Arslan, İlker

Working Paper
Does size of banks really matter? Evidence from CDS market data

Working Papers in Economics, No. 10/08

Provided in Cooperation with:
Department of Economics, Izmir University of Economics

Suggested Citation: Arslan, İlker (2010) : Does size of banks really matter? Evidence from CDS market data, Working Papers in Economics, No. 10/08, Izmir University of Economics, Department of Economics, Izmir

This Version is available at:
http://hdl.handle.net/10419/175917

Terms of use:
Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.
Working Papers in Economics

Does Size of Banks Really Matter?
Evidence from CDS Market Data

İlker Arslan, İzmir University of Economics

Working Paper No.10/08
December 2010

İzmir University of Economics
Department of Economics
Sakarya Cad. No: 156
35330, Balçova İzmir
TURKEY
Does Size of Banks Really Matter?
Evidence from CDS Market Data

Abstract
In this study we try to find that whether markets take into account the phenomenon of Too Big to Fail. With the help of CDS market data, which reflects the risk, markets attribute on banks, we calculate the default probabilities of banks in one, two, and three years. Then we regress these results with financial values like total assets, total shareholders’ equity and net income. Later on we extend our study and repeat our regression analysis using Return on Assets as dependent variable. We find that markets give more importance to profitability of a bank than its size when pricing the riskiness of the bank. We conclude that Too Big to Fail is not a valid term as thought but may be Too Profitable to Fail may be better.

Keywords: Banking, Too Big to Fail, CDS Market
JEL Classifications: G21, G28

İlker Arslan
Department of Economics
İzmir University of Economics
İzmir, Turkey
e-mail: ilker.arslan@std.ieu.du.tr
## Contents

1 Introduction ......................................................................................................................... 4  
2 Literature Review ............................................................................................................... 5  
3 Methodology ......................................................................................................................... 6  
4 Data and Results ..................................................................................................................... 8  
   4. a. Default Probability Trends............................................................................................... 9  
   4. b. Regression Results........................................................................................................ 13  
5 Conclusion .............................................................................................................................. 16  
Bibliography ............................................................................................................................ 17  
APPENDIX .............................................................................................................................. 19
1 Introduction

“Too Big to Fail” is a well known phenomenon which is widely used even by people who are not well-informed in economics and banking. On the other hand the subject is a matter of debate among academicians. Is it really true that a bank that is huge in size must be rescued from bankruptcy? Is it good for the economy as a whole? What is the criterion that makes a bank too big to fail? Do markets really care about this phenomenon in pricing the banks? Why policy makers rely on Too Big to Fail policies so much? Although many people investigate about the subject there are still many questions waiting to be answered?

Bailout of a large bank by a government as seen frequently in the large financial turmoil of 2008 is called as “Too Big to Fail (TBTF)” policy. People who support TBTF policies say that, by rescuing large banks from bankruptcy, impacts of the failure on other institutions or on real economy is eliminated. On the other hand, people who oppose TBTF policies argue that, these policies seem attractive in the short run in spite of the large financial costs to governments; but in the long run the costs are even larger.

Shull (2010), takes the history of TBTF back to the 10th century Abbasid Caliphate and mentions about Jewish Bankers that are protected by the state, or about Bank of England that’s rescued from a run in 1696, in his comprehensive and illuminating study. So we can say that the subject is not new and can be an interesting area for economic historians but the history of TBTF is out of this papers scope.

The phenomenon of “Too Big to Fail” has been one of the most important issues of discussion for the last 25-30 years. The 1960s and 1970s were a transition period in banking from a highly regulated system established in 1930s to a relatively deregulated system. In the course of the transition, bank failures increased (Shull, 2010). Although it is known that in 1931 German government rescued four large banks, which were having difficulties, from bankruptcy; the time when TBTF discussions increased was in 1984, when seventh largest bank of USA, Continental Illinois, came near bankruptcy and Federal Deposit Insurance Corporation (FDIC), gave 100% guarantee for the deposits and bonds of the bank. At the beginning, after the case of Continental Illinois, it was accepted that the largest ten banks would not be allowed for bankruptcy. Later on the number increased to eleven. However, the number of banks that were included in TBTF policy increased implicitly in following years. The issue of TBTF was regulated with Federal Insurance Corporation Improvement Act (FICIA) (1991), and National Depositor Preference Law (1993) in USA.
As one might expect, research about TBTF is abundant. Especially with the recent global economic crisis, the issue became hot again. Debate over the TBTF policies mounted. In March 2010, Federal Reserve Chairman Ben Bernanke claimed TBTF was a pernicious problem. Bernanke also added, regulators had to be significantly tougher on large and complex financial firms to limit wider risks. He said TBTF to be among the most insidious problems that make barriers to competition in financial markets.

It is a matter of discussion why governments need TBTF policies or generally why TBTF phenomenon is needed in a so-called free market world. In our study we will investigate whether markets really value TBTF while pricing riskiness of banks.

2 Literature Review

One of the studies that support TBTF, is Todd & Thomson’s (1990) which argues that, high levels of interbank exposure reduce safety and soundness of the banking system; interbank exposure affects the ability of the FDIC and bank regulators to use market discipline as a constraint on banks’ risk taking, and a rising level of interbank exposure is indicative of reduced stability of the financial system.

On the other hand, Ohara & Shaw (1990) argue that TBTF policies create inequalities among banks. According to them the selective policy of charging the same insurance premium to institutions but providing some with greater coverage, imposes unnecessary costs on the market. They also conclude setting and telling the policy to the market in an understandable way is very important to get the intended result.

Some authors like Soussa (2000), Rime (2005), and Hughes & Mester (1993) claim that banks that are TBTF get favorable ratings and credit spreads. Some other authors on the other hand, argue that TBTF policies allow large banks grow more than optimal. Kane (2000) and Penas & Unal (2004) are among those authors. Similarly, Boyd & Gertler (1993) argues that TBTF policies encourage banks to take excessive risks. On the other hand some other authors do not accept this argument. For example, Demsetz & Strahan (1997) and Soussa (2000) argue large banks do not have excessive risks.

As told before discussions about TBTF increased very much after the latest financial and economic crisis. But, actually before that, Stern and Feldman (2004) claimed that TBTF problem had increased. However, later on Mishkin (2006) refused this idea and claimed TBTF problem had been reduced with the help of FDICIA.
In latest years empirical studies about TBTF have increased. Brewer and Jagtiani (2009) try to estimate the value of being TBTF. Using data from the merger boom of 1991-2004, they find that organizations are willing to pay an added premium to reach an asset size of TBTF. According to their estimations the added premiums for the eight mergers which increased the asset size of organizations over $100 million was $14 million.

Zhou (2009) examines relationship between three measures on systematic importance and size for the bank. He concludes that TBTF argument is not always valid, and alternative measures on systematic importance should be considered.

Shull (2010) argues that, it is risky to have a relatively few large banking institutions in which a large proportion of financial resources are concentrated. In that case, Shull says, each bank, by virtue of its absolute and relative size, would be system threatening in failure, each would unavoidably exercise powerful influence over regulatory authorities, and each would likely be viewed as an irreplaceable national resource. Shull claims that limiting further growth through restrictions on specific activities, revisions of bank merger policy, and possibly divestiture to reduce concentration can reduce the TBTF problems.

Goodlet (2010) is also one of the people who argue that long run costs of TBTF policies are much greater than short run benefits. Goodlet also claims that the reason of Lehman’s bankruptcy in 2008 was that, no one was expecting such a thing after the bailout of Bear Sterns. He adds that the important thing is not rescuing or letting a bank fail but managing the expectations about failures in a consistent and coordinated manner.

3 Methodology

In our study we will focus on the question whether markets price “too big to fail” phenomenon? Or put in other words, do markets care about size of a bank while pricing it? We will use CDS data of international banks and compute their default probabilities with the help of this data. Then we will regress default probabilities of banks with their financial values like total assets, total shareholders’ equity, net income and ROA.

To compute the default probabilities of banks, we will apply the methodology of Ranciere (2001). In this study Ranciere used CDS spreads of Argentina and Brazil to obtain default probabilities of these countries. In our study we will use the same methodology to compute default probabilities of the banks analyzed.
The variables that will be used in the study are:

- DS\(_{t,t'}\) : Default spread between \(t\) and \(t'\)
- R\(_{t,t'}\) : Risk free rate between \(t\) and \(t'\)
- P\(_{s,t}\) : Default probability between \(t\) and \(t+6\) months conditional on no default before \(t\)
- P\(_{t}\) : Default probability between \(t\) and \(t+1\) conditional on no default before \(t\)
- S\(_t\) : Survival probability of an obligation at time \(t\)
- D\(_t\) : Cumulative default probability of an obligation at time \(t\)
- H\(_t\) : Probability of a default between \(t\) and \(t+1\)
- R : The recovery rate

With indicative levels for annualized default spread with a maturity of 1, 2 and 3 years, the no arbitrage condition may be applied iteratively to extract one year forward default spreads in years 1, 2, and 3:

\[
(1 + R_{1,2} + DS_{1,2}) = \frac{(1 + R_{0,2} + DS_{0,2})^2}{(1 + R_{0,2} + DS_{0,2})}
\]

\[
(1 + R_{2,3} + DS_{2,3}) = \frac{(1 + R_{0,3} + DS_{0,3})^3}{(1 + R_{0,1} + DS_{0,1})(1 + R_{1,2} + DS_{1,2})}
\]

Similarly, risk free rates R\(_{1,2}\) and R\(_{2,3}\) are calculated as:

\[
(1 + R_{1,2}) = \frac{(1 + R_{0,2})^2}{(1 + R_{0,1})}
\]

and

\[
(1 + R_{2,3}) = \frac{(1 + R_{0,3})^3}{(1 + R_{0,1})(1 + R_{1,2})}
\]

Having extracted the forward default term structure, we can simply treat each interval of one year independently. The forward spread then reflects the conditional risk of default for the given period. Recalling that the default premium paid every 6 months covers the expected cost of default for the given 6-month period, we apply the risk neutral valuation principal to obtain the conditional 6-month default probability P\(_{s,t}\):
Knowing that no default over one year is equivalent to no default in any of the two 6-months period, we obtained the annualized probability of default as \( P_t = 1 - (1 - P_{S_t})^2 \).

Having derived for each yearly period the conditional default probability, we can then simply compute:

- The survival probability: \( S_t = (1-P_0)(1-P_1)...(1-P_t) \)
- The cumulative default probability: \( D_t = 1 - S_t \)
- The probability of a default between \( t \) and \( t+1 \): \((1-P_0)(1-P_1)...(1-P_{t-1})P_t\)

After obtaining default probabilities for banks we will analyze whether there is consistency between bank size and default probability. To do this we have obtained total assets, total shareholders’ equity, and net income data. Banks publish their financial tables quarterly so our regression panel data is also quarterly. We will regress these values with the default probabilities by ordinary least squares method and investigate whether there is a relationship between default probability of a bank estimated by using CDS data and size of it.

To extend our study we have done the regression and used Return on Assets (ROA) which is calculated as “Net Income/Total Assets” as dependent variable. In this way we will investigate whether profitability is related with banks’ default probability.

### 4 Data and Results

We have used CDS data of 22 banks from different countries for the period 14.08.2008 – 12.09.2010. The list of banks is given below. And for risk free rate we have used two sets of data. For the banks that have USD denominated CDS, we have used US Treasury Bond rates as risk free rate and German Treasury Bonds for the banks that have EUR denominated CDS.
Credit Suisse Group AG  
Deutsche Bank AG  
HSBC Bank PLC  
ING Bank NV  
Lloyds TSB Bank PLC  
Royal Bank of Scotland PLC/The  
SocieteGenerale  
UBS AG  
UniCreditSpA  
American Express Co  
Bank of America Corp  
Citigroup Inc  
Goldman Sachs Group Inc  
JPMorgan Chase & Co  
Morgan Stanley  
Wells Fargo & Co

4. a. Default Probability Trends

In the first part of our study we have analyzed default rate trends especially to see whether they are realistic. Here we give the default rate trends for zero recovery rates. To keep graphs as clear as possible, we separate US and European banks. In the tables it is obviously seen that calculated default probabilities of banks move in a realistic manner. Default rates of American Banks increase suddenly after collapse of Lehman brothers in 15.09.2008. Default rates of US banks relatively converge in time. The periods when default probabilities of for instance Morgan Stanley and Citi Group reach a top, overlap with the periods that bad news and rumors about those banks were frequent. Similar observation can be done in European banks too. For example default rates of BBVA and Santander increases very much in 2010 when concerns about Spanish economy increase.

We can also see that default rates of US banks converge in time but European banks show less homogeneity and less convergent trends. This is because unlike US banks they belong to different countries and reflect economic conditions of their home countries.
Figure 1: 1 Year Default Probability Trends for European Banks

Figure 2: 1 Year Default Probability Trends for US Banks
Figure 3: 2 Year Default Probability Trends for European Banks

Figure 4: 2 Year Default Probability Trends for US Banks
Figure 5: 3 Year Default Probability Trends for European Banks

Figure 6: 3 Year Default Probability Trends for US Banks

* The vertical and horizontal lines in figures 4, 5, and 6 are because of missing data.
4. b. Regression Results

In the second part of our analysis we will regress the default rates calculated in the previous section and regress them with financial data that reflects size. The financial data included is total assets, total shareholders’ equity and net income. American Express is not included in this part as we could not reach financial data of that bank.

As a correlation value of 0.41 is calculated between the data of total assets and total shareholders’ equity and correlation of 0.16 between total shareholders’ equity and net income we did not place total shareholders’ equity data with the other two in the same regression. Correlation between total assets and net income is 0.08.

Our regression results are given in the table below. The detailed results are given in the appendix. In the tables dependent variables are coded this way: Dt is cumulative default probability of an obligation at time t, the last two digits symbolize recovery rate, i.e. D100 means default probability in 1 year with zero recovery rates. And, independent variables are:

ASSET: Total Assets,

EQ: Total Shareholders’ Equity,

NI: Net Income.

All three financial values are in billion USD.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>D100</td>
<td>C</td>
<td>1.575413</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>ASSET</td>
<td>-0.000192</td>
<td>0.1954</td>
</tr>
<tr>
<td>D100</td>
<td>C</td>
<td>1.122335</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>EQ</td>
<td>0.001636</td>
<td>0.4178</td>
</tr>
<tr>
<td>D100</td>
<td>C</td>
<td>1.342073</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>NI</td>
<td>-0.021660</td>
<td>0.0812</td>
</tr>
<tr>
<td>D200</td>
<td>C</td>
<td>3.292400</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>ASSET</td>
<td>-0.000424</td>
<td>0.1019</td>
</tr>
<tr>
<td>D200</td>
<td>C</td>
<td>2.264415</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>EQ</td>
<td>0.002633</td>
<td>0.4576</td>
</tr>
<tr>
<td>D200</td>
<td>C</td>
<td>2.735958</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>NI</td>
<td>-0.039645</td>
<td>0.0656</td>
</tr>
<tr>
<td>D300</td>
<td>C</td>
<td>4.568599</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>ASSET</td>
<td>-0.000413</td>
<td>0.2321</td>
</tr>
<tr>
<td>D300</td>
<td>C</td>
<td>3.547881</td>
<td>0.0000</td>
</tr>
</tbody>
</table>
In the table it is seen that there default probability does not have a significant relationship with either total assets or total shareholders’ equity. But there is a negative relationship between default probability and net income with 10% significance level.

In the second part of our study we regress default probability with total assets and net income together.
In this part we can again claim that there is a significant relationship between default probability and net income but we cannot say the same for total assets. Only in the case of D300 the significance is slightly bigger than 10% but that can be disregarded.

Next, we calculate ROA (Return on Assets) values which is equal to “Net Income/Total Assets”:

Although in this part significance levels are slightly more than 10% except in the case of D225 we can still say that there is a strict negative relationship between profitability of a bank and its default probability.
5 Conclusion

In our study we have tried to find an answer to the question whether there is a relationship between banks’ size and the risk, markets attribute to them. We have calculated default probabilities of banks with the help of CDS market data which are determined by markets. In this part we have concluded that default probabilities reflect market in a realistic manner.

Proceeding to the second part of our analysis, we have regressed default probabilities of banks in one, two, and three years with financial data that reflect size of the banks. We have considered both zero and 25% recovery rates to see whether there is a difference.

We have chosen three financial values which are total assets, total shareholders’ equity and net income. In the first part we have regressed the financial values one by one. In the second part we have regressed total assets and net income together. We did not include total shareholders’ equity as it had high correlation with the other variables.

As a result we could not reach a conclusion that tells us there is a significant relationship between the size of a bank and default probability of it. On the other hand we have reached an interesting and important result. Although it seems there is not a significant relationship between the default probability and size, there seems to be a significant relationship between default probability and profitability of a bank.

As a conclusion we can say that markets do not take into account how big a bank is but how profitable it is. So we propose the new concept of ‘Too Profitable to Fail” instead of TBTF.
**Bibliography**


## APPENDIX

### Results for Zero Recovery Rates:

Dependent Variable: D100

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.575413</td>
<td>0.268587</td>
<td>5.865565</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000192</td>
<td>0.000148</td>
<td>-1.299614</td>
<td>0.1954</td>
</tr>
</tbody>
</table>

R-squared | 0.009145 | Mean dependent var | 1.251428 |
Adjusted R-squared | 0.003731 | S.D. dependent var | 1.362141 |
S.E. of regression | 1.359597 | Akaike info criterion | 3.463006 |
Sum squared resid | 338.2765 | Schwarz criterion | 3.497821 |
Log likelihood | -318.3281 | Hannan-Quinn criter. | 3.477116 |
F-statistic | 1.688996 | Durbin-Watson stat | 0.648066 |
Prob(F-statistic) | 0.195368 |

---

Dependent Variable: D100

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.122335</td>
<td>0.187940</td>
<td>5.971769</td>
<td>0.0000</td>
</tr>
<tr>
<td>EQ</td>
<td>0.001636</td>
<td>0.002015</td>
<td>0.812028</td>
<td>0.4178</td>
</tr>
</tbody>
</table>

R-squared | 0.003590 | Mean dependent var | 1.251428 |
Adjusted R-squared | -0.001855 | S.D. dependent var | 1.362141 |
S.E. of regression | 1.363403 | Akaike info criterion | 3.468597 |
Sum squared resid | 340.1729 | Schwarz criterion | 3.503411 |
Log likelihood | -318.8452 | Hannan-Quinn criter. | 3.482706 |
F-statistic | 0.659390 | Durbin-Watson stat | 0.641331 |
Prob(F-statistic) | 0.417831 |

---

Dependent Variable: D100

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.342073</td>
<td>0.112206</td>
<td>11.96083</td>
<td>0.0000</td>
</tr>
<tr>
<td>NI</td>
<td>-0.021660</td>
<td>0.012353</td>
<td>-1.753377</td>
<td>0.0812</td>
</tr>
</tbody>
</table>

R-squared | 0.016522 | Mean dependent var | 1.251428 |
Adjusted R-squared | 0.011148 | S.D. dependent var | 1.362141 |
S.E. of regression | 1.355427 | Akaike info criterion | 3.455533 |
Sum squared resid | 335.7580 | Schwarz criterion | 3.490348 |
Log likelihood | -317.6368 | Hannan-Quinn criter. | 3.469643 |
F-statistic | 3.074331 | Durbin-Watson stat | 0.678589 |
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.292400</td>
<td>0.472997</td>
<td>6.960723</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000424</td>
<td>0.000258</td>
<td>-1.644155</td>
<td>0.1019</td>
</tr>
</tbody>
</table>

R-squared 0.015127  Mean dependent var 2.570326
Adjusted R-squared 0.009531  S.D. dependent var 2.354608
S.E. of regression 2.343360  Akaike info criterion 4.552221
Sum squared resid 966.4748  Schwarz criterion 4.587971
Log likelihood -403.1476  Hannan-Quinn criter. 4.566718
F-statistic 2.703245  Durbin-Watson stat 0.623769
Prob(F-statistic) 0.101929

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.364415</td>
<td>0.328214</td>
<td>7.203885</td>
<td>0.0000</td>
</tr>
<tr>
<td>EQ</td>
<td>0.002633</td>
<td>0.003537</td>
<td>0.744479</td>
<td>0.4576</td>
</tr>
</tbody>
</table>

R-squared 0.003139  Mean dependent var 2.570326
Adjusted R-squared 0.0002525  S.D. dependent var 2.354608
S.E. of regression 2.357578  Akaike info criterion 4.564319
Sum squared resid 978.2387  Schwarz criterion 4.600069
Log likelihood -404.2244  Hannan-Quinn criter. 4.578817
F-statistic 0.554250  Durbin-Watson stat 0.612194
Prob(F-statistic) 0.457579

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.735958</td>
<td>0.196765</td>
<td>13.90470</td>
<td>0.0000</td>
</tr>
<tr>
<td>NI</td>
<td>-0.039645</td>
<td>0.021397</td>
<td>-1.852785</td>
<td>0.0656</td>
</tr>
</tbody>
</table>

R-squared 0.019131  Mean dependent var 2.570326
Adjusted R-squared 0.013558  S.D. dependent var 2.354608
S.E. of regression 2.338591  Akaike info criterion 4.548146
Sum squared resid 962.5452  Schwarz criterion 4.583897
Log likelihood -402.7850  Hannan-Quinn criter. 4.562644
F-statistic 3.432812  Durbin-Watson stat 0.658116
Prob(F-statistic) 0.065588
## Dependent Variable: D300

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.568599</td>
<td>0.632917</td>
<td>7.218325</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000413</td>
<td>0.000345</td>
<td>-1.198983</td>
<td>0.2321</td>
</tr>
</tbody>
</table>

R-squared: 0.008102
Mean dependent var: 3.864003
Adjusted R-squared: 0.002466
S.D. dependent var: 3.139522
S.E. of regression: 3.135648
Akaike info criterion: 5.134721
Schwarz criterion: 5.170472
Log likelihood: -454.9902
Hannan-Quinn criter.: 5.149219

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>Prob(F-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.437560</td>
<td>0.232146</td>
</tr>
</tbody>
</table>

## Dependent Variable: D300

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.547881</td>
<td>0.437400</td>
<td>8.111292</td>
<td>0.0000</td>
</tr>
<tr>
<td>EQ</td>
<td>0.004042</td>
<td>0.004713</td>
<td>0.857641</td>
<td>0.3923</td>
</tr>
</tbody>
</table>

R-squared: 0.004162
Mean dependent var: 3.864003
Adjusted R-squared: -0.001496
S.D. dependent var: 3.139522
S.E. of regression: 3.141870
Akaike info criterion: 5.138686
Schwarz criterion: 5.174436
Log likelihood: -455.3430
Hannan-Quinn criter.: 5.153183

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>Prob(F-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.735547</td>
<td>0.392257</td>
</tr>
</tbody>
</table>

## Dependent Variable: D300

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.067905</td>
<td>0.262734</td>
<td>15.48296</td>
<td>0.0000</td>
</tr>
<tr>
<td>NI</td>
<td>-0.048805</td>
<td>0.028571</td>
<td>-1.708175</td>
<td>0.0894</td>
</tr>
</tbody>
</table>

R-squared: 0.016308
Mean dependent var: 3.864003
Adjusted R-squared: 0.010719
S.D. dependent var: 3.139522
S.E. of regression: 3.122650
Akaike info criterion: 5.126413
Schwarz criterion: 5.162164
Log likelihood: -454.2508
Hannan-Quinn criter.: 5.140911

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>Prob(F-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.917861</td>
<td>0.089367</td>
</tr>
</tbody>
</table>
## Dependent Variable: D100

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.632140</td>
<td>0.269451</td>
<td>6.057280</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000174</td>
<td>0.000147</td>
<td>-1.183787</td>
<td>0.2380</td>
</tr>
<tr>
<td>NI</td>
<td>-0.020616</td>
<td>0.012371</td>
<td>-1.666442</td>
<td>0.0973</td>
</tr>
</tbody>
</table>

R-squared: 0.024037  Mean dependent var: 1.251428  Adjusted R-squared: 0.013312  S.D. dependent var: 1.362141  S.E. of regression: 1.353044  Akaike info criterion: 3.458674  Schwarz criterion: 3.510896  Log likelihood: -316.9274  Hannan-Quinn criter.: 3.479838  F-statistic: 2.241213  Durbin-Watson stat: 0.685523  Prob(F-statistic): 0.109256

## Dependent Variable: D200

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.392234</td>
<td>0.473754</td>
<td>7.160331</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000391</td>
<td>0.000257</td>
<td>-1.521648</td>
<td>0.1299</td>
</tr>
<tr>
<td>NI</td>
<td>-0.037265</td>
<td>0.021375</td>
<td>-1.743363</td>
<td>0.0830</td>
</tr>
</tbody>
</table>

R-squared: 0.031940  Mean dependent var: 2.570326  Adjusted R-squared: 0.020876  S.D. dependent var: 2.354608  S.E. of regression: 2.329900  Akaike info criterion: 4.546238  Schwarz criterion: 4.599864  Log likelihood: -401.6152  Hannan-Quinn criter.: 4.567985  F-statistic: 2.886941  Durbin-Watson stat: 0.667793  Prob(F-statistic): 0.058406

## Dependent Variable: D300

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.693274</td>
<td>0.634639</td>
<td>7.395181</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000373</td>
<td>0.000344</td>
<td>-1.082405</td>
<td>0.2806</td>
</tr>
<tr>
<td>NI</td>
<td>-0.046537</td>
<td>0.028634</td>
<td>-1.625220</td>
<td>0.1059</td>
</tr>
</tbody>
</table>

R-squared: 0.022850  Mean dependent var: 3.864003  Adjusted R-squared: 0.011683  S.D. dependent var: 3.139522  S.E. of regression: 3.121129  Akaike info criterion: 5.130777  Schwarz criterion: 5.184602  Log likelihood: -453.6569  Hannan-Quinn criter.: 5.152723  F-statistic: 2.046153  Durbin-Watson stat: 0.713799  Prob(F-statistic): 0.132312
### Dependent Variable: D100

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.345134</td>
<td>0.116300</td>
<td>11.56609</td>
<td>0.0000</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.350940</td>
<td>0.223928</td>
<td>-1.567204</td>
<td>0.1188</td>
</tr>
</tbody>
</table>

R-squared: 0.013244  Mean dependent var: 1.251428
Adjusted R-squared: 0.007852  S.D. dependent var: 1.362141
S.E. of regression: 336.8772  Schwarz criterion: 3.493676
Sum squared resid: -317.9447  Hannan-Quinn criter.: 3.472971
Log likelihood: 2.456129  Durbin-Watson stat: 0.664977
Prob(F-statistic): 0.118794

### Dependent Variable: D200

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.739632</td>
<td>0.203417</td>
<td>13.46803</td>
<td>0.0000</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.645542</td>
<td>0.391292</td>
<td>-1.649770</td>
<td>0.1008</td>
</tr>
</tbody>
</table>

R-squared: 0.015229  Mean dependent var: 2.570326
Adjusted R-squared: 0.009634  S.D. dependent var: 2.354608
S.E. of regression: 2.34238  Schwarz criterion: 4.587868
Sum squared resid: -403.1384  Hannan-Quinn criter.: 4.566615
Log likelihood: 2.721742  Durbin-Watson stat: 0.642406
Prob(F-statistic): 0.100774

### Dependent Variable: D300

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.066324</td>
<td>0.271639</td>
<td>14.96957</td>
<td>0.0000</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.771425</td>
<td>0.522523</td>
<td>-1.476346</td>
<td>0.1416</td>
</tr>
</tbody>
</table>

R-squared: 0.012233  Mean dependent var: 3.864003
Adjusted R-squared: 0.006620  S.D. dependent var: 5.139522
S.E. of regression: 3.12912  Schwarz criterion: 5.166298
Sum squared resid: -454.6188  Hannan-Quinn criter.: 5.145046
Log likelihood: 2.179599  Durbin-Watson stat: 0.691610
Prob(F-statistic): 0.141638
## Results for 25% Recovery Rates:

Dependent Variable: D125

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.075871</td>
<td>0.349795</td>
<td>5.934541</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000250</td>
<td>0.000192</td>
<td>-1.297239</td>
<td>0.1962</td>
</tr>
</tbody>
</table>

R-squared 0.009112 Mean dependent var 1.654700
Adjusted R-squared 0.003697 S.D. dependent var 1.773958
S.E. of regression 1.770676 Akaike info criterion 3.991351
Sum squared resid 573.7585 Schwarz criterion 4.026166
Log likelihood -367.2000 Hannan-Quinn criter. 4.005461
F-statistic 1.682828 Durbin-Watson stat 0.646404
Prob(F-statistic) 0.196182

Dependent Variable: D125

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.482581</td>
<td>0.244739</td>
<td>6.057802</td>
<td>0.0000</td>
</tr>
<tr>
<td>EQ</td>
<td>0.002181</td>
<td>0.002623</td>
<td>0.831406</td>
<td>0.4068</td>
</tr>
</tbody>
</table>

R-squared 0.003763 Mean dependent var 1.654700
Adjusted R-squared -0.001681 S.D. dependent var 1.773958
S.E. of regression 1.775448 Akaike info criterion 3.996735
Sum squared resid 576.8557 Schwarz criterion 4.031550
Log likelihood -367.2000 Hannan-Quinn criter. 4.005461
F-statistic 0.691236 Durbin-Watson stat 0.639891
Prob(F-statistic) 0.406828

Dependent Variable: D125

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.774194</td>
<td>0.146099</td>
<td>12.14381</td>
<td>0.0000</td>
</tr>
<tr>
<td>NI</td>
<td>-0.028554</td>
<td>0.016085</td>
<td>-1.775214</td>
<td>0.0775</td>
</tr>
</tbody>
</table>

R-squared 0.016929 Mean dependent var 1.654700
Adjusted R-squared 0.011557 S.D. dependent var 1.773958
S.E. of regression 1.763677 Akaike info criterion 3.983431
Sum squared resid 569.2321 Schwarz criterion 4.018246
Log likelihood -366.4678 Hannan-Quinn criter. 3.997541
F-statistic 3.151385 Durbin-Watson stat 0.677643
Prob(F-statistic) 0.406828
### Dependent Variable: D225

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.315060</td>
<td>0.610931</td>
<td>7.063092</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000545</td>
<td>0.000333</td>
<td>-1.637877</td>
<td>0.1032</td>
</tr>
</tbody>
</table>

R-squared 0.015013
Adjusted R-squared 0.009417
S.E. of regression 0.003326
Sum squared resid 1612.345
Log likelihood -448.6969

Durbin-Watson stat 0.621951
Prob(F-statistic) 0.103234

### Dependent Variable: D225

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.112228</td>
<td>0.423862</td>
<td>7.342543</td>
<td>0.0000</td>
</tr>
<tr>
<td>EQ</td>
<td>3.044626</td>
<td>0.003500</td>
<td>0.766407</td>
<td>0.4445</td>
</tr>
</tbody>
</table>

R-squared 0.003326
Adjusted R-squared -0.002337
S.E. of regression 0.004567
Sum squared resid 1631.476

Durbin-Watson stat 0.610691
Prob(F-statistic) 0.444461

### Dependent Variable: D225

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.602756</td>
<td>0.254064</td>
<td>14.18052</td>
<td>0.0000</td>
</tr>
<tr>
<td>NI</td>
<td>-0.051887</td>
<td>0.027628</td>
<td>-1.878020</td>
<td>0.0620</td>
</tr>
</tbody>
</table>

R-squared 0.019646
Adjusted R-squared 0.014076
S.E. of regression 0.027660
Sum squared resid 1604.762

Durbin-Watson stat 0.657277
Prob(F-statistic) 0.062032
### Dependent Variable: D325

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>5.961653</td>
<td>0.805208</td>
<td>7.403865</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000521</td>
<td>0.000439</td>
<td>-1.188222</td>
<td>0.2363</td>
</tr>
</tbody>
</table>

**R-squared** 0.007958  Mean dependent var 5.073298
**Adjusted R-squared** 0.002322  S.D. dependent var 3.993867
**S.E. of regression** 3.989228  Akaike info criterion 5.616245
**Sum squared resid** 2800.854  Schwarz criterion 5.651995
**Log likelihood** -497.8458  Hannan-Quinn criter. 5.630743
**F-statistic** 1.411871  Durbin-Watson stat 0.664822
**Prob(F-statistic)** 0.236347

### Dependent Variable: D325

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.652558</td>
<td>0.556318</td>
<td>8.363124</td>
<td>0.0000</td>
</tr>
<tr>
<td>EQ</td>
<td>0.005380</td>
<td>0.005995</td>
<td>0.897472</td>
<td>0.3707</td>
</tr>
</tbody>
</table>

**R-squared** 0.004556  Mean dependent var 5.073298
**Adjusted R-squared** -0.001100  S.D. dependent var 3.993867
**S.E. of regression** 3.996064  Akaike info criterion 5.655419
**Sum squared resid** 2810.460  Schwarz criterion 5.634167
**Log likelihood** -498.1505  Hannan-Quinn criter. 5.634167
**F-statistic** 1.411871  Durbin-Watson stat 0.659651
**Prob(F-statistic)** 0.370693

### Dependent Variable: D325

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>5.338843</td>
<td>0.334098</td>
<td>15.97986</td>
<td>0.0000</td>
</tr>
<tr>
<td>NI</td>
<td>-0.063559</td>
<td>0.036332</td>
<td>-1.749408</td>
<td>0.0820</td>
</tr>
</tbody>
</table>

**R-squared** 0.017092  Mean dependent var 5.073298
**Adjusted R-squared** 0.011507  S.D. dependent var 3.993867
**S.E. of regression** 3.960427  Akaike info criterion 5.606996
**Sum squared resid** 2774.005  Schwarz criterion 5.642746
**Log likelihood** -497.0226  Hannan-Quinn criter. 5.621493
**F-statistic** 3.060427  Durbin-Watson stat 0.704020
**Prob(F-statistic)** 0.081964
### Dependent Variable: D125

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.150711</td>
<td>0.350850</td>
<td>6.130000</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000226</td>
<td>0.000192</td>
<td>-1.180096</td>
<td>0.2395</td>
</tr>
<tr>
<td>NI</td>
<td>-0.027198</td>
<td>0.016108</td>
<td>-1.688468</td>
<td>0.0930</td>
</tr>
</tbody>
</table>

- **R-squared**: 0.024394
- **Adjusted R-squared**: 0.013673
- **S.E. of regression**: 1.761788
- **Sum squared resid**: 564.9095

### Dependent Variable: D225

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.445875</td>
<td>0.611753</td>
<td>7.267431</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000502</td>
<td>0.000332</td>
<td>-1.513887</td>
<td>0.1319</td>
</tr>
<tr>
<td>NI</td>
<td>-0.048829</td>
<td>0.027601</td>
<td>-1.769067</td>
<td>0.0786</td>
</tr>
</tbody>
</table>

- **R-squared**: 0.032319
- **Adjusted R-squared**: 0.021260
- **S.E. of regression**: 3.008576
- **Sum squared resid**: 1584.017

### Dependent Variable: D325

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>6.124300</td>
<td>0.807086</td>
<td>7.588164</td>
<td>0.0000</td>
</tr>
<tr>
<td>ASSET</td>
<td>-0.000468</td>
<td>0.000438</td>
<td>-1.069014</td>
<td>0.2865</td>
</tr>
<tr>
<td>NI</td>
<td>-0.060710</td>
<td>0.036415</td>
<td>-1.667199</td>
<td>0.0973</td>
</tr>
</tbody>
</table>

- **R-squared**: 0.023469
- **Adjusted R-squared**: 0.012308
- **S.E. of regression**: 3.969212
- **Sum squared resid**: 2757.063

---
### Dependent Variable: D125

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.778625</td>
<td>0.151429</td>
<td>11.74559</td>
<td>0.0000</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.464116</td>
<td>0.291567</td>
<td>-1.591800</td>
<td>0.1132</td>
</tr>
</tbody>
</table>

R-squared 0.013657  Mean dependent var 1.654700
Adjusted R-squared 0.008267  S.D. dependent var 1.773958
S.E. of regression 1.766610  Akaike info criterion 3.986754
Sum squared resid 571.1268  Schwarz criterion 4.021569
Log likelihood -366.7748  Hannan-Quinn criter. 4.000864
F-statistic 2.533827  Durbin-Watson stat 0.663889
Prob(F-statistic) 0.113156

### Dependent Variable: D225

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.608244</td>
<td>0.262655</td>
<td>13.73760</td>
<td>0.0000</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.847473</td>
<td>0.505240</td>
<td>-1.677366</td>
<td>0.0952</td>
</tr>
</tbody>
</table>

R-squared 0.015735  Mean dependent var 3.385978
Adjusted R-squared 0.010142  S.D. dependent var 3.041075
S.E. of regression 3.025615  Akaike info criterion 5.063278
Sum squared resid 1611.164  Schwarz criterion 5.099028
Log likelihood -448.6317  Hannan-Quinn criter. 5.077776
F-statistic 2.813557  Durbin-Watson stat 0.641395
Prob(F-statistic) 0.095246

### Dependent Variable: D325

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>5.338591</td>
<td>0.345426</td>
<td>15.45510</td>
<td>0.0000</td>
</tr>
<tr>
<td>ROA</td>
<td>-1.011528</td>
<td>0.664458</td>
<td>-1.522336</td>
<td>0.1297</td>
</tr>
</tbody>
</table>

R-squared 0.012997  Mean dependent var 5.073298
Adjusted R-squared 0.007389  S.D. dependent var 3.993867
S.E. of regression 3.979085  Akaike info criterion 5.611153
Sum squared resid 2786.629  Schwarz criterion 5.646904
Log likelihood -497.3926  Hannan-Quinn criter. 5.625651
F-statistic 2.317506  Durbin-Watson stat 0.687784
Prob(F-statistic) 0.129720