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Basel II and the Financing of R&D investments in Malaysia

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ABSTRACT

We analyse how the financing of R&D investment in corporate entities in Malaysia has been affected by the implementation of Basel II. We show the results by disaggregating into three sub sectors: (1) firms with large investments in capital, (2) those not as intensive, (3) and all firms for which we have data on default rates. Our results show that both before and after Basel II, firms do not borrow from external resources in order to build R&D expenditure strategies, and we argue that firms obtain financial resources from external sources for assets purposes rather than for investment and sales strategies. Therefore Basel II was not able to change firm´s financing patterns in relation to R&D, and this fact should be important for policy makers when planning future Basel accords. We also show that firms operating in industries which are characterized by a lower incidence of intangible assets are less exposed to financial constraints. Finally, for those firms for which we have data on default rates in 2008, we show that intangible assets in these companies are more exposed to financial constraints.

JEL Classification : G21, G28, O32.

Keywords: Basel II; corporate sector; financial constraint; R&D investment; Probit

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INTRODUCTION

Corporate loans play a very important role to ensure the soundness of banking performance. The risk level of firms is important to ensure that banks perform well and to control the number of non-performing loans. For example Arora and Sharma (2014) identify factors that contribute to risk identification in banks. There are some general papers, such as Batten (2011), showing general consequences of the impact of the financial sector reform and regulation in Asia-Pacific financial markets. More recently, Sufian (2012) examines several south Asian commercial banks finding that bank specific characteristics have a positive and significant impact on bank performance. In this paper we want to focus on the firm side. Segawa, Natsuda and Thoburn (2014) have shown the effectiveness of Malaysia in obtaining an internationally competitive product in the car industry, while Ahmad, Wilson and Kummerow (2011) have studied how to measure business success. Our main goal is to investigate the effect, from the financial side, of the implementation of Basel II in Malaysia using firm level data on the financing of research and development (R&D), and to compare it with a more developed country, Italy, whose situation was already analysed by Scellato and Ughetto (2009). Scellato and Ughetto (2009) investigated the issue of the financing of R&D investments in small and medium enterprises (SMEs) in Italy. They used a probit model in order to observe if both indicators of product or process innovation and R&D intensity have a significant impact on the needs of external financial resources and they found lending was unaffected by the introduction of Basel II. Lee, Hooy and Hooy (2012) have analysed recently the impact of international diversifications on public listed firms; while we will focus on how Basel II has also affected the different industries in Malaysia. Therefore, we pursue to make an Asia-Europe comparison.

The objective of our paper is therefore to show if the implementation of Basel II leads to changes in the amount of capital that banks need to reserve for different types of loans in Malaysia. This implies that this regulation can potentially affect firm's cost of external financing for projects of different kinds. And this, in turn, implies that we could potentially observe changes in firm's financing patterns, making them finance more or less projects of particular kinds with external financing.

We focus on 20 industries: aerospace; automobile; chemicals; electronics and electrical parts; fixed line telecommunication; mobile telecommunication; food producers; beverages; construction and materials; electricity, gas; water and multi-utilities; general retailers; health care equipment and services; industrial transportation; media; oil equipment and services; real estate investment and services; software and computer services; support services and travel and leisure. As a main novelty of our paper, we extend the analysis of Scellato and Ughetto (2009) by classifying firms in three main sub-sectors (apart from the results at aggregate level): (1) the first group contains firms with large investments in capital. (2) The second group is not as intensive in capital and finally, (3) the third group contains all firms for which we have data on default rates. High capital intensive firms invest more on R&D rather than low capital intensive firms since they had businesses in different segments as stated by Wang and Thornhill (2010). Therefore, the first main sub-sector includes the following industries: aerospace; automobile; chemicals; electronics and electrical parts; fixed line telecommunication and mobile telecommunication. The second sub-sector contains food producers and beverages. And finally, the third sub-sector contains firms in the sectors of construction and materials; electricity; gas; water and multi-utilities; general retailers; health care equipment and services; industrial transportation; media; oil equipment and services; real estate investment and services; software and computer services; support services and travel and leisure. All these sectors have a huge impact in the economy since many individuals purchase products and services from them. In total we analyse 251 firms in Malaysia for 2005 and 2008. We cannot find conclusive results at aggregate level, but we can obtain them when classifying firms into the three sub-groups.

Under the old Basel Accord in 1988, the classification of risk weights is designed as 5 weights: 0%, 10%, 20%, 50%, and 100%. Corporate loans were simply weighted as 100%. The 2008 Basel II Accord has been introduced in Malaysia to measure sensitivity of regulatory capital requirements towards borrowers' risks. It imposes a wider range of credit risk for banks' assets. It consists of three approaches: (1) a standardized approach, (2) the foundation internal rating based approach (FIRB) and (3) the advanced internal rating based procedure (AIRB). Malaysian banks only implemented a standardized approach since January 2008. However, there are some of Malaysian local banks (such as Malaysian Banking Berhad, RHB Bank Berhad, Public Bank and CIMB Bank) that had already implemented FIRB since January 2008. There are no banks in Malaysia that implemented the AIRB approach.

The standardized approach has various categories of exposures and appropriate risk weights. Exposures to corporates have risk weights based on their external ratings which can be in the form of either short term or long term ratings. Short term ratings refer to facilities with an original maturity of 1 year or less. Corporate loans are categorized into 5 categories (which are AAA to AA-, A+ to A-, BBB+ to BB- , B+ to D and unrated), all weighted at 20%, 50%, 100%, 150% and 100%, respectively.

However, the FIRB approach has much wider categories of exposures and risk weights compared to the standardized approach and it is more risk sensitive. The differences of measuring risk weight functions between the standardized approach and the FIRB approach are based on separate assessments of probability of default (PD), loss given default (LGD) and exposure at default (EAD).

Obviously, Basel II has introduced a new range of risk weights for banks' assets. Therefore, the level of risk of banks' assets now depends on the risk weights that are set up to borrowers and give banks the chance to make a wiser decision to offer loans to different borrowers. We want to check if this has affected firms' decisions to finance their R&D.

REVIEW OF LITERATURE

There is a very extensive literature (see e.g. Fisher and Temin (1973), Stiglitz and Weiss (1981), Myers and Majluf (1984), Williamson, (1988), Dosi (1988), Balakrishnan and Fox (1993), Himmelberg and Petersen (1994), Schiantarelli (1995), Christensen, (1995), Hubbard (1998), Cleary (1999), David *et. al.* (2000), Klette *et. al.* (2000), Vicente-Lorente (2001), Bagella, Becchetti and Caggese (2001), O'Brien (2003), Shefer and Frenkel (2005), Hyytinen and Toivanen (2005), Ogawa (2007), Scellato (2007), Ughetto (2008), Wang and Thornhill (2010) and Maxfield (2011)) showing how important R&D and innovation investment is for firms and whether firms are financially constrained by internal or external funding to finance the innovation activities. Moreover, we believe it is crucial to analyse this issue with the introduction of the 2008 Basel II Accord. Our main novelty and our contribution to the literature is in showing our results at disaggregate level by differentiating firms in Malaysia that are more intensive in capital from those less intensive. We also show our results for firms for which we have data on default rates.

The plan of the paper is as follows. The following section contains the model and the data and variable descriptions. Later, we report the empirical results, and finally, we conclude.

RESEARCH METHODOLOGY

We investigate the effect of firm-specific R&D related variables on the probability of desiring additional quantities of credit. The probit model has been chosen because, following Scellato and Ughetto (2009), it is a very useful way to analyse the probability of firms requiring more credit compared to other methods such as discriminant analysis (see Altman (1968)). The probit model imposes the standard normal cumulative distribution function which is expressed integrally. We will provide also an assessment of its fitness in our case by analysing Pearson's residuals in our empirical application. There are many ways to estimate standard deviations, such as different types of bootstrap, jackknife and asymptotic theory. Since we use a standard probit model, we use the procedure based on asymptotic theory to estimate the standard deviations[1]. We specify the model as follows

$$CD_i = X\beta_i + \varepsilon\text{i} \tag{1}$$

where subscript *i* denotes firm *i*. The probit model uses a dependent variable

CD = Dummy for declaring credit constraint

and a few dummy variables as independent variables. The *X* matrix includes all the independent variables and ε is the error term. The details about each variable in the *X* matrix are given as follows

LEV	= Liabilities/(liabilities+equity)
ACID	= Short term activities (inventories+receivables) /short term debt
EBS	= EBIT (earnings before interests) /sales
ASSET	= Logarithm of total assets
CASH	= Dummy for negative cash flow
PAV	= Dummy for intangible assets
RD	= Dummy for companies' R&D expenditures
RDINV	= R&D expenditures/total investment
RDS	= R&D expenditures/total sales
RDTA	= R&D expenditures/total assets

[1] Asymptotic theory in this context produces reasonable estimates in finite samples (see e.g. Wooldridge (2002)).

Table 1 shows first a summary of basic statistics for our variables.

Table 1 Summary statistics of R&D Expenditure (Malaysia Ringgit (MYR) in million (mln))

Variables	Min	Max
Sector 1 (MYR mln 2005)	81.00	347193.00
Sector 2 (MYR mln 2005)	1.00	20046.00
Sector 3 (MYR mln 2005)	71.00	20666.00
Sector 1 (MYR mln 2008)	188.00	29900.00
Sector 2 (MYR mln 2008)	2.00	4271.00
Sector 3 (MYR mln 2008)	26.00	14929.00

We define a dummy for R&D expenditures by assuming that firms contribute some expenditure on R&D. Therefore, we will analyse this dummy R&D by differentiating it into three different groups in which the first sub-group is highly capital intensive, the second sub-group is low capital intensive and group three contains firms with medium degrees of intensity of capital. High capital intensive firms invest more on R&D rather than low capital intensive firms since they had businesses in different segments as stated by Wang and Thornhill (2010). This can be shown in Table 1, which shows that sub-sector one in 2005 and 2008 has the highest minimum value with MYR81.00 million (Malaysia Ringgit is denoted by MYR) and MYR188.00 million, respectively on the R&D expenditure. However, sub-sector two with low capital intensive has the lowest minimum value of R&D expenditure with MYR1.00 million and MYR2.00 million in both periods, respectively. Sector three has a medium of minimum value of R&D expenditure with MYR71.00 million and MYR26.00 million in both periods of 2005 and 2008, respectively. Therefore, we can uncover the effect of R&D expenditure from different levels of capital intensity to differentiate that highly capital intensive firms spend more on R&D than low capital intensive.

From equation (1) we show several possible specifications. We consider five models. The first two models analyse the probit specification on the effect of traditional financial accounting ratios and the dummy for R&D expenditures. The last three models analyse the effects of R&D intensity measures, using three different definitions of R&D intensity to see the effect of R&D expenditures on investment, total sales and total assets as defined by Scellato and Ughetto (2009). R&D expenditure to total assets was also defined by Xu and Zhang (2004) who found it relatively stable and helpful in explaining the average expected stock return. In addition, R&D expenditure relative to sales was used by Chan *et. al.*, (2001) and Liao and Greenfield (1998), who found it to act as an indicator of how many resources a firm devotes to R&D and it is affected by the change in amount of sales. The reason for setting different measurements of R&D intensity is to see the effect of a change in a firm's total assets and investment and how changes in firm's total assets would affect the expenditure on R&D. In addition, we want to see the effect of a change in R&D expenditure relative to total sales. Scellato and Ughetto (2009) did not find any significant effect of three measurements of R&D intensity in the case of Italy.

There are different ways of measuring R&D expenditure that should have a different causal effect on the credit constraint. For example, Ogawa (2007) has analysed a panel data set of Japanese manufacturing firms in research-intensive industries. He investigates quantitatively the extent to which outstanding debt affected firms' R&D activities during the 1990s. He found that massive amounts of outstanding debt had a statistically significant and negative effect on R&D investment during that time. In addition, Schiantarelli (1995) and Hubbard (1998) analysed data from firms quoted on the stock market. It was debated whether or not financial constraints on quoted and unquoted firms have a weak or strong relationship on the R&D investment. Yet, financial constraints on quoted firms are likely to be relatively weak, as these firms are typically large, long-established and financially healthy companies with good credit ratings. A sharper test of the effects of financial constraints on investment would be obtained from a sample that included a large number of unquoted firms, which are more likely to be characterized by adverse financial attributes such as poor solvency, a short track record, and low real assets compared to the quoted firms. However, our analysis does not pursue this different causal effect on the credit constraint.

The probability of firms' requiring more credit is defined from the firms' size. Firms' size is measured by total real assets (total assets minus intangible assets). According to Schiantarelli (1995) smaller firms are likely to face more severe problems of asymmetric information as they are more likely to suffer more from idiosyncratic risk and to have lower collateral values in relation to their liabilities as well as higher bankruptcy costs, and short track records. He divided firms into small, medium and large size by using the distribution of quartiles. Small size of firms also has been found by Vijverberg (2004) to face a credit constraint. He divided firms into small and large sizes by leaving the medium size of firms for analysis of constraint of credit. Therefore, in our analysis, we will assume that small firms that are categorized at the lowest quartiles are the most financially constrained. Therefore, those firms categorized in the lowest quartiles are considered one, and zero for remaining quartiles.

RESULTS AND DISCUSSION

Our dataset consists of a total of 251 firms for the years 2005 and 2008, which has been obtained from DataStream . 2008 has been chosen in order to see the reaction of firms when banks enter Basel II in 2008 (versus the previous Basel Accord). Ughetto (2008) also analysed the case of Italy in 2003, three years before entering into another Basel Accord. First we analyse the impact of R&D on financial constraint by using a probit model. All data are in real terms by using 2005 as the base year.

All firms' balance sheets, profit and loss, and cash flow statements have been chosen from 20 sectors and we have divided them into three sub-groups ((1) firms with large investments in capital, (2) those not as intensive, (3) and all firms for which we have data on default rates). All variables are needed to be calculated using traditional financial accounting ratios.

Summary statistics

Table 2 Sectorial Distribution of Companies: number of firms and percentages by sector

Group	Industry	Firms (2005)	%	Firms (2008)	%
1	Aerospace and Defence	2	0.20	2	0.20
1	Automobile and Parts	22	2.18	20	1.98
1	Chemicals	30	2.98	33	3.27
1	Electronic and Electrical Equipments	32	3.17	36	3.57
1	Fixed Line Telecommunication	4	0.39	3	0.30
1	Mobile Telecommunication	4	0.39	5	0.50
2	Beverages	5	0.49	6	0.60
2	Food Producers	81	8.04	73	7.24
3	Other manufacturing industry	60	5.95	63	6.25
NA	Other manufacturing industry	768	76.19	767	76.09
	Total	1008	100.00	1008	100.00

In Table 2, we present the sectorial distribution of the analysed companies according to the DataStream industry classification. The distribution of those sectors show the percentage for each sector overall or at aggregate level. We have chosen the first sub-sector to include firms that are very capital intensive from aerospace and defence, automobile and parts, chemicals, electronic and electrical equipment, fixed line and mobile telecommunication which dominate 0.2%, 2.18%, 2.98%, 3.17%, 0.39% and 0.39%, respectively. The second sub-sector includes beverages and food producers who contribute 0.49% and 8.04%, respectively (less capital intensive). The third sub-sector is chosen from various sectors which contributes 5.95% of overall firms. The reason for choosing a third sub-sector is because their firms are rated by the Rating Agency Malaysia BhD (RAM) and it is crucial for our analysis to see if this can affect the results.

In 2008 the first sub-sector includes firms in aerospace and defence, automobile and parts, chemicals, electronic and electrical equipment, fixed line and mobile telecommunication which contribute 0.2%, 1.98%, 3.27%, 3.57%, 0.3% and 0.5%, respectively. However, the second sub-sector includes beverages and food producers which contribute 0.6% and 7.24%, respectively at aggregate level. The third sub-sector comes from different sub-sectors, being in total 73 firms that have data available on credit rating. This third sub-sector contributes 7.24% out of overall sectors.

Table 3 Summary statistics of firm size (Malaysia Ringgit (MYR) in million (mln))

Variables	Mean	Std. dev.	Min	Max
Sales (MYR mln 2005)	806805.987	2061243.879	2350.000	18977490.000
Total assets (MYR mln 2005)	1808205.262	6097739.195	14393.000	63494800.000
Sales (MYR mln 2008)	807880.769	1804722.083	8957.729	13303128.630
Total assets (MYR mln 2008)	1066127.712	2397728.325	48436.139	15607406.570

In Table 3, we summarize the size distribution of the companies included in the final sample. All the values are in Malaysia Ringgit (MYR) in millions of (mln) units. The mean value of sales in 2008 is more than in 2005 but this is not true for total assets. However, the minimum value for both sales and total assets in 2008 is more than in 2005. This shows that total sales and total assets of firms in 2005 reached their lowest values when compared with 2008.

Table 4 R&D intensity measures for companies that state they invested in R&D, years 2005 and 2008

Measure	Mean (%) 2005	Mean (%) 2008
R&D expenditures/sales	0.001	0.001
R&D expenditures/total assets	0.001	0.013
R&D expenditures/total investments	0.021	0.003

Finally, table 4 presents the R&D intensity, showing that the percentage of R&D expenditure divided by total investment has the highest intensity in 2005. However, in 2008 the R&D intensity divided by total assets is higher than in 2005.

Analysis of R&D on financial constraints

Results in 2005

We investigate in more detail now the impact of firm-specific R&D related variables on the probability of observing a desire for additional quantities of credit in 2005. We use a set of traditional financial accounting ratios that are expected to affect a bank in its lending decisions. Three categories of financial accounting have been chosen to describe the main aspects of a company's financial profile: leverage, liquidity and profitability. All financial ratios are calculated for the year 2005.

Table 5 Probit model results, dependent variable: dummy for declaring credit constraints (aggregate)-2005

	Model 1	Model 2
LEV	-0.028 (1.489)	-0.027 (1.489)
ACID	-0.001 (0.002)	-0.001 (0.002)
EBS	0.370 (0.464)	0.371 (0.465)
ASSET	-4.957 (0.935)*	-4.954 (0.944)*
CASH	0.164 (0.463)	0.164 (0.463)
PAV	0.132 (0.484)	0.131 (0.487)
RD		0.012 (0.745)
Const	57.799 (10.769)*	57.772 (10.885)*
Pseudo R2	0.853	0.853
LR (chi2)	241.260	241.260
Prob	0.000	0.000

Table 5 (Cont.)

Goodness-of-fit test		
Pearson (chi2)	2184.540	2184.160
Prob	0.000	0.000
Log likelihood	-20.791	-20.791
AIC	0.221	0.229
BIC	-1306.628	-1301.103
Correctly classified	98.01%	98.01%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 5 shows the results of models 1 and 2 in year 2005 at aggregate level. These two models are both considered to estimate the probability of firms requiring more credit for a given dummy dependent variable. The results show that only ASSET is statistically significant with an estimated coefficient of -4.957 for model 1. Besides, for model 2, RD is not statistically significant, but ASSET is statistically significant with an estimated coefficient of -4.954. Moreover, probit estimation results can be analysed using marginal effects, where we take sample averages. This implies that the estimated probability of requiring more credit goes from zero to one expenditure value in asset size. Thus, we evaluate the standard normal cumulative distribution function (cdf), with ASSET=1 and ASSET=0, while as standard practice, variables are set at the preceding values. The estimated marginal effect of ASSET in model 1 is -4.957. Therefore we conclude that firms in 2005 do not require external financing resources.

Table 6 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (aggregate)-2005

	Model 3	Model 4	Model 5
LEV	-0.037 (1.474)	-0.039 (1.474)	-0.039 (1.483)
ACID	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
EBS	0.367 (0.460)	0.365 (0.460)	0.367 (0.460)
ASSET	-4.890 (0.930)*	-4.886 (0.932)*	-4.890 (0.933)*
CASH	0.194 (0.468)	0.194 (0.468)	0.185 (0.467)
PAV	0.095 (0.484)	0.095 (0.484)	0.092 (0.485)
RDS	70.374 (145.809)		
RDTA		125.976 (270.339)	
RDINV			6.670 (14.354)
Const	57.001 (10.707)*	56.948 (10.723)*	57.003 (10.747)*
Pseudo R2	0.855	0.855	0.854
LR (chi2)	241.790	241.820	241.640
Prob	0.000	0.000	0.000
Goodness-of-fit test			
Pearson (chi2)	2062.420	2048.110	2097.020
Prob	0.000	0.000	0.000
Log likelihood	-20.523	-20.512	-20.599

Table 6 (Cont.)

AIC	0.227	0.227	0.228
BIC	-1301.639	-1301.661	-1301.487
Correctly Classified	98.01%	98.01%	98.01%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 6 reports different ratios of R&D expenditures on total assets, sales and investments at aggregate level. The results do not support the R&D intensity measurement to be statistically significant to influence the dummy variable at aggregate level. Models 3 and 5 do not support this hypothesis. This is consistent with the case in Italy in the year before entering Basel II. However, these three models show that only ASSET is statistically significant with an estimated negative coefficient. Therefore, we argue that firms in 2005 do not require financial resources since they can use their own internal resources. This might be due to the risk aversion of those firms that have external funding. On the one hand, one might argue that at aggregate level, companies characterized by different levels of capital intensities have mixed financial positions and profitability. Hence, some of the companies may not be eligible to get additional external financial resources. On the other hand, a simple reason is that they build R&D investment strategies on the availability of internal resources.

The estimated marginal effects of ASSET for models 3, 4, and 5 are -4.890, -4.886, and -4.890, respectively. In terms of goodness of fit tests, none of the five models with aggregate data are found to offer a good measure of fit (see the Pearson chi-squares test which rejects the hypothesis that the models are a good fit with the data). Besides, analysing the BIC Criteria (Bayesian Information Criteria), model 1 shows the highest value, providing weak support for model 1 compared with models 2, 3, 4, and 5 at aggregate level in 2005.

Table 7 Probit model results, dependent variable: dummy for declaring credit constraints (sub-sector 1)- 2005

	Model 1	Model 2
LEV	4.779 (3.112)	5.243 (3.387)
ACID	0.001 (0.007)	0.004 (0.004)
EBS	1.177 (1.641)	1.814 (1.719)
ASSET	-5.778 (2.150)*	-6.173 (2.303)*
CASH	0.529 (0..694)	0.733 (0.827)
PAV	0 .112 (0.678)	0.304 (0.745)
RD		-3.449 (3.661)
Const	62.531 (23.602)*	66.320 (25.067)*
Pseudo R2	0.818	0.852
LR (chi2)	90.03	93.76
Prob	0.000	0.000
Goodness-of-fit test		
Pearson (chi2)	20.800	16.82
Prob	1.000	1.000

Table 7 (Cont.)

Log likelihood	-10.038	-8.175
AIC	0.355	0.337
BIC	-386.151	-385.313
Correctly classified	94.79%	94.79%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 7 shows the results to see whether firms require more credit in the first sub-sector in 2005. In the first sub-sector, we include all companies in sectorial aerospace and defence, automobile and parts, chemicals, electronic and electrical equipment, fixed line and mobile telecommunications. The results show that both models 1 and 2 have the variable ASSET to be statistically significant. Also both models show that ASSET has a negative estimate. However, model 2 shows that R&D expenditures are not statistically significant. This supports the fact that sub-sector 1 in 2005 is not exposed to financial constraints when R&D expenditure changes.

Table 8 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (sub-sector 1)- 2005.

	Model 3	Model 4	Model 5
LEV	4.871 (3.225)	5.126 (3.314)	4.313 (3.108)
ACID	0.001 (0.007)	0.004 (0.005)	0.000 (.0066)
EBS	1.177 (1.681)	1.656 (1.446)	1.197 (1.640)
ASSET	-5.998 (2.232)*	-6.345 (2.410)*	-5.685 (2.074)*
CASH	0.592 (0.716)	0.798 (0.745)	0.639 (0.719)
PAV	0.088 (0.695)	0.049 (0.715)	0.020 (0.703)
RDS	-76.347 (55.122)		
RDTA		-311.398 (187.521)***	
RDINV			-3.742 (3.856)
Const	64.987 (24.425)*	68.368 (26.218)*	61.609 (22.705)*
Pseudo R2	0.825	0.836	0.8253
LR (chi2)	90.780	92.040	90.880
Prob	0.000	0.000	0.000
Goodness-of-fit test			
Pearson (chi2)	20.050	18.710	19.340
Prob	1.000	1.000	1.000
Log likelihood	-9.665	-9.033	-9.617
AIC	0.368	0.355	0.367
BIC	-382.333	-383.596	-382.429
Correctly Classified	94.79%	94.79%	94.79%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 8 shows the effect of R&D intensity measures in 2005 for sub-sector 1. However, only the R&D intensity of total assets measurements is statistically significant. Other financial ratios such as ASSET are statistically significant and negatively correlated in models 3, 4, and 5. These results are consistent with the aggregate results in 2005. The negative correlation between ASSET and the dependent variable shows that firms are less likely to require more credit as their assets increase. This shows how firms' assets can be important to finance their expenditure in future.

The estimated marginal effects of ASSET in models 3, 4 and 5 are -5.998, -6.345 and -5.685, respectively. In terms of the goodness of fit, all models for sub-sector 1 in 2005 are satisfactory when analysing the Pearson chi-squares test which does not reject the null hypothesis. Besides, model 1 shows the highest value of BIC, which provides weak support for the model compared with the other 4 models. Since deviance residuals are simply 2 times the log likelihood, we can compute the difference of deviances as 2 times the difference in log likelihoods. The difference of deviances between models 1 and 2, models 2 and 3, models 3 and 4, and models 4 and 5 are 3.726, 2.98, 1.264, and 1.168, respectively. This shows that the leverage for model 2 is not very high compared with other models.

Table 9 Probit model results, dependent variable: dummy for declaring credit constraints (sub-sector 2)-2005

	Model 1	Model 2
LEV	-43.741 (51.568)	-55.116 (77.398)
ACID	-0.033 (0.039)	-0.037 (0.055)
EBS	-2.770 (3.765)	-2.133 (4.041)
ASSET	-17.812 (18.422)	-24.521 (30.609)
CASH	-4.460 (5.719)	-6.336 (9.233)
PAV	-1.142 (2.307)	-2.190 (3.583)
RD		6.378 (7.821)
Const	223.395 (232.156)	306.257 (384.007)
Pseudo R2	0.898	0.906
LR (chi2)	86.390	87.150
Prob	0.000	0.000
Goodness-of-fit test		
Pearson (chi2)	8.680	1.690
Prob	1.000	1.000
Log likelihood	-4.885	-4.508
AIC	0.273	0.288
BIC	-347.503	-343.792
Correctly classified	96.55%	97.70%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 9 reports the results of sub-sector 2 in 2005 which includes food producers and beverages sectors. The results in models 1 and 2 show that none of financial ratios and R&D expenditures are statistically significant. Also the overall measurement of the model is statistically significant by using the likelihood chi square.

Table 10 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (sub-sector 2)- 2005.

	Model 3	Model 4	Model 5
LEV	-62.59 (79.267)	-56.152 (73.514)	-60.416 (71.232)
ACID	-0.044 (0.055)	-0.038 (0.052)	-0.041 (0.049)
EBS	-2.897 (3.838)	-2.175 (3.910)	-2.376 (3.722)
ASSET	-26.204 (31.724)	-24.908 (29.280)	-26.430 (28.888)
CASH	-6.939 (9.608)	-6.455 (8.825)	-6.928 (8.699)
PAV	-2.229 (3.735)	-2.230 (3.469)	-2.379 (3.469)
RDS	975.672 (1256.173)		
RDTA		6332.65 (8693.2)	
RDINV			171.050 (201.726)
Const	328.215 (397.889)	311.134 (367.164)	330.363 (361.929)
Pseudo R2	0.903	0.906	0.906
LR (chi2)	86.860	87.150	87.120
Prob	0.000	0.000	0.000
Goodness-of-fit test			
Pearson (chi2)	8.240	7.820	7.880
Prob	1.000	1.000	1.000
Log likelihood	-4.652	-4.509	-4.522
AIC	0.291	0.288	0.288
BIC	-343.502	-343.789	-343.762
Correctly Classified	97.70%	96.55%	96.55%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively.Sandard errors are given in the parenthesis.

Table 10 shows the effects of R&D intensity measures for sub-sector 2 in 2005. We find that R&D intensity measures are not statistically significant in models 3, 4, and 5. These results are in accordance with the results in the case of Italy and the other aggregate and first sub-sector models. Besides, none of financial ratios are statistically significant.

All models for sub-sector 2 in 2005 are satisfactory when interpreting the test of Pearson chi-squares for models 1, 2, 3, 4 and 5. Note that p-values of the statistics that check if the explanatory variables are statistically significant usually may have very low power for finite samples, and therefore, we must complement them with other tests such as Pearson's test. Our main objective in Table 10 is to check the robustness of our result that indeed R&D intensity measures are not statistically significant and if their point estimates change substantially when different explanatory variables are added into the model (even if they are not statistically significant and they are irrelevant variables). Indeed, from Models 3-5 the estimated coefficients have very little variation.

Model 1 has the highest value of BIC, followed by model 2 providing weak support for these two models.

Table 11 Probit model results, dependent variable: dummy for declaring credit constraints (sub-sector 3)- 2005

	Model 1	Model 2
LEV	-0.729 (2.101)	-1.159 (2.144)
ACID	-0.001 (0.003)	-0.001 (0.003)
EBS	1.792 (1.789)	2.063 (1.821)
ASSET	-3.010 (0.906)*	-3.159 (0.913)*
CASH	-0.091(0.686)	0.109 (0.722)
PAV	-0.514 (0.876)	-0.628 (0.889)
RD		1.108 (1.222)
Const	38.977 (11.699)*	40.853 (11.779)*
Pseudo R2	0.724	0.735
LR (chi2)	53.700	54.500
Prob	0.000	0.000
Goodness-of-fit test		
Pearson (chi2)	39.510	40.630
Prob	0.985	0.974
Log likelihood	-10.253	-9.851
AIC	0.507	0.525
BIC	-236.884	-233.469
Correctly classified	94.12%	94.12%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 11 shows the third sub-sector which contains firms from various sectors that were rated by RAM. The results show that ASSET is statistically significant and firms' require more credit as showed in model 1. Besides, model 2 shows that RD is not statistically significant. This result also shows that total assets are less exposed to financial constraints since they show a negative estimate.

The estimated marginal effect shows that the probability of acquiring more credit when ASSET increases from zero to one is -3.010 from model 1. Also, the estimated marginal effect of the ASSET in model 2 is -3.159.

Table 12 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (sub-sector 3)- 2005.

	Model 3	Model 4	Model 5
LEV	-1.463 (2.171)	-1.470 (2.183)	-1.154 (2.138)
ACID	-0.001(0.002)	-0.001 (0.002)	-0.001 (0.003)
EBS	1.884 (1.775)	1.951 (1.780)	2.014 (1.810)
ASSET	-2.964 (0.868)*	-3.020 (0.876)*	-3.128 (0.902)*

Table 12 (Cont.)

CASH	0.258(0.749)	0.263 (0.759)	0.085 (0.699)
PAV	-0.590 (0.852)	-0.609 (0.859)	-0.599 (0.884)
RDS	346.048 (578.656)		
RDTA		424.208 (458.531)	
RDINV			23.175 (16.350)
Const	38.347 (11.189)*	39.065 (11.284)*	40.480 (11.635)*
Pseudo R2	0.746	0.744	0.738
LR (chi2)	55.360	55.170	54.740
Prob	0.000	0.000	0.000
Goodness-of-fit test			
Pearson (chi2)	37.070	38.430	40.660
Prob	0.991	0.986	0.974
Log likelihood	-9.421	-9.516	-9.733
AIC	0.512	0.515	0.522
BIC	-234.328	-234.137	-233.705
Correctly Classified	94.12%	94.12%	94.12%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 12 shows the third sub-sector analysis of R&D intensity measurement. Model 3 shows that RDS is not statistically significant. Besides, ASSET is statistically significant. Similarly, models 4 and 5 show that RDTA and RDINV are not statistically significant. In addition only ASSET is statistically significant with coefficient estimates of -3.020 and -3.128, respectively. The estimated marginal effects on ASSET in models 3, 4 and 5 are 2.964, 3.020 and 3.128, respectively when the probability of acquiring more credit on asset increases from zero to one.

When analysing the third sub-sector, we find no evidence of a statistically significant relationship on R&D intensity measurements. This shows that firms do not require external credit for financing in R&D as they have sufficient amount of internal financing. However, a negative estimated coefficient of ASSET shows that assets of firms in sub-sector 3 are less exposed to financial constraints.

All models for sub-sector 3 in 2005 pass the Pearson chi-squares test and we cannot reject the null hypothesis for models 1, 2, 3, 4, and 5. Consistent with other sub-sectors, model 1 still shows the highest BIC providing weak support for this model. Also, models 2 and 5 show the second lowest value of BIC providing strong support for these models.

Results in 2008

Table 13 Probit model results, dependent variable: dummy for declaring credit constraints (aggregate)- 2008

	Model 1	Model 2
LEV	0.514 (1.050)	0.507 (1.047)
ACID	0.000 (0.000)	0.000 (0.000)
EBS	1.134 (0.571)**	1.099 (0.571)***
ASSET	-3.266 (0.578)*	-3.266 (0.579)*
CASH	0.339 (0.377)	0.335 (0.378)
PAV	-0.183 (0.403)	-0.155 (0.412)
RD		-0.343 (0.721)
Const	38.332 (6.686)*	38.337 (6.705)*
Pseudo R2	0.798	0.798
LR (chi2)	229.010	229.250
Prob	0.000	0.000
Goodness-of-fit test		
Pearson (chi2)	891.120	791.980
Prob	0.000	0.000
Log likelihood	-29.058	-28.940
AIC	0.287	0.294
BIC	-1290.095	-1284.805
Correctly classified	97.61%	97.61%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 13 shows the results for the different specifications with aggregate data in 2008. The first model shows the effects on the probability that companies need credit for expenditure only by analysing the financial ratios as independent variables. The result shows that ASSET has a negative and statistically significant effect with the dummy of declaring credit constraints. However, our measure of profitability EBS has a positive and statistically significant estimate. In the Italian case, in 2003, which was analysed by Scellato and Ughetto (2009), they found that ASSET and EBS have positive and negative correlations with the dependent variables, which is contrary to our findings where we obtained negative and positive estimates, respectively. This implies that as firms' assets increase, firms require less credit as assets are less exposed to financial constraints. Nevertheless model 2, which analyses the R&D expenditure effects on the probability of desiring more credit, failed to show a significant effect which would be consistent with Scellato and Ughetto (2009). The estimated marginal effect is equal to 1.099, which means that the probability of firms requiring more credit participation is about 1.099 higher when firms' assets increase in the second model.

Table 14 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (aggregate)- 2008.

	Model 3	Model 4	Model 5
LEV	0.548 (1.063)	0.541 (1.065)	0.514 (1.050)
ACID	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
EBS	1.219 (0.614)**	1.203 (0.656)***	1.134 (0.571)**
ASSET	-3.272 (0.578)*	-3.272 (0.579)*	-3.266 (0.577)*
CASH	0.339 (0.377)	0.339 (0.377)	0.339 (0.377)
PAV	-0.183 (0.403)	-0.183 (0.403)	-0.183 (0.403)
RDS	0.962 (7.149)		
RDTA		2.984 (23.182)	
RDINV			7.48e-11 (2.64e-10)
Const	38.387 (6.691)*	38.381 (6.694)*	38.332 (6.686)*
Pseudo R2	0.798	0.798	0.798
LR (chi2)	229.050	229.030	229.010
Prob	0.000	0.000	0.000
Goodness-of-fit test			
Pearson (chi2)	890.880	893.300	891.120
Prob	0.000	0.000	
Log likelihood	-29.039	-29.048	-29.058
AIC	0.295	0.295	0.295
BIC	-1284.607	-1284.589	-1284.569
Correctly Classified	97.61%	97.61%	97.61%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 14 reports different ratios of R&D expenditure on total assets, sales and investments at aggregate level. The results demonstrate that in none of models 3, 4 and 5 these variables are not statistically significant. This is consistent with the Italian case. This shows that at aggregate level, firms in 2008 were not requiring external financial resources and they were not ready to borrow from external resources to invest in R&D. This is consistent with the result in 2005 before entering Basel II.

Moreover, in the Italian case in Scellato and Ughetto (2009), EBS was found to have a negative and statistically significant effect correlated with the probability of requiring more credit. On the other hand in Malaysia we find a positive and statistically significant coefficient for models 3, 4, and 5, respectively. This shows that the profitability ratio in Malaysia is less exposed to financial constraints compared with the Italian case.

In order to analyse the marginal effects, since only EBS and ASSET appear to be statistically significant, we will analyse the marginal effect of the additional EBS and ASSET on the probability of firms requiring more credit. The estimated marginal effects are 1.219 and -3.27, respectively in model 3. We are unable to explain the marginal effects of R&D intensity measurements since they are not statistically significant in these models.

In addition, in terms of goodness of fit test, we failed to get a good fit in the aggregate model in 2008 which is the same result we got in 2005. This result can be shown by the Pearson's test which rejects the null hypothesis for all models at aggregate level for 2008.

Table 15 Probit model results, dependent variable: dummy for declaring credit constraints (sub-sector 1)-2008

	Model 1	Model 2
LEV	0.299 (0.466)	0.300 (0.466)
ACID	0.001 (0.001)	0.001 (0.001)
EBS	-0.343 (0.212)	-0.342 (0.214)
ASSET		
CASH	0.123 (0.296)	0.118 (0.298)
PAV	0.104 (0.304)	0.095 (0.308)
RD		0.077 (0.422)
Const	-0.984 (0.345)*	-0.987 (0.346)*
Pseudo R2	0.065	0.065
LR (chi2)	7.220	7.260
Prob	0.205	0.298
Goodness-of-fit test		
Pearson (chi2)	98.930	98.940
Prob	0.318	0.292
Log likelihood	-52.332	-52.315
AIC	1.178	1.198
BIC	-322.682	-318.120
Correctly classified	77.78%	77.78%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 15 shows the results for the different specifications by sector. We have to drop one independent variable that is ASSET since the model predicts ASSET perfectly. This first sub-sector shows the same results as sub-sector 2 in 2005 and in the Italian case, where R&D expenditures did not have a statistically significant influence in the probability of desiring more credit. In addition, none of the financial ratios are statistically significantly correlated with the dependent variable in the first and second models. However, we have successfully proven that models 1 and 2 have a good measure of fit from the Pearson's test. Again, in Table 15, introducing irrelevant variables (those that are not statistically significant) helps to explain the robustness of our result that, in models 1-2, R&D expenditures are not statistically significantly to influence the probability of desiring more credit.

Table 16 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (sub-sector 1)-2008.

	Model 3	Model 4	Model 5
LEV	0.317 (0.468)	0.303 (0.468)	0.314 (0.469)
ACID	0.001(0.001)	0.001 (0.001)	0.001 (0.001)
EBS	-0.307 (0.237)	-0.315 (0.239)	-0.313 (0.238)
ASSET			
CASH	0.124 (0.297)	0.139 (0.297)	0.125 (0.296)
PAV	0.092 (0.307)	0.0629 (0.307)	0.100 (0.304)
RDS	10.470 (49.392)		
RDTA		60.242 (60.366)	
RDINV			0.058 (0.275)
Const	-0.987 (0.345)*	-0.997 (0.346)*	-0.986 (0.345)*
Pseudo R2	0.066	0.076	0.065
LR (chi2)	7.400	8.470	7.290
Prob	0.286	0.206	0.295
Goodness-of-fit test			
Pearson (chi2)	98.630	99.190	98.760
Prob	0.299	0.286	0.296
Log likelihood	-52.244	-51.709	-52.299
AIC	1.197	1.186	1.198
BIC	-318.262	-319.333	-318.153
Correctly Classified	77.78%	78.79%	77.78%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 16 shows the results for the first sub-sector that might influence the three measurements of R&D intensity. However, the results show that none of R&D intensity measurements are statistically significant in models 3, 4, and 5. However, we found that the models have a good measure of fit by the Pearson test, and the AIC (Akaike Information) and BIC criteria.

Table 17 Probit model results, dependent variable: dummy for declaring credit constraints (sub-sector 2)-2008

	Model 1	Model 2
LEV	-0.620 (1.042)	-0.189 (1.114)
ACID	-0.019 (0.027)	-0.021 (0.027)
EBS	-1.741 (1.024)***	-1.466 (1.058)
ASSET		
CASH	0.198 (0.339)	0.231 (0.345)
PAV	-0.840 (0.347)**	-0.894 (0.355)**
RD		-0.781 (0.726)

Table 17 (Cont.)

Const	0.205 (0.484)	0.144 (0.491)
Pseudo R2	0.168	0.183
LR (chi2)	15.010	16.380
Prob	0.010	0.012
Goodness-of-fit test		
Pearson (chi2)	73.610	70.490
Prob	0.458	0.529
Log likelihood	-37.189	-36.509
AIC	1.093	1.102
BIC	-244.590	-241.582
Correctly classified	78.48%	79.75%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 17 shows the second sub-sector. We have to drop one independent variable that is ASSET since the model predicts ASSET perfectly. The first model shows that EBS has a negative and significant influence in the dependent variable. In addition, the intangible asset (PAV) has a negative and statistically significant influence in the dependent variable. A negative sign of PAV shows that firms that spend on intangible assets are less exposed to financial constraints. Besides, the other financial ratios such LEV, ACID, and CASH are not statistically significant. However, the second model failed to prove the effect of R&D expenditures on the dependent variable which is similar to the result at aggregate level, the first sub-sector and the Italian findings.

In the second sub-sector, the estimated marginal effects of PAV are -0.840 and -0.894 in models 1 and 2, respectively. It shows that firms spend less on intangible assets when they require more credit.

Table 18 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (sub-sector 2)-2008.

	Model 3	Model 4	Model 5
LEV	-0.641 (1.057)	-0.622 (1.056)	-0.543 (1.050)
ACID	-0.023 (0.028)	-0.023 (0.028)	-0.022 (0.028)
EBS	-1.501 (1.057)	-1.495 (1.057)	-1.485 (1.057)
ASSET			
CASH	0.203 (0.346)	0.205 (0.346)	0.226 (0.345)
PAV	-0.837 (0.353)**	-0.841 (0.353)**	-0.854 (0.352)**
RDS	-3330.870 (7302.815)		
RDTA		-4041.956 (7495.566)	
RDINV			-79.367 (139.066)
Const	0.244 (0.494)	0.240 (0.493)	0.209 (0.491)
Pseudo R2	0.192	0.191	0.187

Table 18 (Cont.)

LR (chi2)	17.160	17.080	16.730
Prob	0.009	0.009	0.010
Goodness-of-fit test			
Pearson (chi2)	68.220	68.340	69.130
Prob	0.604	0.601	0.574
Log likelihood	-36.119	-36.157	-36.334
AIC	1.092	1.093	1.097
BIC	-242.362	-242.287	-241.931
Correctly Classified	75.95%	77.22%	77.22%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis

Table 18 shows the results for the second sub-sector which include the measures of R&D intensity. The results failed to prove a statistically significant effect of all three measurements of R&D intensity on the companies' probability of requiring more credit. Only PAV has statistically significant and negative coefficient estimates. However, all models show negative estimated values. Nevertheless, the other four financial ratios LEV, ACID, CASH and EBS are not statistically significant. The result is consistent with the Italian case, at aggregate level and with the first sub-sector, where we failed to prove the relationship of R&D intensity measurement on the dependent variable. All the models for sub-sector two show a good measure of fit as shown by Pearson chi-squares test. Besides, model 1 shows the highest value of BIC compared with the other four models. The difference of deviance residuals between models 1 and 2, models 2 and 3, models 3 and 4, and models 4 and 5 are 1.36, 0.78, 0.076, and 0.354, respectively.

Table 19 Probit model results, dependent variable: dummy for declaring credit constraints (sub-sector 3)-2008

	Model 1	Model 2
LEV	1.626 (2.055)	2.053 (2.302)
ACID	-0.032 (0.061)	-0.052 (0.150)
EBS	2.527 (1.448)***	2.526 (1.497)***
ASSET	-3.173 (0.884)*	-3.507 (1.114)*
CASH	-0.424 (0.664)	-0.756 (0.787)
PAV	2.609 (1.139)**	3.067 (1.368)**
RD		-1.183 (1.102)
Const	39.218 (11.041)*	43.504 (14.096)*
Pseudo R2	0.731	0.746
LR (chi2)	59.570	60.860
Prob	0.000	0.000
Goodness-of-fit test		
Pearson (chi2)	41.110	34.540
Prob	0.993	0.999

Table 19 (Cont.)

Log likelihood	-10.989	-10.344
AIC	0.493	0.503
BIC	-261.192	-258.193
Correctly classified	94.52%	95.89%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 19 analyses the third sub-sector. The results show that ASSET, EBS and PAV are statistically significant with estimated values of -3.173, 2.527, and 2.609, respectively as shown in model 1. Besides, model 2 shows that RD is not statistically significant, whereas other variables as in model 1 remained statistically significant.

The estimated marginal effect shows the probability of acquiring more credit when PAV increases from zero to one, and it is 2.609 for model 1, whereas the estimated marginal effect of PAV in model 2 is 3.067.

Table 20 Probit model on the effects of R&D intensity measures, dependent variable: dummy for declaring credit constraints (sub-sector 3)-2008.

	Model 3	Model 4	Model 5
LEV	1.578 (2.032)	1.619 (2.059)	1.641 (2.079)
ACID	-0.031 (0.055)	-0.032 (0.061)	-0.034 (0.070)
EBS	2.482 (1.441)***	2.524 (1.448)***	2.537 (1.457)***
ASSET	-3.095 (0.872)*	-3.165(0.903)*	-3.223 (0.926)*
CASH	-0.358 (0.668)	-0.416 (0.691)	-0.485 (0.710)
PAV	2.504 (1.137)**	2.598 (1.170)**	2.686 (1.195)**
RDS	67.032 (168.939)		
RDTA		8.604 (213.575)	
RDINV			-1.91e-09 (7.03e-09)
Const	38.214 (10.889)*	39.115 (11.287)*	39.871 (11.604)*
Pseudo R2	0.733	0.731	0.731
LR (chi2)	59.800	59.570	59.640
Prob	0.000	0.000	0.000
Goodness-of-fit test			
Pearson (chi2)	42.100	41.280	39.570
Prob	0.988	0.991	0.995
Log likelihood	-10.874	-10.988	-10.953
AIC	0.517	0.520	0.519
BIC	-257.133	-256.904	-256.974
Correctly Classified	94.52%	94.52%	94.52%

Note: *,** and *** indicate statistically significant at 1%, 5% and 10% levels, respectively. Standard errors are given in the parenthesis.

Table 20 shows the third sub-sector analysis of R&D intensity measurements. These results are consistent with those at aggregate level in Italy, and at aggregate level and all sub-sectors in 2005 and 2008 (except for sub-sector 1 in 2005) in Malaysia. Besides, model 3 shows that ASSET, EBS and PAV are statistically significant with estimated values of -3.095, 2.482, and 2.504, respectively. Similarly, model 4 shows that ASSET, EBS and PAV are statistically significant. However, model 5 shows that only ASSET, EBS and PAV are statistically significant. The estimated marginal effects on PAV in models 3 and 4 are 2.504 and 2.598, respectively.

All models for sub-sector 3 in 2008 are a good fit with the data according to Pearson chi-square statistic with values of 41.110, 34,540, 42.100, 41.280, and 39.570 for models 1, 2, 3, 4, and 5, respectively. BIC also shows that model 1 again has the highest value (-261.192) compared to other models for sub-sector 3 in 2008. Overall, we conclude from Pearson´s test that we have a better fit in our models when disaggregating the data than at aggregate level.

CONCLUSIONS

In this paper we show support for three main hypotheses in Malaysia. First, that both in 2005 and 2008 (before and after the implementation of Basel II), firms do not borrow from external resources in order to build R&D expenditure strategies. The only exception is when we analyse firms with large investments in capital (subsector 1) in 2005, where we find statistically significant relations for R&D intensity of total assets. Therefore, we argue that firms obtain financial resources from external sources for assets purposes rather than for investment and sales strategies. Second, our results also show support for the fact that the relationships of intangible assets in Malaysia are negatively correlated with the probability of firms requiring more credit for sub-sector 2 (firms less intensive in capital) in 2008. This shows that firms operating in industries which are characterized by a lower incidence of intangible assets are less exposed to financial constraints. Finally, for sub-sector 3 (firms for which we have data on default rates) in 2008, we show that intangible assets in these companies are more exposed to financial constraints.

Our findings are consistent with those of Scellato and Ughetto (2009) in Italy, where it was found that R&D expenditure is not important for Italian firms requiring financial resources as they can provide internal resources.

As a policy measure recommendation, our results support the hypothesis that Basel II was not able to change the way that firms in Malaysia face the issue of how to deal with R&D expenditures, since both before and after Basel II, firms go on not borrowing from external resources in order to build R&D expenditure strategies. Therefore Basel II was not able to change firm´s financing patterns in relation to R&D. This should be taken into account by policy makers when deciding the risk and capital management requirements in the banking system and the consequences that they imply in firm´s financing patterns.

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