DETERMINANTS OF BANK CREDIT RISK: EMPIRICAL EVIDENCE FROM JORDANIAN COMMERCIAL BANKS

Buthiena Kharabsheh, Yarmouk University

ABSTRACT

This study aimed to investigate the credit risk determinants in Jordanian banking sector. Both bank-specific variables and macro-economic variables were included in the analysis using a balanced panel dataset of all Jordanian commercial banks over the period 2000-2017. The findings revealed that, credit risk increased as bank capital ratio, operating inefficiency and the growth rate in credit increased. Whereas, larger and more profitable banks faced lower credit risk. However, no effect was found for bank liquidity. Further, the macroeconomic variables included indicated that as unemployment rate increased, credit risk significantly increased and similar positive effect was also documented for the crisis effect. Moreover, the results showed no significant impact for GDP growth or inflation. The outcome of this study provided evidence that credit risk was influenced by both internal and external factors and this was expected to have important implications for policy makers.

Keywords: Credit Risk, Non-Performing Loans, Jordan, Macro-Economic, Determinants.

JEL Classification: G21, G32

INTRODUCTION

The stability of financial sector is the backbone for any economic development in any country. The recent financial crisis has revealed the importance and the vital role of financial institutions and their major effect on the overall national economy. Despite the fundamental role of the banks, which cannot be ignored, banks face several types of risk that may arise from internal and external factors such as inefficient managers, poor regulation and poor economic conditions among others (Tehulu & Olana, 2014). Among these problems, credit risk is regarded as an important issue that may cause financial instability and threaten the survival of the business. This type of risk is inherent in the traditional function of banks, which is mainly based on granting credit. The interest on credit granted shapes the main bank's assets and represents significant portion of bank's income (Njanike, 2009; Rajha, 2016; Reed & Gill, 1989). However, the lending process requires several steps to ensure the borrowers will repay their outstanding loans, therefore it is not an easy task and not always fruitful as expected. Moreover, the lending process may result a serious problems particularly non-performing loans or as or is commonly known as credit risk (Uppal, 2009). Non-performing loans (NPLs) are known as bad debt where the borrowers are unable to make scheduled payments for a specific period, usually, when payments past due more than 90 days (Dimitrios et al., 2016).

Recently, Non-performing Loans has received more attention from academic, policy makers and practitioners, since the increasing rate of non-performing loans is cited among the main causes of financial crisis and collapse in financial institutions (Adebola et al., 2011; Barr & Siems, 1994). The Jordanian banking sector is considered the largest and the strongest sector in

the Jordanian economy. The banking sector, significantly in 2015 contributed about 18.82% of GDP, monitored and managed by the Central Bank of Jordan (CBJ). Notwithstanding the difficult conditions of regional wars and volatility, decrease in the GDP growth and increase in the burden of public debt, the Jordanian banking sector still stable, strong and viewed as an attractive investment opportunity. However, in the aftermath of the recent financial crisis, the banking sector was negatively affected and a noticeable increase in the non-performing loans was documented. The ratio of non-performing loans relative to the total credit provided has reached 6.5%, 8.2%, and 8.5% for the years 2009, 2010 and 2011 respectively (CBJ, 2017), (this page can be accessed by http://www.cbj.gov.jo/).

The main objective of this study was to examine the main determinants of credit risk in the Jordanian banking sector. This study investigated bank-specific variables such as bank profitability, liquidity, capital, size, growth rate in credit and operating inefficiency. Further, this study included several macro-economic variables like, Growth rate in GDP, inflation, unemployment and the effect of the recent financial crisis. The sample included a balanced panel dataset of all the Jordanian commercial banks over the period (2000-2017).

The importance of this study stems from different points. First, given the importance and high contribution of banking sector in the Jordanian economy, the need calls for more research on this important topic that might threat the stability of financial sector in Jordan. Moreover, the available evidence mainly comes from developed countries while the number of studies on credit risk determinants from emerging countries is still very limited. In addition, it is well documented that credit risk was higher in emerging economies than developed one (Zribi & Boujelbegrave, 2011). Second, the present study is expected to identify the main internal and external determinants of credit risk in light of the changing conditions that face the Jordanian economy, up-to-date data were used and included the effect of the most influential crisis i.e., the recent financial crisis 2007-2009.

The reminder of this paper is structured as follows. Following this introduction, section two provides literature review and hypotheses development. Section 3 presents data and methodology. The main results and discussions are presented in section 4 and the final section concludes the study.

LITERATURE REVIEW

Prior literature had distinguished between two kinds of factors that may influence credit risk. The first one is related to the bank specific variables, which is also known as internal factors. The second type is related to the macro variables or what is known as external factors. Several prior studies examine different bank specific variables and provide mixed findings. Bank size, profitability, capital ratio, Inefficiency, bank liquidity and growth in credit among others. Tehulu & Olana (2014) employed a balanced panel dataset from Ethiopian Banking sector over the period 2007 to 2011. Using the GLS estimation method, the results indicated that larger banks and higher growth rate in credit lower credit risk, while operating inefficiency and ownership positively increased credit risk. The study found insignificant effect for profitability, capital adequacy and bank liquidity. Consistent evidence is provided by Andriani & Wiryono (2015) who used a sample from Indonesian banking sector during 2002 to 2013. Waqas et al. (2017) examined the credit risk determinants using a sample from three different countries namely Pakistan, India, and Bangladesh over the period 2000-2015. The findings confirmed that inefficiency, profitability, capital ratio and leverage were all significant determinants of credit risk. Recently, Zheng et al. (2018) found that bank profitability, size and capital ratio are

negatively related to the non-performing loan. However, net interest margin and operating inefficiency were positively associated with non-performing loans.

Salas & Saurina (2002); Megginson (2005); Hu et al. (2006) and Tehulu & Olana (2014) among others reported negative relationship between bank size and bank credit risk. These studies argued that larger banks were more able to diversify and accordingly carry lower risk. However, De Nicolo (2001) and Rajan & Dhal (2003) found positive association between bank size and credit risk and explained that larger banks may have higher credit risk as a result of lower control. Profitability was another important factor that is expected to determine bank credit risk. Bank profit was seen as a reflection of management quality and shareholder behaviour. Louzis et al. (2012) and Chaibi & Ftiti (2015) documented a negative relationship between profitability and non-performing loans. These studies attributed the negative effect to the bad quality of management.

Another factor included in several studies was capital ratio, since banks with lower capital ratio had higher probability of default (Waqas et al., 2017). Under the moral hazard hypothesis, a negative relationship was expected between capital ratio and credit risk. Low capital ratios may lead banks to take more risk in their loan portfolio as a response to the moral hazard incentives (Berger & DeYoung, 1997; Katuka, 2017). Empirically, Hussain & Hassan (2005) and Godlewski (2004) among others reported negative relationship between capital ratio and credit risk. Growth rate in credit was also cited among the determinants of credit risk. High growth rate in loans can be viewed as a negative signal and a contributing factor of credit risk result in higher losses (Das & Ghosh, 2007; Hess et al., 2009). Vogiazas & Nikolaidou (2011) employed monthly data from Bulgarian banking sector over the period 2001 to 2010 and found that higher loan growth led to higher credit risk. Operating efficiency was an important determinant of credit risk under the bad management hypothesis. Inefficient managers negatively affected the process of granting and monitoring loans, which resulted in bad quality credit and led to higher probability of credit risk (Berger & DeYoung, 1997; Podpiera & Weill, 2008). Supporting empirical evidence on this negative association, was provided, among others, by Salas and Saurina (2002) for Spanish banks. Liquidity ratio may also determines bank's credit risk. As liquidity increased this mean lower amount of credit is granted and as a result, the probability of credit risk decreased (Tehulu & Olana, 2014).

Another line of research focused on the external determinants of credit risk by investigating several macroeconomic variables like inflation, unemployment, GDP growth among others. With respect to the effect of inflation on credit risk, prior literature provided mixed result since the effect was unclear. From one side, an increased inflation rate may lower real value of funds borrowed thus facilitating servicing the debt, while on the other, higher inflation rates lower the real value of income, which in turn negatively affected borrower repayment capacity (Castro, 2013). Another important determinant was the unemployment level where the effect was expected to be positive, since a high level of unemployment meant a decrease in client cash flow, which affected their repayment capacity. The growth rate in real gross domestic product (GDP) was another fundamental variable that may have had an effect on credit risk. During economic expansion, non-performing loans were expected to decrease due to cash flow availability whereas the opposite was expected during periods of recession.

Aver (2008) provided evidence from Slovenian banking sector over the period 1995-2002 that credit risk was highly and significantly influenced by macro-economic factors. The findings revealed that interest rate, unemployment and the stock index value were important determinants of credit risk. Consistent findings were also reported by Castro (2013); Poudel

(2013); Chaibi & Ftiti (2015). Castro (2013), drew his study sample from five countries i.e. Greece, Ireland, Portugal, Spain and Italy, over the period 1997 to 2011, and his findings emphasized the importance of macro-economic variables in determining credit risk. More specifically, GDP growth and the share price indices were negatively related to credit risk, while unemployment rate, interest rate, real exchange rate, and credit growth had positive effects. Recently, Katuka (2017), proposed that credit risk was more often explained by macro-economic variables than by bank specific variables. The study used different estimation methods such as OLS, fixed and random effect and dynamic estimator to analyse a sample from the local listed banks in Zimbabwe during the period 2009-2013. Castro (2013) and Rajha (2016) documented a positive influence of the recent financial crisis on credit risk, both studies found that credit risk significantly increased during the crisis period.

DATA AND METHODOLOGY

Initially, the sample for the present study included all the banks operating in Jordan, a total of 25 banks according to the latest data published by the Central Bank of Jordan, however, Islamic and foreign banks were subsequently excluded since Islamic banks followed different procedures and principles in conducting their operations, which made comparison with conventional commercial banks a difficult task. Foreign banks were merely representative offices and provided only around 6.8% of total credit facilities in Jordan. As a result, the final sample included 13 Jordanian commercial banks over the period 2000-2017. Firm specific variables were collected from annual reports of the commercial banks besides the data available on the website of Amman Stock Exchange. Macroeconomic variables such as inflation, GDP and unemployment rate were gathered from the World Bank website.

Dependent Variable

Consistent with several prior studies credit risk was measured using the ratio of the non-performing loans for a certain year divided by the total loans in that year. This measure is line with prior literature see for example, Waqas et al. (2017) and Zheng et al. (2018).

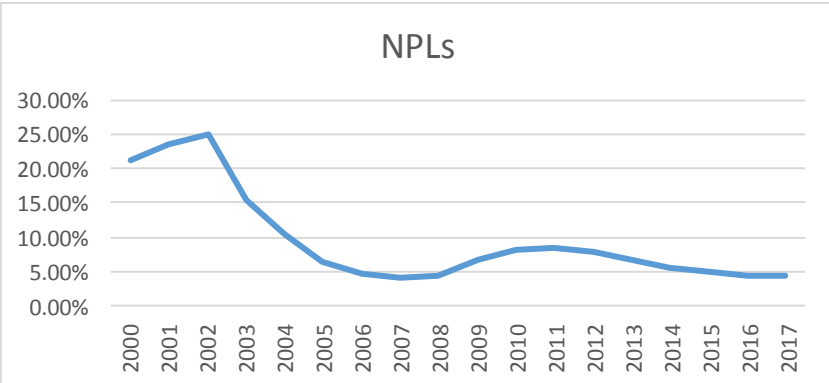

FIGURE 1
ANNUAL RATIOS OF NON-PERFORMING LOANS

According to Figure 1 and Table 1 the ratio of non-performing loans clearly started to decline in the year 2004 and this trend continued until it reached its lowest level in 2007. This decrease can be attributed to several reasons such as the economic recovery during that period, which positively affected the repayment capacity of Jordanian borrowers. In addition, Jordanian banks write-off the non-performing loans for all clients who provided full collateral (Rajha, 2016). Moreover, the numbers showed an increase in the ratio of non-performing loans from 2008 until 2012, possibly as a result of the recent financial crisis, and then began decreasing, reaching 4.2% in 2017.

Table 1
NON- PERFORMING LOANS FOR THE JORDANIAN COMMERCIAL BANKS YEAR BY YEAR

Year	Mean of NPLs
2000	21.3%
2001	23.6%
2002	25.1%
2003	15.5%
2004	10.5%
2005	6.5%
2006	4.5%
2007	4.1%
2008	4.2%
2009	6.7 %
2010	8.2%
2011	8.5%
2012	7.7%
2013	6.8%
2014	5.6%
2015	4.9%
2016	4.3%
2017	4.2%

Independent Variables

The independent variables in this study were divided into bank specific variables and macroeconomic variables. The bank specific variables were selected based on the prior literature where the most cited variables that have an effect on non-performing loans were employed. The first variable was bank profitability, which was measured as return on assets by taking the percentage of net profit after tax to total assets. Bank liquidity was measured as total loans divided by total deposits. Capital Ratio was measured as total equity to total assets. Bank Size was measured as natural logarithm of total assets. Operating Inefficiency was measured as total operating expense divided by total assets. Growth rate in loans was measured as the difference between current year loans and previous year loans divided by previous year loans. This study also controlled for several macroeconomic variables such as GDP growth measured as the percentage change in real gross domestic products. Inflation rate measured as the yearly inflation rate. Unemployment Rate as provided by the World Bank database. Financial crisis following Castro (2012), this study controlled for the recent financial crisis using a dummy variable equal to 1 from 2008 onwards and zero otherwise. All these variables definitions and measurements were in line with prior literature see for example, Tehulu and Olana (2014),

Waqas et al. (2017); Katuka (2017) and Zheng et al. (2018). Table (2) provides a full summary for all the variables employed in this study.

Table 2
VARIABLES' DEFINITIONS AND MEASUREMENT

Variable	Definition
Dependent Variable	
Credit Risk (CR)	The ratio of the non-performing loans for a certain year divided by the total loans in that year.
Independent Variables	
Micro Variables	
Bank Profitability(BP)	Measured as return on assets by taking the percentage of net profit after tax to total assets.
Bank liquidity (BL)	Measured as total loans divided by total deposits.
Capital Ratio (CR)	Measured as total equity to total assets
Bank Size (BS)	Measured as natural logarithm of total assets.
Operating Inefficiency (OI)	Measured as total operating expense divided by total assets.
Growth rate in loans (GL)	Measured as the difference between current year loans and previous year loans divided by previous year loans.
Macro Variables	
GDP growth (GDP)	Measured as the percentage change in real gross domestic products
Inflation rate (INF)	Measured as the yearly inflation rate
Unemployment Rate (UNR)	The annual unemployment rate
Financial crisis (FC)	Dummy variable takes 1 for crisis period and zero otherwise.

Regression Model

Following Poudel (2013) and Katuka (2017), this study employed the following regression model to examine the micro and macro determinants of credit risk.

$$CR_{it} = \alpha_0 + \beta_1 BP_{it} + \beta_2 BL_{it} + \beta_3 CR_{it} + \beta_4 BS_{it} + \beta_5 OI_{it} + \beta_6 GL_{it} + \beta_7 GDP_{it} + \beta_8 INF_{it} + \beta_9 UNR_{it} + \beta_{10} FC_{it} + \varepsilon_{it} \quad (1)$$

To provide complete analysis, this study employed three different estimation methods namely, pooled OLS, and fixed effect and GLS random effect models. It is worth to note that several tests were conducted to check for different problem that might exists in the dataset as follows.

Multicollinearity test, high correlation between independent variables may lead to inconsistent results. This study used two tests to detect multicollinearity problem namely correlation between independent variables and Variance Inflation Factor (VIF). Table 3 presented the correlation between the independent variables. It is clear that the dataset is free from multicollinearity problem since it is argued that if the correlation between any two variables exceed 80% then multicollinearity problem exists (Gujarati, 2004). Table 4 confirmed that the dataset was free from multicollinearity problem since it was assumed that the problem appeared when VIF exceeded 10, however, the average of VIF for all the variables included in the analysis was 1.76.

Table 3
CORRELATION MATRIX

	BP	BL	CR	BS	GL	GDP	INF	UNR	OI
BP	1								
BL	0.065	1							
CR	0.497	0.098	1						
BS	0.027	-0.165	0.084	1					
GL	0.030	0.156	-0.018	0.044	1				
GDP	-0.206	0.039	0.060	-0.179	-0.07	1			
INF	-0.123	0.001	0.013	-0.074	-0.01	0.41	1		
UNR	-0.108	0.112	0.228	-0.210	-0.127	0.50	0.31	1	
OI	-0.078	0.045	-0.033	-0.082	0.059	0.014	0.21	0.011	1

In order to choose between random effect and fixed effect models, Hausman test was conducted and the test result favoured the use of random effect where the p-value was 0.783. Further, Breusch and Pagan LM test was conducted to select between pooled OLS and random effect model. The results of Breusch and Pagan LM test suggested using random effect model (The results of both tests are reported in the Appendices A and B). In the main analysis in the following sections, the results were presented under pooled OLS, random effect and fixed effect models.

Table 4
VARIANCE INFLATION FACTOR

Variable	VIF	1/VIF
BP	3.31	0.30
BL	1.06	0.94
CR	3.41	0.29
BS	1.19	0.84
GL	1.06	0.94
GDP	1.41	0.70
INF	1.24	0.80
UNR	1.42	0.70
Average	**1.76**	**0.69**

Descriptive Statistics

Table 5 presented the descriptive statistics for all the variables included in the analysis. On average, the sampled bank value was 12% as non-performing loans relative to the total loans with a maximum value of 1.3. The average of return on assets for Jordanian banks during the study period was around 2% and the values ranged from a minimum of -5.6% to a maximum value of 5.9%. From Table 5, it is seen that liquidity ratio was high for the Jordanian banks with an average of 58% and a maximum value of 93%. The average value (standard deviation) for capital ratio, bank size, growth rate in credit, and operating inefficiency was 13.2% (8.9%), 20.9 (1.24), 15% (1.10), 45% (29%) respectively. These figures were consistent with recent Jordanian studies see for example, Rabab'ah (2015) and Rajha (2016).

Table 5
DESCRIPTIVE STATISTICS FOR FULL PERIOD

Variable	Average	SDEV	MIN	MAX
CR	0.121	0.158	0.002	1.300

Table 5 DESCRIPTIVE STATISTICS FOR FULL PERIOD				
BP	0.015	0.012	-0.056	0.059
BL	0.584	0.107	0.046	0.932
CR	0.132	0.089	-0.331	0.473
BS	20.943	1.248	17.793	24.027
GL	0.150	1.104	-0.924	12.036
OI	0.45	0.29	0.11	3.24
GDP	0.081	0.201	-0.686	0.284
INF	0.046	0.044	-0.009	0.149
UNR	0.136	0.011	0.119	0.153

EMPIRICAL RESULTS

Table 6 presented the empirical results for model 1 which examined the micro and macro determinants of credit risk on the Jordanian commercial banks. In table 6, the results were presented under pooled OLS, Fixed Effect and Random Effect and it was evident that the results were similar, consistent and robust under the three estimation methods. Bank profitability was highly negatively significant under the three estimation methods at 1% significance level, this negative relationship implied that as bank profit increased, the credit risk decreased.

Furthermore, this negative association between profitability and credit risk was expected because profitability reflected management quality, efficiency and risk management skills. Thus high profitable banks were expected to have lower credit risk and this result was consistent with, Kwan & Eisenbeis (1997); Lin et al. (2005); Louzis et al. (2012); Chaibi & Ftiti (2015); Tehulu & Olana (2014) and Zheng et al. (2018) who reported similar findings.

Table 6 showed that bank liquidity had no effect on credit risk since the coefficients were insignificant under the three estimation methods. Bank capital ratio was a positive and significant determinant of credit risk where the coefficients were positive and significant at (10%) and (1%) under fixed effect and random effect respectively. This positive relationship was contrary to our expectation as it was expected that banks with low capital were motivated to take more risk and therefore should have higher credit risk. However, the positive finding in this study was consistent with several prior studies such as Rime (2001); Lin et al. (2005); Altunbas et al. (2007) and Constant & Ngomsi (2012). The results also showed that as bank size increased this negatively and significantly lowered credit risk. This negative effect revealed that larger banks had greater ability to diversify and superior risk management approaches that led to lower credit risk. This negative finding was consistent with several prior studies such as, Salas and Saurina (2002); Megginson (2005); Hu et al. (2006) and Tehulu & Olana (2014).

Table 6 REGRESSION RESULT FOR MODEL (1)			
Variable	Pooled OLS	Fixed Effect	GLS Random Effect
Constant	0.003*** (0.000)	1.990** (0.021)	1.342*** (0.000)
BP	-0.103*** (0.001)	-0.115*** (0.000)	-0.109*** (0.000)
BL	0.041 (0.542)	-0.013 (0.861)	0.003 (0.996)
CR	0.511 (0.158)	0.633* (0.088)	0.585*** (0.000)
BS	-0.040***	-0.089**	-0.056***

Table 6 REGRESSION RESULT FOR MODEL (1)			
	(0.000)	(0.036)	(0.000)
GL	0.007* (0.055)	0.005** (0.041)	0.004* (0.082)
OI	0.371*** (0.001)	0.322*** (0.000)	0.365*** (0.006)
GDP	0.003 (0.920)	0.006 (0.715)	-0.055 (0.497)
INF	-0.105 (0.683)	-0.092 (0.546)	0.092 (0.720)
UNR	0.952*** (0.001)	0.621** (0.011)	0.811** (0.024)
FC	0.312*** (0.000)	0.251*** (0.001)	0.219*** (0.005)
Prob>F	0.000***	0.000***	0.000***
N	234	234	234
R^2	49%	43%	47%
This table presented the results for model (1) that examines the micro and macro determinants of credit risk for the full period (2000-2017). All t-statistics were based on robust standard errors. ***;**;* represent significance at the 1%, 5% and 10% level. Table 1 provided definitions and measurements of all the variables used in the analysis.			

Consistent with the literature, credit growth rate appeared to be a contributory factor to the increase in bank credit risk, and can be explained as banks with higher growth in credit had higher losses. Moreover the literature indicated that higher growth in credit was viewed as a negative signal of bank health. This finding was consistent with Das & Ghosh (2007); Hess et al. (2009) and Vogiazas and Nikolaidou (2011). As expected, operating inefficiency positively and significantly determined bank credit risk. This positive association can be explained within the context of the bad management hypothesis, since the process of granting and monitoring credit was negatively affected by inefficient managers. Prior studies reported similar positive findings between operating inefficiency and credit risk, see for example, Salas and Saurina (2002); Louzis et al. (2012); Abid et al. (2014) and Chaibi & Ftiti (2015).

Regarding the macro-economic variables, the results indicated that both the growth rate in GDP and inflation rate had no effect on bank credit risk. However, a strong positive significant relationship was detected between unemployment level and credit risk. This positive effect indicated that as the unemployment rate increased, by default the repayment capacity would negatively decrease and accordingly the credit risk would increase. According to Waqas et al. (2017), the positive impact of unemployment on credit risk was strongly expected and could be viewed from two sides: higher unemployment rate diminished cash flow and also decreased production and processing of goods and services; As a result, it was expected that the repayment capacity for borrowers would be negatively affected. Consistent positive evidence was reported by Klein (2013) and Chaibi & Ftiti (2015). Finally, the coefficients on the dummy variable that control for the financial crisis were positive and highly significant under the three estimation methods. The positive effect revealed that this economic shock led to the collapse of several financial institutions around the world. In addition, the fact that the negative effect was evident not only on the financial sector but also on all other sectors, significantly increased credit risk. This result was consistent with Castro (2013) and Rajha (2016).

CONCLUSION

This study examined the main determinants of bank credit risk using a sample of Jordanian commercial banks over the period 2000-2017. Both bank-specific variables and macro-economic variables were included in the analysis to identify the most important determinants that affect bank credit risk. Overall results of this paper revealed that the default failures in the Jordanian commercial banks were attributed to both internal and external factors. With respect to the bank-specific variables, the findings showed that more profitable and larger banks had lower credit risk. However, operating inefficiency, growth rate in credit and capital ratio were the main internal determinants that significantly increase credit risk in the Jordanian commercial banks. These findings give an important signal to the regulatory authority, bank managers and even shareholders. Bank-specific factors are controllable and thus can be managed to avoid default failures, so an important implication for the regulatory authority and decision makers is the need to boost adequate control measures in order to avoid such losses from non-performing loans. Furthermore, the focus should also be on managerial behaviour by enacting sound corporate governance practises to maintain the stability of the financial sector.

With regard to the macro-economic variables, the results indicated that the unemployment rate was the main variable that positively increased credit risk, since a high unemployment rate weakened borrowers' ability to repay their outstanding loans due to interrupted cash flow. Accordingly, decision-makers should adopt a macroeconomic policy that stimulated employment and boosted economic growth in order to safeguard bank assets and thereby reduce credit risk.

APPENDICES

Appendix A **HAUSMAN TEST FOR SELECTING FIXED EFFECTS MODEL OR RANDOM EFFECTS MODEL**
H0: Random effect is more appropriate
chi2 (8)=(b-B)'[(V_b-V_B) ^ (-1)](b-B)=6.89
Prob>chi2= 0.783
(V_b-V_B is not positive definite)
Based on the results above, the null hypothesis is accepted. Therefore, Random effect model is more appropriate.

Appendix B **BREUSCH AND PAGAN LAGRANGIAN MULTIPLIER TEST FOR SELECTING BETWEEN POOLED OLS MODEL OR RANDOM EFFECT MODEL**		
H0: Pooled OLS is more appropriate		
	Var	sd=sqrt(Var)
CR	0.0249971	0.1581046
e	0.0110037	0.1048986
u	0.0050088	0.0707731
Test: Var(u)=0		
chibar2(01)=90.06 Prob >chibar2=0.0000		
Based on the results above, the null hypothesis is rejected. Therefore, Random effect model is more appropriate.		

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