Impact of the Basel I Accord on Credit Expansion in Developing Countries

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In this paper, we have attempted to conduct a mean-test to determine if the Basel I Accord had any significant effect on bank activities. The mean-test indicates that it had significant impact on bank activities. We find that the Accord was successful in raising the capital ratios and equity of banks, paving the way for the financial soundness of commercial banks. Our findings also show limited evidence supporting the "risk-retrenchment" hypothesis. Given that our samples consist of both developed and developing countries, the study finds some evidence of "credit crunch" in developing countries also. Capital regulations resulted in a decline in bank lending.

Keywords: Basel I Accord, Credit Crunch, Capital Requirement, Capital Regulations, Bank Lending and Developing Countries

JEL Classification: E05 Monetary Policy, Central Banking, and the Supply of Money and Credit; G02 Financial Institutions and Services; G 15 International Financial Markets; G28 Government Policy and Regulation

1. Introduction

The Basel I Accord was adopted by the G-10 countries in 1988. The primary objective behind such a worldwide application was to promote the soundness, strengthen the stability of international banking system, and to set up a fair and a consistent international banking system in order to decrease competitive inequality among international banks. It was expected that such stability of the banking sector, will foster economic growth with the help of a better-functioning financial system. The key attainment of Basel I have been to define bank capital and the so-called required bank capital ratio that is sensitive to risk. In order to set up a minimum risk-

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based capital adequacy applying to all banks and governments in the world, banks that operate internationally are required to maintain a minimum amount (8%) of capital based on a percent of risk-weighted assets. The believed motivation for an international bank-capital agreement arose from bank regulators' concern over increased bank risk during the 1980's. Even though there were convincing arguments for Basel Accord, there were concerns in developed countries of possible negative impact in the initial phase of its implementation. The concerns have also been expressed for less developed countries where the possible negative impact of capital requirements seems to be more relevant, given a larger role of banking system in emerging countries. From theoretical and empirical point of view, capital requirements lead to a sudden contraction of bank lending. In other words, the fixed minimum requirement of capital changes the behavior of banks to shrink their balance sheets and in effect, it creates a slowdown in the growth of economy. In recent times, the Third World debt crisis, growth in off-balance-sheet activities, deregulation of deposit interest rates, rapid technological change, and increasing international bank competition eroded the capital bases of international banks. During the 1990's and early 2000's, some concerns were expressed regarding several probable adverse impacts of the Basel I like capital regulations. Over the years, this debate centered around two key questions (IMF, Survey): The first question is what is the reaction of banks' behavior to such an Accord, which entails a capital charge of the risks they take? Specifically we want to know about changes in the lending behavior of banks. Will the banks reduce lending in response to higher required capital? The second question is, central to what is now popularly known as "credit crunch" literature. This part deals with the impact of reduced lending on economic growth. Will a slowdown in lending due to capital regulation also slow down economic growth? If the evidences of such "credit crunch" are true, then the policy makers need to be careful when they adopt and implement capital regulations. The macro-economic side-effect of such impact should also be examined to check the desirability of capital regulations. Wagster (1999) studies the 1989-1992 credit crunch by investigating and studying changes in balance-sheet accounts and the systematic risk of banks from five countries. Banks in Canada, the United Kingdom, and the United States experienced an asset reallocation from loans to securities and an increase in systematic risk. He also finds that the Basle Accord may have given Canadian, British, and German banks a competitive advantage over U.S. banks; it may have failed to reduce the risk of international banks; and, for U.S. banks, no straightforward relationship is found between attaining balance-sheet target ratios and reducing bank systematic risk.

The major objective of the present study is to examine the impact of capital regulations on bank lending by using a very large panel data set using the systems of Peek et al. (1995) and Berger et al. (1994). The former's framework used to test the short-run impact of Basel I; while the latter's framework, being of a long-run nature, has been used to examine the time dimension of risk-based capital, which thus allows us to test the structural change regarding banks' overall loan supplies. We examine a different but a related topic, namely, the impact of capital regulations (minimum capital requirements) from a different perspective such as: (i) the lending behavior of banks, (ii) several variables representing equity; loan; and profitability, and (iii) the risk sensitivity of loans. Finally, because banking sectors from emerging market countries differ from one another in many respects, we take into account

international (as well as inter-temporal) dimensions with the help of panel analyses, and by including control variables for year and macro-economic effects. Our study will contribute to body of knowledge now extant in the literature.

Following Introduction in Section one, the paper is organized as follows. Section two presents literature review. Section three discusses the model, Section four presents empirical results, and finally Section five concludes the study.

2. Literature Review

Myers et al. (1984) points out that banks may prefer to shrink rather than issue new equities, due to asymmetric information and "lemons" problems. When banks face a constraint of capital for the loans they want to offer, they must raise new capital. Nonetheless, asymmetric information and "lemons" problems may prevent them from issuing new capital. Holmtrom et al. (1997) provides evidence revealing the importance of capital as determinants of investment, monitoring, and interest rates, and the importance of capital in terms of macro-economic implications, especially with regard to banks. As a result of such difficulties associated with raising new capital and the concomitant importance of the role of capital in the decision-making of banks, they may decrease lending in response to capital regulation. This constitutes the central argument of the "credit crunch" aspect. Notwithstanding the above argument and evidence on "credit crunch," banks may respond positively to capital requirements and increase – rather than decrease – capital and bank lending. Recent work by Chami et al. (2001) revealed that banks were more likely to expand their lending to meet pent-up demands for credit, and risk punishments from other banks. Using the data from New Jersey during 1991-1992, Bernanke et al. (1991) demonstrated that loan growth at individual banks during the 1991-1992 was positively linked to initial capital ratios. They also found evidence that declines in bank capital have contributed to the slowdown in lending, which is consistent with 'capital crunch' hypothesis. They cautioned that the magnitude of the effect is insignificant but also not extremely large either. Peek et al. (1995) found the same kind evidence of "credit crunch" for similar period of time by focusing on bank deposits. In addition, the results of several studies on Japanese banks (Ito & Sasaki, 1998; Kim & Moreno, 1994; Woo, 1999; Honda, 2002) show that the impact of Basel I on Japan was similar to that of the United States.

Berger et al. (1994) investigated the impact of risk-based capital adequacy on credit crunch in the United States as well as some alternative explanations of credit decline of early 1990s. They compared how bank portfolios changed in the early 1990s from the 1980s and how these changes were related to key variables related with risk based capital and other variables (large banks, banks with weaker capital ratios, and banks supervised by the Office of the Comptroller of Currency). Their findings indicate that the risk based capital related credit crunch hypothesis fares the worst of all the alternative explanations of the bank credit reallocation of the 1990s. On the other hand, macro-regional effects dominate the other factors behind the credit decline. With respect to the emerging market countries, Chiuri et al. (2001) argued that the introduction of higher minimum bank capital requirements may well induce a contraction of bank credit, and aggregate slowdown. Their sample includes 16 emerging countries, 10 of which experienced both regulatory change and financial crises; another five were non-crisis countries. This study confirms the existence of "credit crunch." On the other hand, Barajas et al. (2005) did not find any

solid evidence of a Basel-induced credit crunch in Latin America. Watanabe (2004) analyzes the impact of prudential regulation in slowing down credit expansion, countering the effectiveness of monetary policy in stimulating economic conditions in Japan. Stagnation in Japan persisted during the last decade despite monetary easing, as evident by "zero interest rate policy" since February 1999, which proved to be ineffective. Over the years, quite a few scholars have studied the impact of capital regulations intensively. Aggarwal et al. (1998, 2001) and Jacques et al. (1997) dealt exclusively with the impact of such regulations on the risk-taking behavior of commercial banks and changes in capital ratios. One of the major objectives of Basel was to increase the capital ratios of undercapitalized banks. These studies on developed countries find that the basic relationship between risk-taking and capital ratios was negative. They also find that such regulations increase the capital ratios of undercapitalized banks. Van Roy (2005) later found evidence that risk-taking by commercial banks and capital ratios were negatively related in developing countries, confirming the earlier findings in the literature. Hussain and Hassan (2004) reports similar results, and also noted that the impact of Basel I fell short of expectations (i.e., did not increase the capital ratios of banks).

3. Model Description

To fulfill the objectives of this paper, we identify the countries in the emerging market region who adopted the Basel I Accord, and make note of when it was adopted. We rely on IMF (2003) and World Bank surveys of bank regulations for this. We construct a database of individual banks from 1987 to 2004 to test for structural changes *vis-à-vis* banks' overall loan supplies. We adopt the following equation from Peek et al. (1995) and Chiuri et al. (2001) to test the hypothesis. We propose the use of countrywide dummy variables (given by vector X) to account for countrywide heterogeneity.

$$dD\tau/A\tau\text{-}1 = a_0 + a_1 TC\tau\text{-}1/A\tau\text{-}1 + (a_2 + a_3 TC\tau\text{-}1/A\tau\text{-}1)dTC\tau/A\tau\text{-}1 + a_4 \log(A\tau) + a_5 \log(ROA\tau) + a'jX + a'iDy\tau + \varepsilon D \quad \ldots\ldots(1.1)$$

with $\tau = (t\text{-}1, t, t+1)$,

$$dL\tau/A\tau\text{-}1 = b_0 + b_1 TC\tau\text{-}1/A\tau\text{-}1 + (b_2 + b_3 TC\tau\text{-}1/A\tau\text{-}1)dTC\tau/A\tau\text{-}1 + b_4 \log(A\tau) + b_5 \log(ROA\tau) + b'jX + b'iDy\tau + \varepsilon L \quad \ldots\ldots(1.2)$$

with $\tau = (t\text{-}1, t, t+1)$,

Superscript "d" represents the change over the previous period. The variables TC represent total capital, D represents total deposit and L indicates total loan. These are normalized by the beginning of period assets, to reduce the potential heteroscedasticity problems with the error term. This is widely used in the literature. εD and εL are normal i.i.d. random errors in the deposit and loan equations, respectively. The vector $Dy\tau$ consists of year dummies, which use the year preceding the enforcement as a reference category. This controls for year-wise heterogeneity of the panel data set. As bank-specific variables, we include both log (A) (as the natural logarithm of the total assets of banks) and *ROA* (or the return on assets). The coefficient a_2 captures the effect of a change in initial total capital over total assets on current deposit, over initial total assets where log of total assets and country/time varying act as controls. The impact of a change in total capital on current deposit over initial capital is shown by a_3 for undercapitalized banks.

In the second equation, b_2 represents the impact of a change in the ratio of initial total capital over total assets on current loan over initial total assets. As with the first equation, the coefficient b_3 measures the same impact but for an undercapitalized bank. In the next step, the time dimension of risk-based capital is examined by using the framework of Berger et al. (1994). We implement the two modifications of the original Berger et al. (1994) approach, as proposed and adopted by Barajas et al. (2005) The first modification involves longer sample period compared to the original Berger et al. (1994) approach, which places emphasis on the longer-term impacts of Basel I. In the second modification, Barajas et al. (2005) examine both the composition of bank assets and the real growth rate of loans.

In order to assess whether there is a significant change in means, between the spread post-Basel periods in bank capital and lending, we initially regress each variable on an intercept variable:

$$V_{ijt} = BASELYR_{jt} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1.3)$$

Vijt represents the ratio of equity to total assets (*EQTA*), total capital ratio. (*TOTCAPRAT*), the ratio of net loans to total assets (*NLOANTA*), the real annual growth rate of loans (*LOANGROWTH*), return on assets (*ROA*), and net interest margin (*NIM*). Sub-indices *i*, *j*, and *t* stand for bank, country, and year, respectively, and *BASELYR* is a dummy variable for the adoption year of each country.

In line with the approach taken by Barajas et al. (2005), we run the following tests: (i) an OLS regression across countries and time, (ii) a fixed-effect regression with bank-specific intercepts, (iii) a regression that includes only country dummies, and (iv) a regression that includes a relative measure of financial development, *FINDEV*, as well as its interaction with *BASELYR*. In the next step, we utilize a specification similar to Berget et al. (1994) and Barajas et al. (2005), in order to test if loan supply declined in the wake of the implementation of Basel regulations. Bank loans are assumed to respond to lagged risk factors; if risk increases, banks decrease their lending activity. It can be argued that banks with higher levels of risk would tend to adjust by having a smaller loan portfolio on average, compared to safer banks. This is the "risk retrenchment" hypothesis discussed by Berger et al. (1994).

We examine the following model to work with the hypothesis:

$$V_{ijt}=\alpha_0+\alpha_1 BASELYR_{jt}+\alpha_2 RISK_{ijt-1}+\alpha_3 BASELYR_{jt}.Risk_{ijt-1}+\alpha_4 X_j \ldots\ldots\ldots\ldots \quad (1.4)$$

We alternatively use two dependent variables: the loan-asset ratio (*NLOANTA*) and growth rate of loans (*RLOANGROWTH*). Also included are three risk measures: capital ratio (*EQTA*), the ratio of nonperforming loans to total loans (*NPFRAT*), and a proxy for credit risk measure (*RWATA*) (i.e., risk-weighted assets divided by total assets). Our macro-economic controls are the real growth rate of GDP (to capture changes in loan demand), and the annual change in the inverse money velocity (to capture shifts in the public's demand for bank deposits). This is calculated as the absolute annual change in the ratio of money and quasi-money to GDP. The coefficient of *BASELYR*RISK* (α_3) measures the impact of the Basel I Accord on the marginal impact of risk. A positive value for this coefficient will imply that banks decreased loans even more in response to a drop in capital, which will confirm risk retrenchment. For the other variable measuring risk (the ratio of non-performing loans to total loans), a negative value of α_3 will imply that banks contract loans in

response to a rise in credit risk. If the value of coefficient α_1 is negative, then we can conclude – regardless of their risk characteristics – those bank in the emerging market countries experienced a loan contraction following Basel.

4. Empirical Findings

Table 1.1-a presents summary statistics of the key variables included in the study. Different columns of the table show the mean, standard deviation and the number of observations. Table 1.1-b. shows the names of the countries included in the study and the number of banks included from each country. We have 32 countries with a grand total of 359 banks. The largest number of banks comes from USA with a share of 13 percent of the grand total of banks. This is closely followed by France with 11 percent of the grand total. So, the data base we choose is a large panel data-set. Table 1.1 presents summary statistics for the important variables use in this paper. Table 1.2 presents the estimates of equations (1.1) (column (2)) and (1.2) (column (3)), based on a fixed effect with bank-specific intercepts. Column (2) of the table shows that the sign of the coefficient of the change in total capital, divided by the total assets variable, is significant and positive. This implies that a change in deposit scaled by total assets is positively associated with a change in the bank capital endowment.

For the interaction term between total capital and change in total capital – each scaled by total assets– we find a negative and significant coefficient. Given the set-up of the Peek and Rosengren (1995) model, this coefficient implies that as the interaction term increases for undercapitalized banks, the total deposit divided by total assets of the last period decreases.

Column (3) of Table 1.2 presents the estimates of equation (1.2). In this case, we find both the coefficients of total capital divided by total assets and the interaction variables are significant and positive. As a result, we do not find evidence in this case to support a "credit crunch." In summary, evidence by way of these models and in support of the "credit crunch" remains ambiguous. This contradicts the findings of Chiuri et al. (2001), who found evidence in support of the "credit crunch."

Table 1.1-a *Summary Statistics of the Variables used*

Variable (1)	Mean (2)	Standard Deviation (3)	Observations (4)
EQTA	0.121767	0.15666	25632
TOTCAPRAT	17.47954	28.75076	11534
NLOANTA	50.96548	24.56715	25373
RLOANGROWTH	186.3817	16659.14	21149
ROA	0.735846	6.528802	25426
NIM	4.425397	10.23031	24774
NPFRAT	0.037159	0.07823	11145
RWA	106536.3	485319.5	7871
RWATA	0.037665	2.315992	7869

Table 1.1-b *Countries in the Study*

Observation	Country	No. of Banks	Percentage of Total
1	ARGENTINA	12	3
2	BELGIUM	9	3
3	BRAZIL	24	7
4	CANADA	7	2
5	CHAD	1	0
6	CHILE	4	1
7	COSTA RICA	4	1
8	CROATIA	5	1
9	FRANCE	39	11
10	GERMANY	30	8
11	HUNGARY	4	1
12	INDIA	6	2
13	INDONESIA	11	3
14	ITALY	21	6
15	JAPAN	24	7
16	KOREA REP. OF	6	2
17	MALAYSIA	6	2
18	MAURITIUS	1	0
19	MOROCCO	1	0
20	NETHERLANDS	8	2
21	NORWAY	3	1
22	PARAGUAY	4	1
23	SLOVENIA	3	1
24	SWEDEN	2	1
25	SWITZERLAND	27	7
26	THAILAND	2	1
27	TOGO	1	0
28	TURKEY	11	3
29	UNITED KINGDOM	24	7

Table 1.1-b *Countries in the Study(continued)*

Observation	Country	No. of Banks	Percentage of Total
30	URUGUAY	6	2
31	USA	46	13
32	VENEZUELA	5	1
	Grand Total	**359**	**100**

Table 1.2 *Peek and Rosengren (1995) Model*

The following tables present the estimates of equations (1.1) and (1.2). Fixed effects with bank-specific intercepts were used to obtain the estimates.

	Change in Deposit Divided by Total Assets of Previous Period	**Change in Lending Divided by Total Assets of Previous Period**
	$dD_\tau / A_{\tau-1}$	$dL_\tau / A_{\tau-1}$
(1)	(2)	(3)
$TC_\tau - 1 / A_\tau - 1$	7.06	1.489
	0.343	0.12
	(.000***)	(.000***)
$dTC_\tau / A_{\tau-1}$	7.033	4.997
	0.031	0.01
	(.000***)	(.000***)
$TC_\tau - 1 / A_\tau - 1 * dTC_\tau / A_\tau - 1$	-5.977	0.494
	0.094	0.032
	(.000***)	(.000***)
$\log(A_\tau)$	0.047	0.017
	0.009	0.003
	(.000***)	(.000***)
$\log(ROA_\tau)$	-0.021	-0.003
	0.022	0.007
	-0.328	-0.681
CONSTANT	-0.785	-0.388
	0.109	0.037
	(.000***)	(.000***)

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

In Table 1.3, several alternative dependent variables are presented across the columns: *EQTA, TOTCAPRAT, NLOANTA, RLOANGROWTH, ROA,* and *NIM*. Each panel presents different models: panel A: Year Dummies Only; panel B: Country Dummies Only; panel C: Countries and Year Dummies (Country Dummies Not-Presented); panel D: Fixed Effects with Bank-Specific Intercept; Panel E: Financial Development Model; and Panel F: Financial Development Model Without Interaction. The focus here is on the significant and signs of the dummy variable *BASELYR*, which takes a value of zero before and one after the dummy variable is implemented.

Table 1.3 *Test of Change in Mean before and after Adoption of the Basel I Accord*

Estimates for equation (1.3) are presented here. Alternate dependent variables are presented along different columns with name of the dependent variables in the top cell.

Panel A *Year Dummies Only*						
Dependent Variables	***EQTA***	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
BASELYR	-0.014	-1.437	0.3	-1668.426	0.577	-2.649
	0.004	1.277	0.628	505.269	0.167	0.263
	(.001)***	-0.261	-0.48	(.001)***	(.001)***	(.000)***
t1	0.04	1.923	2.329	1580.586	0.123	3.261
	0.016	7.796	2.492	2292.476	0.663	1.062
	(.012)***	-0.805	-0.93	-0.491	-0.852	(.002)***
t2	0.037	3.783	1.68	1241.707	0.111	3.968
	0.015	7.119	2.344	2032.403	0.625	1.002
	(.013)***	-0.595	-0.72	-0.541	-0.859	(.000)***
t3	0.05	5.06	1.987	1497.805	0.047	4.519
	0.015	7.047	2.301	1952.629	0.613	0.985
	(.001)***	-0.473	-0.86	-0.443	-0.939	(.000)***
t4	0.052	7.577	2.122	1362.057	0.393	5.117
	0.014	7.001	2.271	1920.378	0.605	0.972
	(.000)***	-0.279	-0.93	-0.478	-0.516	(.000)***
t5	0.042	7.14	2.988	3776.775	0.037	3.859
	0.014	6.918	2.218	1900.712	0.591	0.951
	(.003)***	-0.302	-1.35	(.047)**	-0.95	(.000)***
t6	0.04	6.809	2.836	1651.965	-0.029	4.26

Table 1.3 *Test of Change in Mean before and after Adoption of the Basel I Accord*

Panel A *Year Dummies Only*						
Dependent Variables	***EQTA***	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
	0.014	6.928	2.232	1889.837	0.595	0.956
	(.004)***	-0.326	-1.27	-0.382	-0.96	(.000)***
t7	0.042	6.64	2.502	1637.852	-0.29	4.464
	0.014	6.923	2.233	1889.979	0.595	0.957
	(.003)***	-0.338	-1.12	-0.386	-0.626	(.000)***
t8	0.048	8.095	2.115	1614.058	0.259	4.693
	0.014	6.917	2.232	1888.524	0.595	0.956
	(.001)***	-0.242	-0.95	-0.393	-0.664	(.000)***
t9	0.057	9.04	3.076	1631.418	0.245	4.553
	0.014	6.917	2.233	1889.073	0.595	0.957
	(.000)***	-0.191	-1.38	-0.388	-0.68	(.000)***
t10	0.061	10.802	2.16	1606.608	-0.118	4.949
	0.014	6.916	2.233	1888.967	0.595	0.956
	(.000)***	-0.118	-0.97	-0.395	-0.843	(.000)***
t11	0.063	11.755	1.68	1697.744	-0.631	4.693
	0.014	6.917	2.237	1891.693	0.596	0.958
	(.000)***	-0.089	-0.75	-0.369	-0.289	0
t12	0.055	10.173	2.193	1728.096	-0.06	4.323
	0.014	6.929	2.246	1896.157	0.598	0.962
	(.000)***	-0.142	-0.98	-0.362	-0.92	(.000)***
t13	0.065	10.002	0.467	1697.477	0.727	6.518
	0.016	7.319	2.586	2087.276	0.688	1.102
	(.000)***	-0.172	-0.18	-0.416	-0.291	(.000)***
t14	-0.022		-4.538		0.317	-0.426
	0.028		4.504		1.185	1.946
	-0.443		(-1.010)		-0.789	-0.827

Table 1.3 *Test of Change in Mean before and after Adoption of the Basel I Accord*

Dependent Variables	***EQTA***	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
t15	-0.012	-0.7	-0.061	495.159	0.609	-0.417
	0.021	11.715	3.368	3243.523	0.896	1.443
	-0.583	-0.952	(-.020)***	-0.879	-0.496	-0.773
CONSTANT	0.084	10.178	48.359	6.19	0.231	2.395
	0.013	6.764	2.099	1795.552	0.559	0.902
	(.000)***	-0.132	-23.04	-0.997	-0.679	(.008)***

Note: Year 16 is the base year, and its dummy has been dropped from these equations.
Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

Table 1.3 *Panel B*

	EQTA	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
BASELYR	0.009	4.69	-1.389	-2738.185	-5.643	-0.75
	0.005	1.832	0.689	658.777	0.419	0.3
	(.041**)	(.010**)	(.044**)	(.000***)	(.000***)	(.012**)
d1	-0.044	-35.778	4.943	59.722	-2.993	-9.558
	0.01	8.314	1.469	1209.045	0.45	0.628
	(.000***)	(.000***)	(.001***)	-0.961	(.000***)	(.000***)
d2	-0.154	-35.707	-7.612	13.573	-1.689	-15.509
	0.01	3.429	1.575	1298.814	0.39	0.675
	(.000***)	(.000***)	(.000***)	-0.992	(.000***)	(.000***)
d3	-0.03	-23.393	-5.606	-196.884	-3.024	-5.619
	0.009	2.162	1.368	1126.933	0.468	0.585
	(.001***)	(.000***)	(.000***)	-0.861	(.000***)	(.000***)
d4	-0.106	-16.809	24.069	42.311	-2.268	-14.899
	0.011	2.604	1.639	1340.215	0.383	0.702
	(.000***)	(.000***)	(.000***)	-0.975	(.000***)	(.000***)
d5	-0.031	-33.042	10.109	73.29	-2.676	-15.552
	0.009	3.538	1.341	1101.591	0.495	0.574
	(.001***)	(.000***)	(.000***)	-0.947	(.000***)	(.000***)

Table 1.3 *Panel B-continued*

	EQTA	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
d6	-0.06	-22.439	18.96	-198.994	-1.901	-12.046
	0.011	2.831	1.732	1414.502	0.518	0.741
	(.000***)	(.000***)	(.000***)	-0.888	(.000***)	(.000***)
d7	-0.07	-29.067	19.773	-333.134	-3.061	-10.819
	0.012	12.736	1.809	1490.006	0.381	0.777
	(.000***)	(.022**)	(.000***)	-0.823	(.000***)	(.000***)
d8	-0.114	-36.966	7.724	87.249	-3.115	-14.697
	0.009	2.795	1.33	1093.027	0.374	0.57
	(.000***)	(.000***)	(.000***)	-0.936	(.000***)	(.000***)
d9	-0.12	-31.71	6.906	65.012	-2.213	-14.72
	0.009	2.168	1.31	1076.895	0.389	0.561
	(.000***)	(.000***)	(.000***)	-0.952	(.000***)	(.000***)
d10	-0.084	-26.668	2.304	197.312	-2.15	-13.593
	0.009	2.552	1.353	1112.206	0.513	0.602
	(.000***)	(.000***)	(.089*)	-0.859	(.000***)	(.000***)
d11	-0.028	-23.451	8.893	-1941.793	-2.531	-11.443
	0.012	4.518	1.793	1493.742	0.513	0.771
	(.019**)	(.000***)	(.000***)	-0.194	(.000***)	(.000***)
d12	-0.119	-34.252	7.762	74.571	-4.612	-12.355
	0.012	3.239	1.794	1467.621	0.462	0.769
	(.000***)	(.000***)	(.000***)	-0.959	(.000***)	(.000***)
d13	-0.124	-23.953	13.114	-2281.554	-2.68	-13.676
	0.011	2.833	1.613	1354.858	0.448	0.694
	(.000***)	(.000***)	(.000***)	(.092*)	(.000***)	(.000***)
d14	-0.163	-36.157	4.478	1255.729	-3.182	-15.062
	0.01	2.257	1.567	1278.885	0.392	0.672
	(.000***)	(.000***)	(.004***)	-0.326	(.000***)	(.000***)

Table 1.3 *Panel B- continued*

	EQTA	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
d15	-0.107	-30.544	9.864	144.024	-3.916	-14.2
	0.009	2.045	1.372	1130.889	0.381	0.588
	(.000***)	(.000***)	(.000***)	-0.899	(.000***)	(.000***)
d16	-0.18	-37.104	27.551	87.539	-4.037	-15.623
	0.009	1.987	1.332	1094.522	0.48	0.571
	(.000***)	(.000***)	(.000***)	-0.936	(.000***)	(.000***)
d17	-0.17	-37.516	15.764	6189.559	-2.75	-15.277
	0.011	2.7	1.677	1366.647	0.696	0.72
	(.000***)	(.000***)	(.000***)	(.000***)	(.000***)	(.000***)
d18	-0.124	-34.741	10.822	-176.003	-4.977	-13.799
	0.016	6.547	2.41	1931.634	0.751	1.13
	(.001***)	(.000***)	(.000***)	-0.927	(.000***)	(.000***)
d19	-0.067	-31.742	16.409	107.814	-2.686	-14.269
	0.017	5.228	2.691	2211.024	0.472	1.15
	(.000***)	(.000***)	(.000***)	-0.961	(.000***)	(.000***)
d20	-0.131	-30.485	18.199	-263.942	-2.522	-14.492
	0.011	2.456	1.657	1345.805	0.456	0.712
	(.000***)	(.000***)	(.000***)	-0.845	(.000***)	(.000***)
d21	-0.116	-27.745	4.771	50.593	-2.767	-15.565
	0.01	2.586	1.597	1311.589	0.577	0.721
	(.000***)	(.000***)	(.003***)	-0.969	(.000***)	(.000***)
d22	-0.154	-35.94	39.033	23.63	-1.723	-14.832
	0.013	2.821	2.015	1628.366	0.573	0.868
	(.000***)	(.000**)	(.000***)	-0.988	(.003***)	(.000***)
d23	-0.067		10.611	66.329	-2.973	-6.678
	0.013		2.002	1688.778	0.649	0.859
	(.000***)		(.000***)	-0.969	(.000***)	(.000***)

Table 1.3 *Panel B- continued*

	EQTA	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
d24	-0.158	-25.152	16.598	105.5	-2.716	-14.623
	0.015	3.078	2.266	1874.794	0.577	0.972
	(.000***)	(.000***)	(.000***)	-0.955	(.000***)	(.000***)
d25	-0.104	-31.95	11.885	78.563	-2.34	-13.524
	0.013	3.101	1.991	1631.396	1.663	0.864
	(.000***)	(.000***)	(.000***)	-0.962	-0.159	(.000***)
d26	-0.061		17.173	-2639.486	-2.671	-10.493
	0.039		5.805	4951.393	1.461	2.979
	-0.113		(.003***)	-0.594	(.068*)	(.000***)
d27	-0.165		14.838	-2102.192	-5.323	-11.495
	0.034		5.101	4444.323	0.587	2.19
	(.000***)		(.004***)	-0.636	(.000***)	(.000***)
d28	-0.168	-35.537	28.965	-83.175	-1.846	-15.761
	0.014	3.07	2.051	1643.237	0.451	0.88
	(.000***)	(.000***)	(.000***)	-0.96	(.000***)	(.000***)
d29	-0.099	-19.395	-6.01	42.724	-2.148	-3.476
	0.01	3.008	1.575	1312.117	0.369	0.677
	(.000***)	(.000***)	(.000***)	-0.974	(.000***)	(.000***)
d30	-0.126	-32.552	20.805	102.927	-5.7	-12.813
	0.008	1.915	1.291	1061.695	0.513	0.553
	(.000***)	(.000***)	(.000***)	-0.923	(.000***)	(.000***)
d31	-0.065		23.458	257.159	3.527	-10.757
	0.012		1.793	1530.403	0.399	0.77
	(.000***)		(.000***)	-0.867	(.000***)	(.000***)
CONSTANT	0.218	43.921	40.998	2660.043	-5.643	18.145
	0.009	2.593	1.395	1198.703	0.419	0.601
	(.000***)	(.000***)	(.000***)	(.026**)	(.000***)	(.000***)

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

Table 1.3 Panel C *Countries and Year Dummies (Country Dummies not Presented)*

Dependent Variables	***EQTA***	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
BASELYR	-0.009	3.19	-0.675	-3068.008	0.143	-0.734
	0.006	2.095	0.861	787.189	0.247	0.373
	-0.119	-0.128	-0.433	(.000***)	-0.564	(.049**)
t1	0.039	-1.349	1.66	2822.67	0.573	0.881
	0.016	7.709	2.346	2352.075	0.673	1.032
	(.013**)	-0.861	-0.479	-0.23	-0.395	-0.393
t2	0.039	-1.143	-1.084	2304.217	0.485	1.056
	0.015	7.19	2.231	2101.273	0.641	0.985
	(.008***)	-0.874	-0.627	-0.273	-0.449	-0.284
t3	0.049	-0.076	-0.154	2674.01	0.454	1.288
	0.015	7.117	2.203	2041.777	0.633	0.974
	(.001***)	-0.992	-0.944	-0.19	-0.474	-0.186
t4	0.05	2.288	0.13	2513.162	0.728	1.716
	0.014	7.061	2.175	2004.127	0.624	0.961
	(.001***)	-0.746	-0.952	-0.21	-0.243	(.074*)
t5	0.045	1.477	-0.463	4929.041	0.393	0.793
	0.014	7.004	2.135	1984.582	0.613	0.944
	(.002***)	-0.833	-0.828	(.013**)	-0.521	-0.401
t6	0.04	0.393	-0.338	3005.992	0.371	0.777
	0.014	7.044	2.169	1997.154	0.623	0.959
	(.006***)	-0.956	-0.876	-0.132	-0.551	-0.418
t7	0.043	0.823	-1.168	3010.16	0.147	0.885
	0.014	7.041	2.171	1999.698	0.623	0.96
	(.003***)	-0.907	-0.59	-0.132	-0.814	-0.356
t8	0.049	1.679	-1.463	3006.281	0.673	0.931
	0.014	7.039	2.171	1999.298	0.623	0.96
	(.001***)	-0.812	-0.5	-0.133	-0.28	-0.332

Table 1.3 Panel C *Countries and Year Dummies (Country Dummies not Presented)*

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOAN GROWTH*	*ROA*	*NIM*
t9	0.056	2.466	-0.659	3025.389	0.671	0.733
	0.014	7.04	2.172	1999.768	0.624	0.96
	(.000***)	-0.726	-0.762	-0.13	-0.282	-0.445
t10	0.059	4.09	-1.471	3006.187	0.328	0.998
	0.014	7.04	2.173	2000.32	0.624	0.96
	(.000***)	-0.561	-0.498	-0.133	-0.599	-0.299
t11	0.061	4.655	-1.849	3114.323	-0.168	0.833
	0.014	7.045	2.179	2006.186	0.626	0.963
	(.000***)	-0.509	-0.396	-0.121	-0.789	-0.387
t12	0.054	3.144	-1.561	3162.618	0.423	0.553
	0.015	7.068	2.191	2013.512	0.629	0.968
	(.000***)	-0.656	-0.476	-0.116	-0.501	-0.568
t13	0.034	-1.023	0.575	3048.234	1.06	-0.476
	0.017	7.471	2.514	2213.095	0.721	1.106
	(.042**)	-0.891	-0.819	-0.168	-0.141	-0.667
t14	-0.017		-6.827		0.356	-0.429
	0.027		4.134		1.172	1.846
	-0.525		(.099*)		-0.761	-0.816
t15	-0.01	-0.603	-0.126	495.709	0.619	-0.368
	0.02	11.456	3.09	3242.577	0.886	1.369
	-0.634	-0.958	-0.967	-0.878	-0.484	-0.788
CONSTANT	0.184	42.52	41.34	-114.121	3.015	17.385
	0.015	6.923	2.304	2075.867	0.661	1.013
	(.000***)	(.000***)	(.000***)	-0.956	(.000***)	(.000***)

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

In panel A, we present the model for the time dummy variables. We find significant and negative coefficients in the *EQTA*, *NIM*, and *RLOANGROWTH* columns, which means that these variables declined in value in the aftermath of implementing such regulations. On the other hand, *ROA* has a positive sign, which means that *ROA* increased after the implementation of capital regulations.

In panel B, we present models with country dummy variables. Here, we find significant and positive coefficients for the *EQTA* and *TOTCAPRAT* columns. On the

other hand, for *NLOANTA*, *RLOANGROWTH*, *ROA* and *NIM* columns, the coefficients are negative.

In panel C, we present models for country and year dummies; here, there are negative and significant coefficients for the *RLOANGROWTH* and *NIM* columns. Panel D presents models with fixed effects and bank-specific intercept. We have negative and significant coefficients for the *EQTA*, *NLOANTA*, *RLOANGROWTH*, *ROA*, and *NIM* columns. Panel E presents models with financial development variable. We have positive coefficients in the *EQTA*, *TOTCAPRAT*, and *ROA* columns. Panel F presents a model with a financial development variable model, with interaction term. We have negative and significant coefficients for *OANTA*, but in the *TOTCAPRAT* and *ROA* columns, we have positive and significant coefficients.

Table 1.3 Panel D *Fixed Effects with Bank-specific Intercept*

Dependent Variables	***EQTA***	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
BASELYR	-0.001	2.832	-1.066	-5379.466	-0.115	-0.563
	0.003	1.364	0.361	23180.31	0.211	0.268
	(.008***)	-0.159	(-1.774***)	(0815.220***)	(-.530***)	(1.088**)
CONSTANT	0.123	14.794	51.945	-6391.393	0.842	4.942
	0.003	1.303	0.337	21916.94	0.197	0.25
	-0.117	-12.24	-51.283	(-350.830***)	-0.455	-4.452

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

Table 1.3 Panel E *Financial Development Model*

Dependent Variables	***EQTA***	***TOTCAPRAT***	***NLOANTA***	***RLOAN GROWTH***	***ROA***	***NIM***
BASELYR	0.011	3.427	-3.965	-4103.727	0.391	-0.113
	0.004	1.253	0.579	13345.07	0.158	0.246
	(.002***)	(.006***)	(.000***)	-0.758	(.013**)	-0.648
FINDEV	0	-0.054	0.085	-134.054	0.001	-0.032
	0	0.005	0.003	63.788	0.001	0.001
	(.000***)	(.000***)	(.000***)	(.036**)	-0.24	(.000***)
CONSTANT	0.14	21.161	44.635	8320.962	0.262	8.304
	0.004	1.238	0.569	12977.34	0.155	0.242
	(.000***)	(.000***)	(.000***)	-0.521	(.091*)	(.000***)

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

Let us now present the above findings in terms of variables. *EQTA* is positively associated with *BASELYR* in panels B, D, and E, but it is negatively associated with

BASELYR in panel A. As a result, it is concluded that capital regulations have a positive impact on equity of banks – that is, the mean of post-Basel equity was higher than that of the pre-Basel era. The same conclusion can be obtained for *TOTCAPRAT* in panels A, B, D, E, and F. It does appear that Basel and Basel I-like capital regulations did have the desired impact on the banks.

Table 1.3 Panel F *Financial Development Model without Interaction*

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOAN GROWTH*	*ROA*	*NIM*
BASELYR	-0.001	1.584	-0.481	-2077.076	0.188	0.081
	0.002	0.664	0.203	1495.554	0.062	0.128
	-0.464	(.017**)	(.018**)	-0.165	(.002***)	-0.526
FINDEV	-0.001	-0.155	-0.374	10.53	-0.008	-0.047
	0	0.003	0.002	7.149	0	0.001
	(.000***)	(.000***)	(.000***)	-0.141	(.000***)	(.000***)
FINDEV_ BASELY R	0.008	0.008	0.007	0.006	0.009	0.009
	0	0	0	0	0	0
	(.000***)	(.000***)	(.000***)	(.000***)	(.000***)	(.000***)
CONSTANT	0.13	19.229	50.793	-767.793	0.685	6.002
	0.002	0.656	0.2	1454.359	0.061	0.126
	(.000***)	(.000***)	(.000***)	-0.598	(.000***)	(.000***)

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

Let us examine the "credit crunch" literature in terms of *NLOANTA* and *RLOANGROWTH*. *RLOANGROWTH* is negatively associated with *BASELYR* dummy variables in panels A, B, C, and D. On the other hand, *NLOANTA* is negatively associated with *BASELYR* dummies in panels B, D, and F; thus, we do find evidence of a decrease in these loan-related variables in the aftermath of Basel, indicating a supply-driven "credit crunch." These findings are in line with those of Barajas et al. (2005). Based on aforementioned evidence, we can claim that overall, Basel and similar capital regulations resulted in changes of all the included bank specific variables. Given that these variables play a significant role in banks' important decision-making, it can be expected that such regulations profoundly impacted the behavior of banks. This assertion, too, is in line with the findings of Barajas et al. (2005).

In Table 1.4, we present results for tests of the "risk retrenchment" hypothesis. The impact of the Basel I Accord on risk sensitivity will be measured by the interaction between *BASELYR* and the respective risk variable. If banks experienced risk retrenchment after Basel, then the coefficient of the interaction term should be positive in the *EQTA* model and negative in the *NPFRAT* and *RWATA* models. As mentioned, we use two alternate dependent variables (*NLOANTA*, or total loan to

total asset ratio, and *RLOANGROWTH*, or growth rate of loans). Two variations of the models are presented: one with macro-economic variables, and another without.

For the total loans to total assets ratio (column (2)), we find a negative and significant coefficient for capital ratios. This is unexpected evidence against the "risk retrenchment" hypothesis. If banks' lending become more sensitive to risk after adopting capital regulations, the coefficient should be positive. This, however, is not the case; we find that bank lending becomes less sensitive to capital ratios. However, when we use the net-problem loans to total assets ratio and risk-weighted assets as a proxy for credit risk, we get expected results: the signs here should be negative, and indeed they are.

Table 1.4 *Risk Sensitivity and Basel*

The results of equation (1.4) are presented below.

Dependent Variables	***NLOANTA***	***RLOANGROWTH***	***NLOANTA***	***RLOANGROWTH***
BASELYR	4.248	-2279.43	4.345	-2288.281
	0.689	578.164	0.693	607.606
	(.000***)	(.000***)	(.000***)	(.000***)
EQTA	-15.881	-4772.352	-13.95	-5266.119
	3.278	2890.269	3.247	2984.837
	(.000***)	(.099*)	(.000***)	(.078*)
BASELYR _EQTA	-31.173	4662.735	-34.849	5237.732
	3.46	3030.223	3.444	3145.541
	(.000***)	-0.124	(.000***)	(.096*)
CONSTANT	52.318	2364.886	0.007	-0.087
	0.659	556.321	0.002	2.518
	(.000***)	(.000***)	(.000***)	-0.973
INTEREST RATE			0.208	72.108
			0.051	41.036
			(.000***)	(.079*)
GDP GROWTH RATE			-0.025	-0.752
			0.004	5.435
			(.000***)	-0.89
INFLATION			52.33	2204.426
			0.687	601.618
			(.000***)	(.000***)
BASELYR	13.616	3.359	11.285	12.473
	1.169	37.053	1.102	37.793
	(.000***)	-0.928	(.000***)	-0.741

Dependent Variables	*NLOANTA*	*RLOANGROWTH*	*NLOANTA*	*RLOANGROWTH*
NPFRAT	34.852	-92.619	40.786	-55.619
	5.139	156.882	4.852	161.194
	(.000***)	-0.555	(.000***)	-0.73
BASELYR _ NPFRAT	-14.113	-93.644	-10.458	-128.32
	5.906	180.082	5.538	185.547
	(.017**)	-0.603	(.059*)	-0.489
CONSTANT	42.536	31.748	-0.583	1.584
	1.148	36.418	0.018	1.446
	(.000***)	-0.383	(.000***)	-0.273
INTEREST RATE			-0.094	4.092
			0.069	2.405
			-0.175	(.089*)
GDP GROWTH RATE			0.154	-1.361
			0.012	1.646
			(.000***)	-0.408
INFLATION			47.764	10.004
			1.121	38.347
			(.000***)	-0.794
BASELYR	38.212	-90282.26	33.32	-90486.4
	7.233	12834.05	7.126	12904.64
	(.000***)	(.000***)	(.000***)	(.000***)
RWATA	4847.659	-8355030	4664.58	-8382089
	1002.155	1768576	987.421	1779629
	(.000***)	(.000***)	(.000***)	(.000***)
BASELYR _RWATA	-4849.16	8355026	-4665.971	8382100
	1002.156	1768578	987.422	1779631
	(.000***)	(.000***)	(.000***)	(.000***)
CONSTANT	21.905	90318.02	-0.248	-17.52
	7.231	12829.57	0.076	136.327
	(.002***)	(.000***)	(.001***)	-0.898
INTEREST RATE			-0.251	22.244
			0.095	159.541
			(.008***)	-0.889

Dependent Variables	*NLOANTA*	*RLOANGROWTH*	*NLOANTA*	*RLOANGROWTH*
GDP GROWTH RATE			-0.301	-0.291
			0.087	155.032
			(.001***)	-0.999
INFLATION			28.679	90497.76
			7.131	12908.27
			(.000***)	(.000***)

Note: *** Denotes significant at 1% level; ** significant at 5% and * significant at 10%

So, in this case, the banks' contract loans change even more in response to a rise in credit risk in the aftermath of capital regulations. This supports the "risk retrenchment" hypothesis. In columns (3) and (5), we use *RLOANGROWTH* as a dependent variable. As expected, for risk measured with capital ratios, we find positive and significant coefficients. On the other hand, for the non-performing loans to total assets ratio, no significant coefficient is found. For risk-weighted assets, we find positive and significant coefficients; this is unexpected and runs counter to the "risk retrenchment" hypothesis. Therefore, for this part of the analysis, we find only limited support for the "risk retrenchment" hypothesis. There is limited evidence in support of both the "credit crunch" and "risk retrenchment" hypotheses, which is, in accord with the findings of Barajas et al. (2005). Tallman et al. (2000) also found similar evidence for Australian Banks for the period 1986 to 1993. But Berger et al (1994) did not observe any evidence of "credit crunch". They only found limited evidence in support of "risk retrenchment."

5. Conclusion

In this study, using a cross-section database, we have attempted to conduct a mean-test to determine if the Basel I Accord had any significant effect on bank activities. The mean-test indicates that the Accord had a significant impact on bank activities bank capital increased in the wake of adoption of the Accord, loans scaled by total assets and the growth rate of loans decreased for the same period. In view of that, we find that the Accord was successful in raising the capital ratios and equity of banks, paving the way for the financial soundness of commercial banks. At the same time, we further find evidence of "credit crunch." Capital regulations resulted in a decline in bank lending again. Our findings also show limited evidence supporting the "risk-retrenchment" hypothesis. We find that the loans-total assets ratio is negatively related to credit risk – that is, ratios of problem loans to total assets and risk-weighted assets to total assets. We also note that the loan-growth rate was positively related with capital ratios. Therefore, an increase in capital ratios did not result in the cost of a decline in loans. Growth of loan has not been hampered by an increase in capital ratios. During the 1990s and early 2000s, the principles of Basel I have emerged as the core principles of capital regulation regimes around the world, but data on the year of implementation years and stages throughout the world was relatively scarce and remains scattered. One of the limitations of this study is that many developing and emerging market countries have adopted and implemented (or

are at different phase of implementation) a national capital regulation regime. Given our samples that consist of both developed and developing countries, our study presents evidence of "credit crunch" of developing countries as well. Policy makers will benefit if they take into consideration our finding during policy framing / implementations of any capital regulations.

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