi-square) = 0.0001 < 0.05, hence with the significance level of 5%, we have reason to reject the hypothesis H0 and accept H1. The Fixed effects model (FEM) is the only suitable model to study.

After selecting the model FEM, the lowest level of significance can be accepted is 10%; we will eliminate the variables with p-value is greater than 0.1 The regression will eliminate the ROE, the final the results are below.

$$P_i = 14.43 + 2.02^a * SD + 0.85^a * RR + (1.84e-08)^c * PAT + (1.72e-06)^b * EPS$$

Note:

- a: results are accepted at level of significance of 10%
- b : results are accepted at level of significance of 5%
- c: results are accepted at level of significance of 1%

Interpretation results

The dependent variables used in the model can explain 17.31% of the variation in stock prices on the market.. ROE were excluded from the regression because value of p-value = 0.331 exceeds acceptable level (at least 10%). Stock prices are affected by a specific dividend policy as follows: Dividend shares (SD), The ratio of retained earnings (RR), Profit after tax (PAT) and Earning Per Share (EPS). The four are all positive impacts.

- Dividend shares (SD): predictive value  $\alpha_1 = 2.02 (>0)$  which is true to the original expectations of the model. Dividend shares have a positive impact on the value of shares on the market, the dividend payment led to increases in price and vice versa. When dividend shares increased by 1 unit, share price will increase to 2.02 units. According to the principle of "Bird in the Hand" investors prefer to be divided and holding more money than less. The dividend increase is decoded as a positive signal about the operation of the business. Upon receiving this information, investors will increase the purchasing that makes stock prices rise. The predictive value is significant at 10% (p-value = 0.057). Comparing with previous studies, dividend shares in this article have higher impacts on the stock price (regression coefficient was 0.0024 previously). This shows that throughout every stage, the dividend payment will bring the different signals for the investors and have different impacts on the stock price also.

- The ratio of retained earnings (RR):  $\alpha_2 = 0.85 (>0)$  and statistical significance at the 10% (p-value = 0.091). When ratio of retained earnings increases 1%, stock price will increase 0.85 units, this is true to the original positive expectations of the model. Stock prices in the market totally depends on the information - factors that affect directly on the confidence of investors. When the ratio of retained earnings in the enterprise increases, following regression results we can explain that: the majority of investors will consider this information as a good signal. The increase in the ratio of retained earnings can be seen as a movement to increase business investment in the future, and investors can expect higher profits in the future. Previous studies result performed  $\alpha = 0.0594$  which is smaller than that in the current study; however they both have positive impact on the stock price. In recent years, when evaluating about business, the retained profit has been more focused on, the impact of this factor on price therefore is higher than the previous price also.

- Earning per share (EPS): coefficient prediction  $\alpha_4$  ( $=1.72e-06$ ) is greater than 0 but still at a very small level. EPS affects positively on stock prices. This result is accepted at significance level of 5% (p-value = 0,020). EPS is considered an important variable when calculating the share price, the higher EPS reflects higher trading capacity of companies, high ability to pay dividends and rising tendency in stock prices also. When analyzing correlation, the results also lead to a huge correlation between EPS and stock prices, this is an important factor for investors to consider when making decisions to buy shares in the market. The small estimated coefficients can be explained due to that fact that investors are only interested in current business EPS which is large or small compared to the average level of the industry, they are less interested in the change of EPS over years. Nghiên cứu trước đây chỉ ra hệ số ước lượng 0.0033 lớn hơn so với nghiên cứu của nhóm và cùng tác động dương lên giá cổ phiếu. Previous studies indicated 0.0033 estimated coefficients which are greater than that in our study, besides they all have the positive impact on the stock price.

- Profit after tax (PAT): estimated coefficients are accepted at 1% (p-value = 0.005) with  $\alpha_3 = 1.84e-08$ . This is still a positive impact on stock prices similarly to the initial expectations. Low coefficient  $\alpha$  indicates that the shareholders do not focused on profits they are more interested in the amount of dividends paid to themselves. That amount can be paid in calculation of profits or profits from previous years. Previous research supported a positive correlation between price and profit retained also, the estimated coefficient is  $6.02e-17$ . Retained earnings affect on share prices although not significantly.

- Return on equity (ROE): with FEM model, estimated value are found to be -11.83, likewise in REM is -25.84, both models generate negative results. ROE is inversely related to the share price on the market. To explain, we can understand that the shareholder capital were not effectively used by business managers, the income is not as large as the investment amount and their initial expectations as well, thus this brings negative impact that caused fall in the stock price. Estimated coefficient  $\alpha_4$  of ROE in FEM model is not accepted by the excess of 10%, while REM shall be accepted at the 5% significance level. Negative correlation between stock prices and ROE are also found in previous studies, in that study ROE is statistically significant at 5% and the coefficient is -57.1983.

From these studies, it can be seen that dividend policy is one of the major factors affecting business value in the short term as well as long-term, and the way it impacts every business in every period is different.

## 5. CONCLUSION AND PETITION

### 5.1 Conclusion

This study was conducted to find out the impact of dividends paid on the stock price. Random samples were collected in 44 companies which were listed on HOSE, collecting period was from 2011 to 2015. Research methodology used is approach the data table, fixed effects model and random effects model were applied to measure the relationship between the dividend policy and stock prices. In addition, the researchers also used descriptive statistical methods to gather data and assess the situation, release overall comments about dividend policy which is being applied by listed companies.

With the goal of understanding the relationship between the dividend policy and stock prices, we use model with 5 independent variables, there are four significant variables directly affect share prices when research in HOSE stock market in 2011-2015: PAT, EPS, RR and SD. These variables have positive impacts on the stock price. In different period, the dividend policy will have different effects on prices, in 2011-2015, the impact of dividend policy on stock prices are positive impacts that mean to increase dividend payout ration then the stock price has also increased in the order at 1: 2.02.

### 5.2 Petition

- Firstly in terms of business: results showed that when the stock dividend rise 1, the share price will increase 2.02 that means investors who have high interest in dividends that are paid annually. Enterprises need a consistent dividend policy, if shares are broken down for many investors it can hold high dividend scales because tax policies will affect little to investors, vice versa, when businesses have fewer investors but they holds large quantities of shares, high dividends are not benefit because they incur a large amount of income.

- Secondly with regards to retained earnings ratio, there will have two different viewpoints of investors, First, business works ineffectively therefore the rate of retained earnings shall be high, this has negative impact on share prices.

Second, enterprises are looking to invest in increased efficiency as well as income. The impact on the stock price is good business impact then, thus there will have consideration before a decision on the rate retained earnings ratio of enterprise, because this is the capital shall be increased without causing a negative signal as well as other costs.

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## APPENDIX: MODELS IN ARTICLES

### 1. FEM model

```
. xtreg pi sdi rri epsi pati roei,fe
```

Fixed-effects (within) regression  
Group variable: **mcpl**

Number of obs = **218**  
Number of groups = **47**

R-sq: within = **0.1731**  
between = **0.5079**  
overall = **0.4037**

Obs per group: min = **1**  
avg = **4.6**  
max = **5**

corr(u\_i, Xb) = **0.3138**

F(5,166) = **6.95**  
Prob > F = **0.0000**

pi	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
sdi	2.021178	1.053714	1.92	0.057	-.0592313 4.101587
rri	.8499226	.4994786	1.70	0.091	-.1362268 1.836072
epsi	1.72e-06	7.33e-07	2.35	0.020	2.73e-07 3.17e-06
pati	1.84e-08	6.44e-09	2.86	0.005	5.72e-09 3.12e-08
roei	-11.83238	12.1324	-0.98	0.331	-35.78607 12.12131
_cons	14.42645	1.547471	9.32	0.000	11.37119 17.48171
sigma_u	11.041756				
sigma_e	9.7667127				
rho	.56104599	(fraction of variance due to u_i)			

F test that all u\_i=0: F(46, 166) = **4.07** Prob > F = **0.0000**

### 2. REM model

```
. xtreg pi sdi rri epsi pati roei,re
```

Random-effects GLS regression  
Group variable: **mcpl**

Number of obs = **218**  
Number of groups = **47**

R-sq: within = **0.1623**  
between = **0.6928**  
overall = **0.4974**

Obs per group: min = **1**  
avg = **4.6**  
max = **5**

Random effects u\_i ~ **Gaussian**  
corr(u\_i, X) = **0** (assumed)

wald chi2(5) = **117.41**  
Prob > chi2 = **0.0000**

pi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
sdi	3.616431	.9959451	3.63	0.000	1.664414 5.568447
rri	.9069028	.4931728	1.84	0.066	-.0596981 1.873504
epsi	3.54e-06	6.61e-07	5.35	0.000	2.24e-06 4.84e-06
pati	1.68e-08	3.47e-09	4.85	0.000	1.00e-08 2.36e-08
roei	-25.81708	11.46242	-2.25	0.024	-48.28302 -3.351144
_cons	10.63556	1.640811	6.48	0.000	7.419634 13.8515
sigma_u	5.7566914				
sigma_e	9.7667127				
rho	.25783838	(fraction of variance due to u_i)			

### 3. Hausman Accreditation

```
. hausman fe re
```

Note: the rank of the differenced variance matrix (3) does not equal the number of coefficients being tested (5); be sure this is what you expect, or there may be problems computing the test. Examine the output of your estimators for anything unexpected and possibly consider scaling your variables so that the coefficients are on a similar scale.

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
sdi	2.021178	3.616431	-1.595253	.3441036
rri	.8499226	.9069028	-.0569802	.0791165
epsi	1.72e-06	3.54e-06	-1.82e-06	3.15e-07
pati	1.84e-08	1.68e-08	1.62e-09	5.43e-09
roei	-11.83238	-25.81708	13.9847	3.975917

b = consistent under Ho and Ha; obtained from xtreg  
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\begin{aligned} \text{chi2}(3) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= \mathbf{21.22} \\ \text{Prob}>\text{chi2} &= \mathbf{0.0001} \\ (V_b-V_B \text{ is not positive definite}) \end{aligned}$$

#### 4. Correlation matrix between variables

```
. corr pi sdi rri epsi pati roei
(obs=218)
```

	pi	sdi	rri	epsi	pati	roei
pi	1.0000					
sdi	0.4772	1.0000				
rri	0.1651	0.0064	1.0000			
epsi	0.6071	0.5171	0.1251	1.0000		
pati	0.3411	0.0529	0.0776	0.1232	1.0000	
roei	0.4530	0.4166	0.0996	0.7871	0.2917	1.0000

#### 5. Statistics

```
. sum
```

variable	obs	Mean	Std. Dev.	Min	Max
mcp	0				
nam	220	2013	1.417439	2011	2015
pi	220	21.55682	17.65961	2.7	99.5
sdi	220	1.066499	.9657078	0	4.996518
rri	220	.2738875	1.670402	-18.83601	2.687275
epsi	220	2079191	2249798	-4884000	2.06e+07
pati	220	1.43e+08	3.23e+08	-5.19e+07	2.95e+09
roei	218	.1154155	.1240476	-.67	.9
mcp1	220	26	13.52826	1	48