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Did the Basel Accord Cause a Credit Slowdown in Latin America?

Many countries throughout the world have experienced significant credit slowdowns in recent years, and researchers have set out to determine the possible causes. One strand of this literature examines postcrisis cases of a marked decline in credit in Scandinavia and East Asia. Some of the more dramatic cases covered include Finland, which lost over 44 percentage points of gross domestic product (GDP) in the banking system's credit to the private sector over the 1992–97 period, and Thailand, which experienced a drop of about 36 percentage points in 1998–2000.[1] Such experiences triggered concern over whether these declines were merely a reflection of depressed economic activity, or whether they resulted from a diminished capacity or increased unwillingness of banks to lend. The latter phenomenon (that is, a supply-driven credit decline) is termed a credit crunch. A number of studies set out to test whether credit crunches had occurred, by estimating a system of supply and demand functions for bank credit and allowing the observed quantity to be determined by the short end of the market.[2] In most of these studies, the findings were more in line with a credit demand contraction than a credit crunch.

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1. See Barajas and Steiner (2002, table 3).

2. See Pazarbasioglu (1997) on Finland; Ghosh and Ghosh (1999) on East Asia; and Woo (1999) on Japan.

A second strand of the credit crunch literature focuses on the experience of the United States in the early 1990s, when credit growth not only declined but was suspected of contributing to the economy's slow recovery. The same aggregate measure used above indicates that the U.S. banking system reduced credit by 13 percentage points of GDP between 1990 and 1993. To the extent that bank credit was not easily substitutable with other sources of finance, such a credit contraction could have contributed to a decline in economic activity. Several studies address these issues and explore whether the credit tightness could be linked to the adoption of the Basel Accord's risk-based minimum capital requirements toward the end of the 1980s. Bernanke and Lown, who analyze the reasons for credit tightness in the early 1990s, find evidence that a so-called capital crunch had occurred and that it played a procyclical role in the subsequent recession.[3] They conclude, however, that the deteriorating financial condition of firms (that is, the balance sheet channel), rather than the depressed supply of credit from capital-constrained banks (that is, the bank lending channel), may have been the major contributor to the ensuing recession. Berger and Udell look at the impact of lagged fundamentals on loan growth; they find evidence that the adoption of the Basel Accord had a negative impact on loan growth overall, but they argue that the evidence does not clearly point toward an increased sensitivity of loan expansion to different measures of risk.[4] Peek and Rosengren find evidence supporting a credit crunch; a bank's initial capital ratio at the time the country adopted risk-based capital requirements played a key role in determining its subsequent lending activity.[5]

Several countries in Latin America and the Caribbean have also experienced large credit slowdowns in the past twenty years. As table 1 illustrates, declines in bank credit took place throughout the region, with many occurring in the 1990s. Many cases featured double-digit reductions in the ratio of bank credit to GDP, with a drop of nearly 16 percentage points in Bolivia and 20 percentage points in Mexico. On an average annual basis, most declines ranged around 1–3 percentage points. A notable exception is the recent experience in Panama, which saw a 16 percentage point decline over the last two years. Furthermore, recent credit

3. Bernanke and Lown (1991).
4. Berger and Udell (1994).
5. Peek and Rosengren (1995).

TABLE 1. Credit Slowdowns in Latin America[a]

Country	*Slowdown period*	*Credit GDP at end of slowdown*	*Difference versus peak*	*Average yearly fall from peak*	*More recent performance*[b]
Recent cases					
Argentina	1999–2000	23.8	–0.4	–0.2	–4.4
Bolivia	1999–2003	39.4	–15.6	–3.9	. . .
Brazil	1995–2002	27.1	–9.7	–1.2	1.8
Colombia	1999–2000	17.9	–4.8	–2.4	0.4
Ecuador	1999–2003	20.0	–11.1	–2.2	. . .
El Salvador	2001–2003	4.7	–0.3	–0.1	. . .
Guyana	1999–2003	34.0	–10.9	–2.2	. . .
Mexico	1995–2001	14.1	–19.9	–2.8	1.1
Panama	2002–2003	82.5	–16.1	–8.1	. . .
Paraguay	1998–2003	13.5	–10.1	–1.7	. . .
Peru	2000–2003	20.3	–7.1	–1.8	. . .
Previous cases					
Chile	1985–91	37.0	–20.2	–3.4	n.a.
Venezuela	1983–95	5.9	–23.4	–1.8	0.3

Source: *International Financial Statistics* and authors' calculations.

. . . Not applicable.

n.a. Not available.

a. The table shows credit to the private sector by deposit money banks, scaled by GDP (that is, the geometric average of GDP in years t and $t + 1$, except for 2003, where that year's GDP is taken).

b. Average annual change from the end of the slowdown period through 2003.

growth has tended to be sluggish even in cases in which the declines ended before 2003.[6]

Barajas and Steiner looked at eight of these Latin American cases (namely, Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela) and examine three of the more recent episodes in detail (specifically, Colombia, Mexico, and Peru).[7] Their study estimated separate supply and demand functions to determine the most probable causes for the credit stagnation. While the study revealed a diversity of experiences, three major common elements emerge across countries. First, both reductions in sources of funds and increases in alternative uses of funds occurred during the credit decline. Second, all three countries studied in detail experienced some degree of contraction in credit supply. In Mexico,

6. In the case of Argentina, we sought to differentiate the credit slowdown period (1999–2000) from the subsequent crisis-related decline in overall intermediation activities caused largely by a substantial deposit outflow in the system (2001–03).

7. Barajas and Steiner (2002).

however, this effect was swamped by the demand-side contraction, and in Colombia the demand and supply contractions were of roughly the same magnitude. Third, the study found certain regulatory and risk-related variables to be significant in explaining the credit supply contraction in all three cases.[8]

One regulatory factor not included in the above study may be asociated to the recent credit slowdowns in Latin America and the Caribbean—namely, the adoption of the Basel Accord. Originally negotiated among the developed countries in 1988, the Basel Accord, or Basel I, established uniform rules for regulating the amount of capital a bank must hold. It defined risk-based minimum capital requirements, which became a major component of banking regulation throughout the world. Weights were established for various categories of assets, and banks were required to hold more capital for categories of assets deemed to be more risky. The Basel Accord also defined the various forms of capital that could be used to meet these requirements.

Many Latin American countries have adopted the Basel Accord since the early 1990s, imposing risk-based minimum capital requirements on their banks. Until recently, data on the timing of adoption throughout the world were relatively scarce and limited to the original G-10 signers of the Accord.[9] We therefore constructed a cross-country database on Basel adoption, based primarily on a mid-2003 survey we conducted in conjunction with desk economists at the International Monetary Fund (IMF). We supplemented the survey with a variety of sources: the World Bank database on Bank Regulation and Supervision, various central bank websites, the IMF Monetary and Financial Systems Department regulatory database, and several research papers that date Basel adoption across individual or groups of countries.[10] The information we compiled indicates that countries in Latin America and the Caribbean began adopting the Basel Accord in 1991 and continued throughout the decade, with most

8. The ratio of loan loss provisions to nonperforming loans is included as a proxy for the severity of regulations on bank risk-taking; credit risk was measured as the ratio of nonperforming loans to total loans.

9. The Group of Ten (or G-10) actually comprises eleven countries: Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States.

10. The World Bank data set provided a yes or no answer to whether the country had adopted the Basel Accord, but not a date of adoption; the most notable of the research papers that provided adoption dates is Chiuri, Ferri, and Majnoni (2002).

adoptions occurring between 1993 and 1997. Our sample covers a total of twenty-four countries in the region, of which twenty-two have adopted the Accord and two have not. We found specific adoption dates for twenty of the countries. This compares with a total of 103 adopting countries in the rest of the world (we have specific adoption dates for seventy-one of them) and nine nonadopting countries.

It is not clear, to date, what impact Basel I has had on bank behavior throughout the world. For example, enhancing bank stability is one of the principal objectives of imposing risk-based capital requirements, but no studies present strong empirical evidence bearing this out. In perhaps the most comprehensive worldwide study on regulation and bank performance, Barth, Caprio, and Levine relate the stringency of capital requirements—of which adherence to Basel I is a key component—to the probability that a country will experience a banking crisis.[11] They find only weak results: although minimum capital requirements are positively related to stability (in that they are associated with a lower probability of crisis), this result is not robust to various specifications in which other regulatory variables are also included.

To the extent that Basel I regulations are binding, one would expect banks to increase their regulatory or risk-weighted capital ratio. Banks can achieve such an increase in three ways: by increasing capital, the numerator; by decreasing total assets, which reduces the denominator; or by shifting the composition of assets toward those with a lower risk weight and away from those with a higher risk weight, which again lowers the denominator. One example might be to reduce commercial loans (with a 100 percent risk weight) in favor of securities (with a zero risk weight). Furthermore, regardless of the lack of substantial empirical evidence, many policymakers appear to behave as if a direct link exists between regulatory capital ratios, credit supply, and—ultimately—economic activity. One noteworthy case is Singapore's recent decision to lower the regulatory capital ratio from 12 percent to 10 percent, in part to encourage lending and thus provide stimulus to the economic recovery.[12]

Many studies have therefore investigated how Basel I affected bank behavior, including the effect on capital ratios and the components (that

11. Barth, Caprio, and Levine (2004).

12. Izham Ahmad, Abdul Hadhi, and Pang Ai Lin, "Singapore to Relax Bank Rules," *Asian Wall Street Journal,* 28–30 May 2004.

is, the numerator and denominator) through which these increases are achieved. One prominent cross-country study surveyed the main empirical evidence available for the early adopters, the G-10 countries.[13] The study showed that banks generally increased their capital ratios by means of a combination of raising new capital and reducing risk-weighted assets, there was also significant and growing regulatory arbitrage, in which banks resorted to securitization to boost their capital ratios. This was particularly true in the United States, where capital markets are highly developed and liquid. Dionne and Harchaoui examine the relation between securitization, regulatory capital ratios, and risk for the Canadian case.[14] Konishi and Yasuda, in turn, focused on bank risk-taking, using risk measures based on bank stock prices in Japan to test the impact of Basel I adoption; they find that adoption reduced risk.[15] Van Roy obtained a similar result in a study of credit risk-taking among the G-10 countries.[16] Finally, Chiuri, Ferri, and Majnoni use the Peek and Rosengren framework to look at the impact of the Basel Accord on credit growth in sixteen emerging markets.[17] They argued that capital-adequacy requirements may have contributed to a credit crunch in countries that experienced a financial crisis; this effect seems to be greatest for those banks that are not well capitalized initially. Their results also support that risk-based capital requirements induce procyclical behavior.

Understanding whether the minimum capital requirements put in place by Basel I contributed to credit slowdowns is important in and of itself, but it is particularly relevant for the future since virtually all adopting countries are contemplating a move toward a second round of regulations, or Basel II. The Bank for International Settlements (BIS) recently promulgated regulations to enhance the effectiveness of the original Basel Accord, with the new regulations scheduled to be implemented in 2006. Countries are now scrambling to understand how the new accord will affect their banking and financial sectors, as well as what it will mean for their economies.[18] Moreover, the Basel II proposal, while containing several innovations over Basel I, retains a heavy reliance on risk-based capi-

13. Basel Committee on Banking Supervision (1999).
14. Dionne and Harchaoui (2003).
15. Konishi and Yasuda (2004).
16. Van Roy (2003).
17. Chiuri, Ferri, and Majnoni (2002).
18. See, for example, Majnoni, Miller, and Powell (2004).

tal requirements.[19] As von Thadden points out, of the 163 pages of the Basel Committee's 2003 Consultative Paper on the new regulations, 132 pages are devoted to minimum capital requirements.[20]

The present study uses our new data set on Basel I adoption in combination with a bank data set spanning 2,893 banks drawn from over 150 countries to examine whether the adoption of the Basel Accord caused banks to reduce their lending activities. We test this hypothesis for the world overall and for Latin America and the Caribbean. Our methodology is based on the Berger and Udell framework, which allows us to test for a structural change in banks' overall loan supply, as well as their sensitivity to risk.[21] As Berger and Udell correctly point out, a true test for structural change requires a sufficient number of both pre- and post-Basel observations. In particular, it requires a sufficiently long control period before the adoption of the Basel Accord against which to test for a change in behavior. In contrast, the Peek and Rosengren framework used by Chiuri, Ferri, and Majnoni relies on only one or two pre- and post-Basel observations and is thus a test of the Basel Accord's short-run impact.[22] Our study thus differs from Berger and Udell in that we use an extensive cross-country panel rather than a single-country experience to test for possible common effects across countries, and it goes beyond the cross-country analysis of Chiuri, Ferri, and Majnoni by incorporating a structural change test that lets us focus on the long-run or permanent impact of the adoption of risk-based capital requirements on bank lending behavior.[23]

We show that the Basel Accord was associated with an average increase in capital and lending activities in Latin America and the Caribbean, as well as throughout the world. With regard to credit crunches, we find little evidence that either the loan-asset ratio or the average growth rate of loans declined after Basel I adoption, but we do find some evidence that loan growth became more sensitive to certain risk factors, which is consistent with the hypothesis of risk retrenchment in the face of increased regulatory scrutiny. In Latin America, this effect primarily shows up

19. Several papers study the possible role of Basel II in exacerbating business cycles. See Ayuso, Pérez, and Saurina (2004); Caterineu-Rabell, Jackson, and Tsomocos (2003); Kashyap and Stein (2004); Estrella (2004); Zicchino (2004).

20. Von Thadden (2004).

21. Berger and Udell (1994).

22. Peek and Rosengren (1995, 1997, 2000); Chiuri, Ferri, and Majnoni (2002).

23. Estrella (2004) provides an analysis of both the short- and long-term impact of capital constraints.

through a heightened sensitivity of loan growth to past shortfalls in equity. Finally, we find that the more financially developed economies tended to undergo a contraction in loan growth after adoption of the Basel Accord. This result, however, is driven mainly by the more advanced countries in Europe, and it weakens considerably when the early adopters of the Accord are excluded from the sample and when we focus only on countries in Latin America and the Caribbean.

The next section summarizes the existing theoretical work on the impact of capital constraints on the optimal behavior of banks. The paper then presents a description of the banking data set, followed by our main empirical results. The final section concludes and discusses policy implications.

The Theoretical Link between Risk-Based Capital Requirements and Asset Allocation

A large literature analyzes the impact of the Basel Accord on bank behavior, as well as on the economy as a whole.[24] This section highlights the key elements for understanding the asset portfolio allocation decision of banks facing risk-based capital constraints. Regulators place capital restrictions on banks to enhance bank safety, with two basic factors in mind. The first key factor involves the presence of deposit insurance and the possible contagion effect arising from bank panics. The existence of deposit insurance creates a moral hazard for the bank's owner relative to the taxpayer, since depositors have little incentive to monitor the asset portfolio decisions of bank managers.[25] This raises the probability of a bank default, which leads to losses for taxpayers. When banks are required to hold more capital, the owners' stake is increased, and the incentive to take excessive risks declines. The second key factor is the possibility of cascading bank failures in a liquidity crisis, as described in Diamond and Dybvig.[26] These concerns led regulators to adopt capital requirements to create a larger cushion against losses to the taxpayer.[27] Initially, these capital regulations

24. Chami and Cosimano (2001) and Barth, Caprio, and Levine (2004) provide recent comprehensive reviews. See also Berger, Herring, and Szego (1995); von Thadden (2004).

25. Kane (1985) documents the role of moral hazard in the savings and loan crisis in the United States.

26. Diamond and Dybvig (1983).

27. Kane (2002) discusses the moral hazard associated with a regulator who is acting as an agent for the taxpayer.

varied from country to country based on internal political and economic forces. Banks, which competed across countries, were concerned about unfair advantages when the capital regulations were less restrictive in one country than in another. As a result, the Basel Accord that was negotiated in 1988 among the G-10 countries sought to unify the capital constraints across countries, rather than introduce new capital requirements.

The risk-based regulation of bank capital can be analyzed in light of what Kane calls the regulatory dialectic, whereby regulation leads to evasion which, in turn, leads to a new round of regulation.[28] Here, the Bank for International Settlements, in conjunction with regulators from G-10 countries, identified a need for uniform regulations so that banks from a specific country did not receive an advantage from lax regulations relative to other countries. As noted above, the initial purpose of the capital-adequacy requirements was to minimize the possibility of bank failures without imposing undue restrictions on positive net-present-value investment projects.[29] However, this leads to a level of equity that exceeds the level the market finds acceptable.[30] The increase in capital generally raises the bank's operating costs, which engenders incentives for the banks to develop ways to evade or circumvent the regulations. This behavior is termed regulatory capital arbitrage, an example of which is a bank reshuffling its asset portfolio or using securitization to decrease risk-weighted assets without effectively raising costly capital.[31] In the case of securitization of loans, the banks place safe loans off the balance sheet and leave more risky loans on.[32] Once these arbitrage behaviors are widespread and observed by the regulator, a new round of regulations ensues to circumvent the bank's measures to avoid the initial regulations. Basel II follows this pattern, requiring the use of internal or external measures of asset riskiness to establish the percentage of capital required by the regulators.

28. Kane (2000).

29. See Kashyap and Stein (2004); Berger, Herring, and Szego (1995); Dewatripont and Tirole (1994).

30. See Barrios and Blanco (2003) for a recent microeconomic example of how regulatory capital is distinct from market capital. Holmstrom and Tirole (1997) and Marshall and Prescott (2000) provide general equilibrium examinations of the impact of regulatory capital relative to the market capital.

31. See, for example, Jones (2000).

32. Both Koehn and Santomero (1980) and Froot and Stein (1998) argue that banks become less risk averse when they are forced to hold more capital, which leads to increased loan portfolio risk. See Thakor (1996) for an opposing result.

Recent work by Chami and Cosimano shows how capital regulations affect bank behavior.[33] Their model treats bank capital as an endogenous variable. This reveals how the changes in regulations, as well as changes in other exogenous variables (such as market structure and economic activity), affect a bank's choice of the level of capital. The level of capital, in turn, affects a bank's ability to extend credit in future periods.

The Chami-Cosimano model describes banks as operating in an imperfectly competitive market.[34] In such a setting, banks find it optimal to behave collusively, creating a monopolist-like environment in which the banks set one loan rate and share the profits equally.[35] Chami and Cosimano demonstrate that banks are more likely to cooperate in the presence of risk-based capital constraints such as those imposed by the Basel Accord, because individual banks may be reluctant to expand loans to meet pent-up demand for credit and because they face risk punishment from other banks.[36] Interestingly, risk-based capital requirements give value to the bank's holding of capital. This value of holding capital—which Chami and Cosimano model as a call option—is affected by the current level of required risk-based capital, the uncertainty and elasticity of demand for loans, the level of economic activity, and the level of interest rates. For example, Chami and Cosimano show that a high level of required capital increases the value of holding capital to a bank. Holding

33. Chami and Cosimano (2001).

34. This assumption is reasonable based on existing evidence that banks continue to have some degree of market power in many countries. For example, Claessens and Laeven (2004) use the Panzar and Rosse (1987) test of contestability to identify the degree of competition in the banking system for fifty countries, including eleven Latin American economies. They find evidence of a monopolistic competitive industry in all of these countries. De Bandt and Davis (2000) use a similar methodology and find evidence of noncompetitive behavior in the European Union. See Chami and Cosimano (2001) for a comprehensive discussion of the evidence for monopoly power in banking industries.

35. Following Abreu, Pearce, and Stacchetti (1986, 1990) and Rotemberg and Saloner (1986), Chami and Cosimano (2001) assume that the industry is represented as a super game, in which each bank follows a strategy of monopolistic behavior in the loan market, as long as every other bank follows this strategy. Chami and Cosimano identify an equilibrium to the super game, in which it is in the best interest of all banks to engage in monopolistic behavior in the loan market.

36. A discussant to this paper pointed out that this strategy would only work if all the other banks in the industry have sufficient capital to service this increased level of loans. This raises the issue of capacity precommitment addressed by Kreps and Scheinkman (1983) and Davidson and Deneckere (1986). This issue does not arise here, however, since banks tend to hold substantially more capital than required by the regulators.

an excess level of capital prevents the bank from becoming capital constrained, so the bank will be able to extend loans in the future. The authors show that banks anticipate the possibility of future increases in capital requirements and raise their capital holdings in the current period, so as to avoid becoming capital constrained. In contrast, as the elasticity of demand increases, indicating a more competitive banking sector or a more contestable loan market, the value to the bank of holding capital falls, and the bank will hold less capital. This implies that fewer loans will be available next period.

This last result relates to banks' incentives to arbitrage regulation. In a less contestable market, banks benefit from holding more capital, whereas in a more contestable market, the value of capital falls, which gives banks an incentive to engage in regulatory arbitrage rather than raise capital to comply with the regulation. The ability of banks to circumvent the regulation, however, depends on the level of financial market development and the strength of the legal and institutional framework in place. In an economy with a well-developed financial market, banks can arbitrage regulation by using securitization and other off-balance-sheet activities to raise their capital-to-asset ratio.[37] If strict risk-based capital regulation causes banks to move from costly credit-risk activities to other activities that do not involve credit risk, the result could lead to a credit crunch, and these new activities expose a bank to new types of risks, such as market risk, interest rate risk, and operational risk.[38] On the other hand, raising more capital, although costly, would allow banks to extend credit, but banks resist raising capital in a recessionary environment, which implies that bank capital becomes procyclical.

The level of financial development should have an impact on how the Basel Accord affected bank behavior in different countries, although it is not entirely clear in which direction. Banks in emerging markets or developing economies—where capital markets and securitization possibilities are not well developed—may have a hard time arbitraging the new risk-based capital regulation. These banks would be obliged to either raise new and costly capital or reduce their supply of credit. At the same time,

37. Another example would be lending to the government, which receives a zero risk factor (at least for member countries of the Organization for Economic Cooperation and Development). This effectively means that capital-to-asset ratio is being raised by reducing the denominator, rather than by raising more capital (see Jones, 2000).

38. See Chami, Khan, and Sharma (2003).

emerging markets often have a weak legal and regulatory framework in place, such that monitoring of bank activities and enforcement of regulations may be weak. Banks in such markets may exploit the presence of loopholes to give lip service to abiding by the new regulation. They would then be able to show that their regulatory capital-to-asset ratio has increased—and use that to increase credit—while their true economic capital had not really changed.

Empirical Estimation of the Impact of the Basel Accord on Credit Growth

To estimate the impact of the Basel Accord on lending, we used a panel derived from Bankscope annual individual bank information for up to fifty of the largest banks in each of 152 countries.[39] This gave us a total of 2,893 banks, or nineteen banks per country, on average. The maximum number of potential time observations per bank was fourteen, spanning from 1987 to 2000, which produced a total of 20,102 potential observations (or 132.3 per country, on average).[40] Table 2 presents summary statistics for several banking performance variables over the entire sample period. The number of usable observations declines substantially from the total, however, depending on the specific variable being analyzed. For example, we have considerably more observations for the ratio of equity to total assets (20,102) than for the total capital ratio (6,718) or the tier 1 ratio (4,157).

39. Many studies use Bankscope data for cross-country analysis. For instance, Cetorelli and Gambera (2001) examine the relation between bank concentration and economic growth in forty-two countries in 1989–96. Demirgüç-Kunt, Laeven, and Levine (2004) focus on the 1995–99 period to study the impact of bank concentration on the net interest margin in seventy-two countries. Finally, Claessens and Laeven (2004) test for contestability in 1994–2001 in fifty countries. For our study, it was necessary to combine information from several eight-year Bankscope CD's to build the 1987–2000 time period. We are currently in the process of expanding the database to include more recent time observations and a greater number of banks for each country.

40. As table 2 shows, this corresponds to the number of observations for the most widely reported variable that we used—namely, the ratio of equity to total assets. Due to differences in reporting across banks, time, and variables, the number of observations varied for each type of analysis we undertook. Also, the number of observations fell once we limited the sample to the countries for which we had dated information on Basel adoption and implementation.

TABLE 2. Selected Banking Indicators by Region, 1987–2000[a]

Average percentage

Indicator	Region						World average	No. obs.
	Africa	*Asia*	*Europe*	*Middle East*	*United States and Canada*	*Latin America and Caribbean*		
Capitalization								
Total capital ratio	20.24	13.98	16.84	20.38	11.63	17.06	15.82	6,718
	(30.31)	(14.73)	(14.62)	(28.52)	(10.43)	(16.35)	(17.07)	
Equity/total assets	12.10	9.12	10.22	10.02	8.29	12.72	10.50	20,102
	(14.26)	(14.33)	(11.68)	(12.97)	(5.49)	(17.58)	(13.61)	
Tier 1 ratio	13.04	9.22	12.08	14.46	9.33	12.61	10.80	4,157
	(9.50)	(8.04)	(10.56)	(10.43)	(10.42)	(12.77)	(10.09)	
Profitability and operational costs								
Return on average equity	20.06	5.04	10.84	14.22	12.41	10.89	10.84	19,546
	(43.16)	(49.91)	(35.71)	(23.14)	(14.49)	(39.22)	(38.31)	
Net interest margin	7.28	3.00	4.18	3.46	3.75	7.60	4.74	19,305
	(5.06)	(3.09)	(6.31)	(2.52)	(2.23)	(8.05)	(5.99)	
Overhead/total assets	5.24	2.35	3.55	2.66	3.80	6.46	3.95	19,337
	(3.63)	(3.28)	(4.93)	(5.80)	(5.03)	(5.70)	(5.05)	

(*continued*)

TABLE 2. Selected Banking Indicators by Region, 1987–2000[a] (*continued*)

Average percentage

Indicator	Region						World average	No. obs.
	Africa	*Asia*	*Europe*	*Middle East*	*United States and Canada*	*Latin America and Caribbean*		
Asset composition and liquidity								
Net loans/total assets	48.77	58.41	45.86	45.15	64.56	51.39	50.57	19,860
	(22.57)	(16.85)	(23.71)	(17.12)	(16.64)	(20.89)	(21.85)	
Net loans/total deposits and borrowing	58.72	69.37	57.69	55.04	83.23	65.84	61.48	9,835
	(30.18)	(30.28)	(35.93)	(25.92)	(23.58)	(36.00)	(34.29)	
Liquid assets/total deposits and borrowing	64.17	38.43	34.60	51.79	25.87	35.18	37.60	8,536
	(48.43)	(36.67)	(32.00)	(31.33)	(31.09)	(35.21)	(34.94)	
Loan loss provisioning								
Loan loss provision/net interest income	25.83	30.22	23.37	26.41	24.01	20.61	24.54	15,770
	(54.20)	(88.12)	(64.90)	(78.25)	(59.58)	(63.89)	(69.57)	
Loan loss reserves/nonperforming loans	82.57	89.12	110.69	104.09	268.92	117.52	128.70	6,797
	(85.17)	(116.81)	(112.35)	(97.81)	(197.73)	(118.90)	(140.19)	
Loan loss reserves/gross loans	8.83	3.87	6.10	10.35	2.15	5.30	5.75	13,854
	(13.48)	(7.41)	(8.12)	(11.80)	(1.85)	(15.15)	(10.92)	

Source: Bankscope and authors' calculations.

a. Standard deviations are in parentheses.

The table identifies four types of banking indicators—namely, capitalization, profitability and operational costs, asset composition and liquidity, and loan loss provisioning—and compares their means and standard deviations across regions for the full sample period. Capitalization measures include the traditional average ratio of equity to assets, as well as the Basel-related total and tier 1 capital ratios, in which the denominator is equal to risk-weighted assets. Profitability and operational costs are represented by the return on assets, the net interest margin, and the ratio of overhead to assets. Asset composition is measured by the ratio of net loans to total assets, intermediation activity by the ratio of net loans to deposits, and liquidity by the degree to which short-term liabilities (that is, deposits) are covered by short-term assets.[41] Finally, loan loss provisioning is measured by the provisioning cost in each period as a percentage of interest revenue and by the stock of accumulated reserves as a percentage of nonperforming and gross loans.

Compared with world averages, Latin American banks have similar or even slightly higher capitalization and profitability, but decidedly higher interest margins and overhead costs. They tend to concentrate more of their activities in lending and less in liquid assets. Latin America and the Caribbean thus appear, at first glance, to have less competitive and less efficient banking systems than the rest of the world. Interest margins and overhead costs are not only above the world average, but also the highest of any region. This is consistent with the findings of recent studies analyzing the persistently high levels of interest spreads and intermediation costs in Latin America, even after reforms were enacted throughout the region in the 1990s to liberalize interest rates and ease entry into the system, particularly by foreign banks.[42]

Moreover, loan loss provisioning tends to be small as a fraction of net interest income (20.6 percent for Latin America and the Caribbean versus 24.5 percent for the world average), and loan loss reserves tend to be smaller in relation to total loans (5.3 percent versus 5.8 percent). This might reflect some degree of moral hazard and excessive risk-taking in the banking system, caused in part by the existence of an implicit or explicit deposit insurance scheme. Moral hazard and weak regulation and supervi-

41. Liquid assets are not necessarily riskless, as they often include corporate and government securities that are not exempt from default risk.

42. Brock and Rojas-Suárez (2000).

sion are also cited by Brock and Rojas Suárez as major sources of weakness among Latin American banks.[43] Other studies, however, show that market discipline exists to a measurable extent even in Latin American countries with explicit deposit insurance systems, and moral hazard is not as widespread as one might think.[44]

These two provisioning ratios are affected by their denominators, namely, the high interest spreads and extensive lending activities in Latin America and the Caribbean. Loan loss reserves in Latin American and Caribbean banks are well above 100 percent of nonperforming loans (117.5 percent) and are above the levels in most other regions, although they are well below those observed in the United States and Canada (269 percent). The figures also show that high interest revenues essentially lower the financial burden of provisioning for banks in Latin America and the Caribbean.

Our Basel Accord database also distinguishes, whenever possible, between full-fledged implementation of the Accord and its mere legal adoption. Implementation would entail either the completion of a transition period for banks to comply or an effective enforcement of the capital standards through improvements in supervisory authorities' capacity to carry out their functions, or both. We thus constructed two separate dummy variables: BASELYR, which indicates the year of adoption for all countries, and BASELYR1, which indicates either the adoption year or the implementation year for those countries where it was possible to make this distinction.[45] Throughout this paper, we focus our analysis on BASELYR1, since it incorporates our most complete information on the timing of the Basel Accord adoption.[46]

Table 3 revisits the major banking performance indicators and compares them across the pre- and post-Basel periods, using BASELYR1 to separate the two. We find that capitalization increased, as measured by both the regulatory measures and the average equity-asset ratio, and that profitability, interest spreads, and average overhead declined. The former

43. Brock and Rojas-Suárez (2000).

44. For example, Martínez Pería and Schmukler (2001); Barajas and Steiner (2000).

45. BASELYR and BASELYR1 are identical in most countries in the sample; the differences between the two arise from the twenty-five countries for which we obtained a separate implementation date. Details on the two measures are available on request.

46. We also conducted the statistical analysis using BASELYR, and the results were not markedly different.

TABLE 3. Selected Banking Indicators by Region, before and after Adoption of the Basel Accord[a]

Sample mean

	Region							
Indicator	*Africa*	*Asia*	*Europe*	*Middle East*	*United States and Canada*	*Latin America and Caribbean*	*World average*	*No. obs.*
Capitalization								
Total capital ratio: Before	15.35	11.59	16.14	20.56	3.21	13.67	14.52	1,221
After	22.36	12.01	16.38	17.30	12.45	18.03	15.20	4,582
Equity/total assets: Before	11.64	8.55	11.61	7.97	5.95	10.24	9.62	4,909
After	14.85	6.31	9.75	9.45	8.50	14.30	10.24	11,774
Tier 1 ratio: Before	11.93	7.72	9.78	13.05	2.42	11.27	8.14	520
After	12.48	8.89	11.76	15.47	10.01	12.50	10.74	3,269
Profitability and operational costs								
Return on average equity: Before	18.95	6.59	13.85	14.86	9.15	14.62	12.32	4,635
After	18.86	–0.89	10.26	12.53	12.71	7.39	9.12	11,625
Net interest margin: Before	6.17	3.68	6.95	3.85	3.35	8.49	5.71	4,540
After	6.43	2.32	3.79	2.65	3.79	7.50	4.36	11,603
Overhead/total assets: Before	3.82	2.89	4.33	3.26	3.08	6.94	4.35	4,572
After	4.55	1.99	3.28	2.22	3.87	6.38	3.77	11,593

(*continued*)

TABLE 3. Selected Banking Indicators by Region, before and after Adoption of the Basel Accord[a] (*continued*)
Sample mean

	Region							
Indicator	*Africa*	*Asia*	*Europe*	*Middle East*	*United States and Canada*	*Latin America and Caribbean*	*World average*	*No. obs.*
Asset composition and liquidity								
Net loans/total assets: Before	54.02	57.38	46.73	39.78	59.54	50.63	50.58	4,748
After	61.18	61.76	46.04	51.58	65.02	51.48	51.24	11,714
Net loans/total deposits and borrowing: Before	75.11	70.76	61.62	47.43	63.72	61.67	62.66	2,178
After	63.76	68.54	57.61	67.65	84.40	67.25	61.46	5,934
Liquid assets/total deposits and borrowing: Before	52.92	39.26	33.67	58.18	38.16	37.79	42.23	1,817
After	37.75	28.18	33.93	37.48	25.14	30.31	32.67	5,373
Loan loss provisioning								
Loan loss provision/net interest income: Before	36.17	20.17	33.10	24.79	27.10	16.84	23.55	3,597
After	20.86	44.22	21.63	34.93	23.72	24.17	25.42	9,760
Loan loss reserves/nonperforming loans: Before	70.24	75.71	142.83	119.84	135.03	112.54	111.07	1,368
After	105.76	85.81	105.88	79.05	282.56	118.81	140.83	4,258
Loan loss reserves/gross loans: Before	6.13	4.86	7.96	11.20	2.75	5.09	6.39	3,451
After	6.28	3.42	5.66	9.02	2.09	5.70	5.09	7,955

Source: Bankscope and authors' calculations.

a. For the subset of countries for which Basel adoption or implementation dates (or both) are available, this table shows the means of the above variables in each region before (BASELYR1 = 0) and after (BASELYR1 = 1) Basel Accord implementation or adoption. Values between the two periods are not strictly comparable as a result of missing values.

movements suggest that, at least on average, the Basel Accord succeeded in raising capitalization rates, although the ratio of equity to total assets increased appreciably less than the two regulatory measures. As for the profitability and cost efficiency of the banking system, the aggregate statistics suggest that other banking system reforms leading to increased competition—such as liberalization or the entry of foreign banks—might have been carried out simultaneously with the adoption of the Basel Accord's risk-based capital requirements.

With regard to bank lending, our preliminary examination of the data finds no indication of a Basel-induced credit contraction. Whether scaled by total assets or short-term liabilities, net loans increased while liquid assets declined. The post-Basel period thus coincided with an increase in bank intermediation activities and perhaps in vulnerability to deposit outflows, although overall bank default risk presumably declined as a result of the increased capitalization.

Changes in capitalization and lending vary across regions. Latin America and the Caribbean increased capital by more than the world average while also increasing the share of loans in assets by much more (5 percentage points for Latin America and the Caribbean versus 1 percentage point for the world average). At the other extreme is Europe, where banks registered the highest average capitalization rates before the adoption of the Basel Accord. Europe is the only region in which both capitalization and lending ratios declined between periods. We examine the statistical significance of these average changes both at an aggregate and regional level in a later section.

Latin American and Caribbean banks registered declines in the profitability and cost efficiency measures similar to those for the world average, such that they continued to have the highest interest spreads and overheads of any region in the post-Basel period. Finally, provisioning intensified in the post-Basel period in some regions (namely, Asia, Latin America, and the United States and Canada), where the coverage of nonperforming loans with loan loss reserves increased substantially. The opposite occurred in Europe and the Middle East. In the case of Africa, provisioning declined relative to interest revenue, but banks were still able to increase the ratio of loan loss reserves to nonperforming loans.

In summary, the adoption of the Basel Accord around the world is associated with an expansion of equity capital and increased lending. On average, the return on equity declined, with the net interest margin falling more

than overhead expenses. The exception to this general pattern is Europe, which is characterized by a relatively high level of banking development.[47]

Estimation of the Effects of the Basel Accord on Bank Behavior—Full Sample

Our estimation approach is similar to that followed by Berger and Udell in their study of the impact of the Basel Accord on credit growth in the United States.[48] We modify their analysis in that we compare a significant time period both before and after the adoption of Basel I. As a result, our analysis places more emphasis on the long-term impact of Basel I. In addition, we examine both the composition of bank assets and the real growth rate of loans.

We first estimated a regression to assess whether bank capital and lending experienced a significant change in means between the pre- and post-Basel periods. Our initial test regressed each of four bank capitalization or loan variables on an intercept variable and a Basel-related dummy variable, as follows:

$$V_{ijt} = \alpha_0 + \alpha_1 \, \text{BASELYR1}_{jt}, \tag{1}$$

where V_{ijt} represents each of the dependent variables: the ratio of equity to total assets (EQTA), the total capital ratio (TOTCAPRAT), the ratio of net loans to total assets (NLOANTA), and the real annual growth rate of loans (RLOANGROWTH).[49] The subindices *i, j,* and *t* denote bank, country, and year, respectively. We tested whether adoption of the Basel Accord was associated with a change in bank behavior, by regressing the bank variables on a dummy variable for the adoption year in each country, BASELYR1 (which varies by time and country, but not by bank). We conducted this test

47. As we show in the next section, our measure of financial development is centered on the size of private sector credit by the banking system relative to GDP. Many European economies thus appear more financially developed than the United States, because they are more reliant on the banking system than on capital markets.

48. Berger and Udell (1994).

49. We also ran regressions for the Tier 1 Ratio (T1RAT), the ratio of loans to deposits and total borrowing (LOANDEP), the ratio of gross loans to assets, and the growth rate of real loans scaled by the previous period's assets. In all cases, the results were similar to those obtained for TOTCAPRAT, NLOANTA, and RLOANGROWTH, respectively. The number of observations declined considerably in the case of T1RAT, however, because many banks do not report this indicator.

for the full sample and for a sample excluding the early adopters (that is, the fourteen countries that adopted the Basel Accord in 1988).[50]

We ran four basic versions of this test: (i) an ordinary least squares (OLS) regression across countries and time; (ii) a fixed-effects regression that included bank-specific intercepts; (iii) a regression that included country dummies; and (iv) a regression that included a relative measure of financial development, FINDEV, and its interaction with BASELYR1.[51] We ran each of these regressions for the full sample and for the sample excluding early adopters.[52]

The results of the means tests for capitalization ratios are shown in tables 4 and 5.[53] A significant increase in the average equity-asset ratio was captured in all but the fixed-effects regressions. We also find evidence that the regulatory capital ratio increased significantly after Basel.[54] Finally, the results show that banks in more financially developed countries had lower capitalization rates, on average, than less financially developed countries prior to Basel, and they did not tend to increase capitalization by a greater amount after Basel.

Tables 6 and 7 show the means test results for bank lending activities. With regard to the ratio of net loans to total assets (NLOANTA), the simple OLS and fixed-effects estimates show that, contrary to the credit and capital crunch hypotheses, Basel adoption did not coincide with a shift in bank assets away from loans. In fact, the simple OLS and the specifica-

50. We also tested whether the 1988 signing of the Basel Accord itself was associated with a change in means across all countries, regardless of whether or when they adopted it. We found no evidence of such an announcement effect either on capital ratios or on lending behavior, as none of the above variables exhibited a significant change in means between subperiods.

51. We calculated FINDEV as the ratio of banking system credit to GDP in 1995 relative to the worldwide maximum, registered by Switzerland (168 percent). FINDEV thus takes the value of unity for Switzerland and is less than unity for all other countries (for example, 0.15 in Mexico and 0.32 in Korea). The United States has a value of only 0.41 since stock and bond markets represent a large percentage of the economy.

52. This excludes the United States and Canada.

53. We expanded the data set with respect to previous drafts of this paper, roughly doubling the number of banks included. Since we had previously limited the data set to the largest banks in each country, the expansion brought in smaller banks in virtually every case. This resulted in some small changes, although most of the general results of the statistical analysis continued to hold.

54. In this section, we use the phrase after Basel to refer to the country-specific adoption and implementation of the Basel Accord.

TABLE 4. Means Tests for the Ratio of Equity to Assets[a]

	Excluding early adopters of Basel				*Full sample*			
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
BASELYR1 (dummy for implementation date)	3.218	−0.526	1.692	2.456	0.615	−0.386	1.534	1.784
	(9.43)***	(1.50)	(5.62)***	(4.16)***	(2.28)***	(1.60)	(6.00)***	(3.31)***
Financial development variables								
FINDEV				−10.205				−6.756
				(6.57)***				(5.12)***
BASELYR1* FINDEV				1.400				−1.209
				(0.73)				(0.86)
Summary statistic								
R^2	0.010	0.000	0.097	0.017	0.000	0.000	0.112	0.017
F tests for joint significance (with *p* values)								
Fixed effects		5.96				7.20		
		(0.00)				(0.00)		
Country dummies			65.47				101.20	
			(0.00)				(0.00)	
No. observations	9,098	9,098	9,098	9,098	16,683	16,683	16,793	16,793

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable is equity/total assets (EQTA). The estimation method used in columns 1 and 5 is OLS across countries and time; in columns 2 and 6, fixed effects with bank-specific intercepts; in columns 3 and 7, OLS with country dummies; and in 4 and 8, OLS with interaction between FINDEV and BASELYR1. The sample in the first four columns excludes early adopters of the Basel Accord; the last four columns use the full sample. The figures in parentheses are *t* ratios, which in the OLS regressions are calculated from robust standard errors.

TABLE 5. Means Tests for the Total Capital Ratio[a]

	Excluding early adopters of Basel				*Full sample*			
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
BASELYR1 (dummy for implementation date)	1.513	–0.568	0.984	3.025	0.682	1.658	2.783	0.381
	(1.45)	(0.39)	(1.11)	(1.90)*	(0.93)	(2.40)**	(5.90)***	(0.29)
Financial development variables								
FINDEV				–5.356				–13.223
				(0.98)				(6.02)***
BASELYR1 * FINDEV				–9.849*				1.591
				(1.68)				(0.65)
Summary statistic								
R^2	0.001	0.001	0.096	0.008	0.000	0.000	0.108	0.018
F tests for joint significance (with *p* values)								
Fixed effects		2.58				3.86		
		(0.00)				(0.00)		
Country dummies			7,039.0				7,728.0	
			(0.00)				(0.00)	
No. observations	2,485	2,485	2,485	2,485	5,803	5,803	5,803	5,803

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable is the total capital ratio (TOTCAPRAT). The estimation method used in columns 1 and 5 is OLS across countries and time; in columns 2 and 6, fixed effects with bank-specific intercepts; in columns 3 and 7, OLS with country dummies; and in 4 and 8, OLS with interaction between FINDEV and BASELYR1. The sample in the first four columns excludes early adopters of the Basel Accord; the last four columns use the full sample. The figures in parentheses are *t* ratios, which in the OLS regressions are calculated from robust standard errors.

TABLE 6. Means Tests for Net Loans as a Percentage of Assets[a]

	Excluding early adopters of Basel				*Full sample*			
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
BASELYR1 (dummy for implementation date)	1.022	0.318	−0.320	2.466	0.668	−0.085	−0.221	5.794
	(2.38)**	(0.93)	(0.72)	(3.84)***	(1.85)*	(0.34)	(0.59)	(9.18)***
Financial development variables								
FINDEV				37.138				21.842
				(18.38)***				(13.33)***
BASELYR1 * FINDEV				2.283				−19.140
				(0.88)				(10.29)***
Summary statistic								
R^2	0.001	0.001	0.076	0.069	0.000	0.000	0.273	0.011
F tests for joint significance (with *p* values)								
Fixed effects		14.45				27.97		
		(0.00)				(0.00)		
Country dummies			223.12				257.37	
			(0.00)				(0.00)	
No. observations	8,894	8,894	8,894	8,894	16,462	16,462	16,462	16,462

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable is net loans/assets (NLOANTA). The estimation method used in columns 1 and 5 is OLS across countries and time; in columns 2 and 6, fixed effects with bank-specific intercepts; in columns 3 and 7, OLS with country dummies; and in 4 and 8, OLS with interaction between FINDEV and BASELYR1. The sample in the first four columns excludes early adopters of the Basel Accord; the last four columns use the full sample. The figures in parentheses are *t* ratios, which in the OLS regressions are calculated from robust standard errors.

TABLE 7. Means Tests for Real Growth Rate of Loans[a]

	Excluding early adopters of Basel				*Full sample*			
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
BASELYR1 (dummy for implementation date)	0.016	–0.041	–0.014	0.051	–0.002	–0.020	0.004	0.033
	(2.62)***	(4.94)***	(1.74)*	(4.51)***	(0.34)	(3.25)***	(0.56)	(3.37)***
Financial development variables								
FINDEV				0.118				–0.008
				(3.77)***				(0.37)
BASELYR1 * FINDEV				–0.151				–0.084
				(3.84)***				(3.44)***
Summary statistic								
R^2	0.001	0.001	0.067	0.003	0.000	0.000	0.062	0.007
F tests for joint significance (with *p* values)								
Fixed effects		2.09				2.25		
		(0.00)				(0.00)		
Country dummies			116.39				403.71	
			(0.00)				(0.00)	
No. observations	6,804	6,804	6,879	6,879	13,066	13,066	13,141	13,141

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable is the Real annual growth rate of loans (RLOANGROWTH). The estimation method used in columns 1 and 5 is OLS across countries and time; in columns 2 and 6, fixed effects with bank-specific intercepts; in columns 3 and 7, OLS with country dummies; and in 4 and 8, OLS with interaction between FINDEV and BASELYR1. The sample in the first four columns excludes early adopters of the Basel Accord; the last four columns use the full sample. The figures in parentheses are *t* ratios, which in the OLS regressions are calculated from robust standard errors.

tion that controlled for the level of financial development point to a significant increase in the loan-asset ratio after Basel. This increase tended to be smaller among more financially developed countries than among less financially developed countries, and those with a sufficiently developed financial sector experienced a reduction in the loan-asset ratio. Based on the point estimate in the final column of table 6, the cutoff point appears to be 30 percent of the maximum level of banking development, equivalent to a 1995 ratio of private sector credit to GDP of 50 percent or greater.[55] Countries such as Australia (73 percent), Korea (53 percent), and the United Kingdom (115 percent) should have experienced a contraction in loans following Basel, while Chile (49 percent), for example, should have seen virtually no change.

The loan-asset ratio may mask the behavior of loans when asset growth is also changing between periods. We therefore also examined the real growth rate of loans directly. Table 7 presents the results of these means tests, after we removed outliers.[56] Contrary to the behavior of the loan-asset ratio, these estimations point to a decline in loan growth after Basel. When we control for relative financial development, we find that this effect takes place above a certain level of financial development. The cutoff point (again based on the point estimate in the final column of the table) is somewhat higher than in the case of the loan-asset ratio: a country with a credit-to-GDP ratio of over 64 percent would tend to experience a decline in lending growth.

To test whether loan supply contracted as a result of the Basel Accord, we used a specification similar to that of Berger and Udell's study of the U.S. banking system.[57] We assumed that bank loans generally respond to lagged risk factors: when risk increases, banks subsequently contract their lending activities either voluntarily or through regulatory pressure. This also operates cross-sectionally, in that banks with a high level of risk (for example, through low capital holdings) tend to adjust by reducing their portfolio more, on average, than banks with a low level of risk. Thus one

55. This is obtained as the overall intercept shift from BASELYR1 (5.794) divided by the coefficient of the interaction between BASELYR1 and FINDEV (−19.140).

56. We removed observations in which the annual real growth rate of loans was greater than 100 percent or less than −50 percent. This made an enormous difference in terms of predictability and significance of the coefficients, but still preserved a large number of observations for each country.

57. Berger and Udell (1994).

aspect of the test is to examine whether the Basel Accord made banks more sensitive to risk, to the extent that increases in risk might have been associated with the danger of falling below the regulatory minimum level of capital. This corresponds to the risk retrenchment hypothesis discussed by Berger and Udell, whereby a contraction in loan supply is associated with bank risk.[58] We also examine whether non-risk-related factors may have come into play to reduce loan supply, through an intercept shift. Finally, we include a vector of macroeconomic controls, **X,** to proxy for loan demand factors and other non-Basel-related loan supply factors. Our specification is as follows:

$$V_{ijt} = \alpha_0 + \alpha_1 \text{BASELYR1}_{jt} + \alpha_2 \text{RISK}_{ijt-1} + \alpha_3 \text{BASELYR1}_{jt} \text{RISK}_{ijt-1} + \alpha_4 \mathbf{X}_{jt}. \tag{2}$$

The dependent variable, *V,* is the loan-asset ratio (NLOANTA) and the real growth rate of loans (RLOANGROWTH). We also use two risk measures—the capital ratio (EQTA) and the ratio of nonperforming loans to total loans (NPFRAT). Our two macroeconomic controls are the real growth rate of GDP (RGDPG), which captures changes in loan demand, and the annual change in the inverse money velocity (DM3GDP), which captures shifts in the public's demand for bank deposits.[59] For a given level of risk, an increase in money demand would shift banks' loan supply through an exogenous increase in their loanable resources.

If bank loans respond negatively to a prior increase in risk, we expect the coefficient on the lagged capital ratio to be positive and the coefficient on the lagged nonperforming loan ratio to be negative. Furthermore, loan supply should be positively related to the economic growth rate and to increases in money demand. The impact of the Basel Accord on risk sensitivity is measured by the coefficient α_3 on the interaction term between BASELYR1 and the respective risk variable. If banks experienced risk retrenchment after Basel, then α_3 should be positive for the capital ratio (that is, banks decrease loans even more in response to a drop in capital)

58. Berger and Udell also distinguish between voluntary and regulatory risk retrenchment, depending on whether banks became more sensitive to risk on their own or as a result of more rigorous action by regulators. For now, we focus on whether banks display any change at all in their attitude toward risk, be it voluntary or regulatory in nature.

59. Defined as the absolute annual change in the ratio of money and quasi-money to GDP, as reported in the IMF's *International Financial Statistics.*

and negative for the nonperforming loan ratio (that is, banks contract loans even more in response to a rise in credit risk). Finally, a negative α_2 coefficient would indicate that all banks, regardless of their risk characteristics, experienced a loan contraction following Basel.

The results of this test for NLOANTA are shown in table 8 and for RLOANGROWTH in table 9. We include each of the risk factors individually or together. Three types of estimations are presented: OLS, fixed effects, and instrumental variables (IV) with fixed effects. The latter procedure accounts for the possible endogeneity of the bank risk variable (capital or nonperforming loan ratio), using its lagged values as well as the macroeconomic controls as instruments. Because few banks report the nonperforming loan ratio, the sample size is reduced appreciably when this variable is included. We find that banks respond to risk in the expected direction, contracting loan supply following a drop in capital (EQTA) or an increase in the nonperforming loan ratio (NPFRAT), and that the real GDP growth rate tends to be positively associated with the proportion of bank assets devoted to loans. Instrumenting tends to strengthen the estimated response of banks to risk factors, particularly of the loan-asset ratio to changes in nonperforming loans and of loan growth to changes in equity.

The impact of the Basel Accord on the loan-asset ratio is not clear. In the OLS regressions, Basel adoption is associated with a direct increase in loans across all banks—a constant term shift—but this result is weakened when we account for bank-specific determinants of loans (unrelated to the risk factors included). With regard to risk factors, the Basel Accord appears not to have increased banks' sensitivity to either EQTA or NPFRAT; in most cases the coefficient on the interaction term was not of the expected sign and was not statistically significant. In fact, every regression includes at least one coefficient that signals a decline in the sensitivity to risk after Basel, thus implying a reduction in banks' prudent response.

The results for RLOANGROWTH are generally stronger and slightly more consistent with a Basel-induced credit contraction. The response of loan growth to bank fundamentals and macroeconomic controls was consistently of the expected sign and usually statistically significant. Although the direct impact of Basel through the intercept shift was mostly positive, we find some indication of risk retrenchment—through an increased sensitivity of lending to nonperforming loans (with a negative, albeit not statistically significant, interaction coefficient) and occasionally through a rise in sensitivity to equity.

TABLE 8. Effect of the Basel Accord on Net Loans as a Percentage of Assets, Full Sample[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
BASELYR1	2.244	6.905	8.323	0.572	−0.396	1.822	4.517	1.719	−6.420
	(3.59)***	(6.57)***	(6.94)***	(1.73)*	(0.61)	(2.04)**	(1.74)*	(0.53)	(1.08)
Bank risk variable									
EQTA(−1)	0.010		−0.034	0.085		0.104	−0.172		−0.575
	(0.29)		(0.48)	(6.24)***		(2.23)***	(0.99)		(2.01)**
NPFRAT(−1)		−0.413	−0.427		−0.570	−0.515		−0.577	−0.881
		(2.57)***	(2.86)***		(14.04)***	(10.95)***		(2.97)***	(3.54)***
Interaction term									
EQTA(−1) * BASELYR1	−0.154		−0.154	−0.085		−0.188	−0.046		0.432
	(3.53)***		(1.90)*	(4.29)***		(3.66)***	(0.24)		(1.39)
NPFRAT(−1) * BASELYR1		0.036	0.032		0.332	0.268		0.362	0.664
		(0.22)	(0.20)		(6.59)***	(4.90)***		(1.73)*	(2.53)**
Macroeconomic control									
Real GDP growth (RGDPG)	0.014	0.365	0.360	0.225	0.042	0.027	−0.317	1.164	1.170
	(0.26)	(4.47)***	(4.46)***	(7.18)***	(0.72)	(0.46)	(1.40)	(4.26)***	(4.27)***
Change in inverse velocity (DM3GDP)	0.179	−0.163	−0.160	0.003	−0.079	−0.018	0.617	−0.419	−0.414
	(5.67)***	(2.65)***	(2.63)***	(0.26)	(1.96)**	(2.02)**	(4.95)***	(2.84)***	(2.79)***
Summary statistic									
R^2	0.007	0.070	0.076	0.000	0.050	0.052	0.003	0.060	0.049
F test for fixed effects (with *p* values)				28.20	11.25	11.20			
				(0.00)	(0.00)	(0.00)			
No. observations	14,041	4,882	4,882	14,041	4,850	4,850	11,760	3,551	3,551

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable is net loans/assets (NLOANTA). The estimation method used in columns 1–3 is OLS across countries and time; in columns 4–6, fixed effects with bank-specific intercepts; and in columns 7–9, IV with fixed effects, in which the instruments used are the lagged values of EQTA and NPFRAT and contemporaneous values of the macroeconomic controls. The figures in parentheses are *t* ratios, except in the case of the IV regressions, where z statistics are shown. In the OLS regressions, the *t* ratios are calculated from robust standard errors.

TABLE 9. Effect of the Basel Accord on the Real Growth Rate of Loans, Full Sample[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
BASELYR1	*0.015*	*0.034*	*0.000*	*–0.021*	*–0.002*	*–0.013*	*0.109*	*–0.016*	*0.113*
	(2.17)**	(3.01)***	(0.03)	(2.63)***	(0.18)	(0.67)	(4.76)***	(0.50)	(1.88)*
Bank risk variable									
EQTA(–1)	0.002		–0.001	0.004		0.007	0.006		0.009
	(4.28)***		(0.60)	(9.49)***		(5.32)***	(3.69)***		(2.98)***
NPFRAT(–1)		–0.002	–0.002		–0.004	–0.003		–0.004	0.000
		(1.93)*	(2.58)***		(3.22)***	(2.24)**		(1.90)*	(0.05)
Interaction term									
EQTA(–1) * BASELYR1	0.001		0.003	0.001		0.001	–0.004		–0.007
	(0.96)		(2.58)***	(2.02)**		(0.65)	(2.47)**		(2.20)**
NPFRAT(–1) * BASELYR1		–0.001	–0.001		0.000	0.000		0.002	–0.002
		(1.16)	(0.85)		(0.18)	(0.31)		(0.92)	(0.68)
Macroeconomic control									
Real GDP growth (RGDPG)	0.017	0.019	0.019	0.017	0.017	0.018	0.016	0.002	0.020
	(23.41)***	(16.73)***	(16.87)***	(22.66)***	(13.54)***	(13.81)***	(8.73)***	(7.91)***	(7.26)***
Change in inverse velocity (DM3GDP)	0.003	0.004	0.004	0.003	0.036	0.003	0.007	0.003	0.003
	(9.49)***	(5.06)***	(5.07)***	(8.90)***	(4.14)***	(3.79)***	(6.50)***	(2.28)**	(2.18)**
Summary statistic									
R^2	0.065	0.079	0.086	0.057	0.076	0.058	0.047	0.063	0.049
F test for fixed effects (with *p* values)				2.23	1.85	1.90			
				(0.00)	(0.00)	(0.00)			
No. observations	13,063	4,593	4,593	13,063	4,563	4,563	11,110	3,368	959

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable is the real growth rate of loans (RLOANGROWTH). The estimation method used in columns 1–3 is OLS across countries and time; in columns 4–6, fixed effects with bank-specific intercepts; and in columns 7–9, IV with fixed effects, in which the instruments used are the lagged values of EQTA and NPFRAT and contemporaneous values of the macroeconomic controls. The figures in parentheses are *t* ratios, except in the case of the IV regressions, where z statistics are shown. In the OLS regressions, the *t* ratios are calculated from robust standard errors.

While the fixed-effects specifications allowed for bank-specific intercept heterogeneity, we were also interested in uncovering possible systematic and measurable sources of cross-country heterogeneity, both on the intercepts and on the effect of Basel on lending behavior. We thus reintroduced the degree of financial development as a further control variable and ran OLS regressions that included FINDEV and its interaction with BASELYR1, for the full sample and for the subsample excluding the early adopters. Table 10 shows our results for the full sample. Lending activity tended to shrink in response to increased risk, as in the previous set of regressions. One main result of including greater country heterogeneity was that the signs of the direct impact and the risk-related impact of Basel adoption were more robust across specifications; in particular, adoption appeared to increase loan supply directly in virtually all regressions.

The results of the NLOANTA and the RLOANGROWTH estimations were markedly different, however, in three key aspects. First, the loan-asset ratio's sensitivity to risk tended to decline after Basel throughout the specifications, while that of loan growth generally increased. This can be seen from the signs of the interaction coefficients in the last three columns of table 10. Loan growth declined further in response to declines in equity or increases in nonperforming loans after Basel adoption than it had before. Although not all of these estimated effects are significant, they do indicate that whatever credit slowdown effects Basel might have, they become more visible through the growth rate of loans rather than through the proportion of loans on banks' balance sheets. Second, as before, loan growth appears to respond more reasonably than the loan-asset ratio to the macroeconomic controls, increasing with both the economic growth rate and the change in money demand (as proxied by the inverse velocity of M3). Third, the level of banking development, while highly correlated with the loan-asset ratio, is not a significant explanatory variable for loan growth.[60]

Even after controlling for bank-specific fundamentals, the estimations show that the direct positive impact of Basel on lending is smaller the more financially developed is the country and that there is a threshold

60. This should not be surprising, as the financial development indicator is derived from a measure of aggregate bank credit as a percentage of GDP, which should be positively correlated with the loan-asset ratio of individual banks.

TABLE 10. Effects of the Basel Accord on Bank Loans, Full Sample[a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
BASELYR1	8.564	3.443	4.380	0.037	0.086	0.050
	(9.22)***	(2.70)***	(2.60)**	(3.36)***	(3.85)***	(1.66)*
Bank risk variable						
EQTA(−1)	0.039		0.015	0.002		−0.001
	(1.16)		(0.20)	(4.25)***		(0.61)
NPFRAT(−1)		−0.408	−0.402		−0.002	−0.002
		(2.58)***	(2.78)***		(1.93)***	(2.02)**
Interaction term						
EQTA(−1) * BASELYR1	−0.180		−0.059	0.000		0.002
	(4.25)***		(0.71)	(0.60)		(1.76)*
NPFRAT(−1) * BASELYR1		0.070	0.058		−0.001	−0.001
		(0.42)	(0.39)		(1.37)	(1.06)
Macroeconomic control						
RGDPG	−0.006	0.401	0.399	0.017	0.019	0.019
	(0.11)	(5.26)***	(5.24)***	(22.49)***	(16.28)***	(16.43)***
DM3GDP	0.171	−0.274	−0.273	0.003	0.004	0.004
	(5.40)***	(4.26)***	(4.23)***	(9.65)***	(5.66)***	(5.59)***

FINDEV	23.059	21.265	21.475	0.000	−0.006	−0.015
	(9.97)***	(4.26)***	(4.04)***	(0.02)	(0.09)	(0.22)
FINDEV * BASELYR1	−21.998	2.890	1.973	−0.051	−0.153	−0.119
	(9.97)***	(0.55)	(0.36)	(2.21)**	(2.26)**	(1.67)*
Summary statistic						
R^2	0.016	0.112	0.112	0.067	0.092	0.094
No. observations	14,041	4,850	4,850	13,063	4,563	4,563
OLS regressions with country dummies						
F test for joint significance of country dummies (with *p* values)	234.58	210.94	214.76	56.04	184.51	105.24
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.291	0.290	0.291	0.106	0.162	0.164
No. observations	14,120	4,882	4,882	13,138	4,593	4,593

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable in columns 1–3 is net loans/assets (NLOANTA) and in columns 4–6 is the real growth rate of loans (RLOANGROWTH). The estimation method used is OLS across countries and time, with interaction between FINDEV and BASELYR1; the table also reports summary statistics for OLS regressions that use country dummies in place of the financial development indicators. The figures in parentheses are *t* ratios, calculated from robust standard errors.

beyond which Basel may have led to a credit slowdown. Depending on the regression, this threshold in the financial development index generally lies in the 40–50 percent range.[61]

Finally, we ran regressions in which we included country-specific dummy variables in place of the financial development variable. As the lower portion of table 10 shows, the results point to overwhelming joint significance of the country dummy variables and a substantial increase in the R^2. The direct increase of loan growth after Basel is less clear than in the previous specification, but we still find some evidence of an increased sensitivity of loans to risk variables after Basel. Loan growth, in particular, may have become more sensitive to past equity.

Our empirical analysis, while not conclusive, seems to weigh in against the hypothesis that the adoption of the Basel Accord induced a widespread credit crunch. We found limited evidence that bank loan growth became increasingly responsive to risk following the adoption of the Accord. We also found evidence, however, that the loan-asset ratio became less responsive to risk factors. Finally, we uncovered little evidence of a direct Basel-induced tightening of credit conditions across all banks and countries—that is, an intercept shift—although this may have occurred in some early-adopting countries with sufficiently developed financial systems.

Estimation of the Effects of the Basel Accord on Bank Behavior in Latin America

To examine the Basel Accord's specific impact in Latin America, we first ran the means tests for capitalization and lending variables including five regional dummy variables (AFRICA, ASIA, EUROPE, USCANADA, and MIDEAST), as well as their interactions with BASELYR1, and using Latin America and the Caribbean as a base region. The coefficient on BASELYR1 thus gave us the estimated impact of Basel on bank behavior in Latin America and the Caribbean, and all other dummies and interaction terms allowed us to test for differences between this region and each of the other regions. The results of these means tests are shown in table 11.

61. This result is particularly robust for RLOANGROWTH, where the negative effect of the level of financial development remained even after we ran the regression excluding the early adopters. For NLOANTA, this effect becomes positive once the early adopters are excluded.

TABLE 11. Means Tests for Capitalization and Lending, Latin America and Other Regions[a]

	Capitalization		*Lending Behavior*	
Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*
BASELYR1	3.683	2.681	1.557	0.037
	(5.39)***	(2.48)***	(2.12)**	(3.25)***
Regional dummy				
AFRICA	1.307	1.802	3.084	–0.002
	(1.44)	(0.54)	(2.09)**	(0.14)
EUROPE	1.124	2.607	–4.313	0.023
	(1.53)	(1.86)*	(4.89)***	(1.49)
ASIA	–1.783	–1.957	6.450	0.046
	(2.34)**	(1.68)*	(8.68)***	(3.83)***
USCANADA	–4.387	–10.333	8.611	–0.080
	(6.82)***	(11.96)***	(5.28)***	(3.28)***
MIDEAST	–2.368	7.016	–11.156	0.047
	(2.89)***	(3.52)***	(13.00)***	(3.47)***
BASELYR1 · AFRICA	–0.476	4.333	5.602	–0.010
	(0.36)	(0.97)	(2.81)***	(0.45)
BASELYR1 · EUROPE	–5.280	–2.209	–2.167	–0.040
	(6.57)***	(1.34)	(2.11)**	(2.35)**
BASELYR1 · ASIA	–5.928	–2.259	2.821	–0.098
	(7.10)***	(1.58)	(2.92)***	(6.80)***
BASELYR1 · USCANADA	–1.125	6.562	3.921	0.092
	(1.56)	(5.34)***	(2.23)**	(3.53)***
BASELYR1 · MIDEAST	–2.201	–5.942	10.245	–0.020
	(2.29)**	(2.31)**	(8.40)***	(1.13)
Summary statistic				
R^2	0.025	0.036	0.092	0.008
No. observations	16,793	5,803	16,572	13,141

Source: Authors' calculations.
* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.
a. The dependent variable in column 1 is equity/total assets (EQTA); in column 2, the total capital ratio (TOTCAPRAT); in column 3, net loans/assets (NLOANTA); and in column 4, the real growth rate of loans (RLOANGROWTH). The estimation method used is OLS across countries and time. The figures in parentheses are *t* ratios, calculated from robust standard errors.

The regressions show that after Basel, banks in Latin America and the Caribbean, on average, increased capitalization rates, the proportion of assets devoted to loans, and the growth rate of loans. The coefficients on the regional dummies indicate that Latin America's capitalization rates were about average prior to Basel (Asia, the United States, and Canada had lower levels, while those for Europe were higher), whereas its loan growth rates were the lowest, along with Africa. After Basel, Asia increased its

capital by less than Latin America, and Europe appears to have reduced capitalization levels in absolute terms. Finally, the United States and Canada increased their regulatory capital by more than Latin America and the Caribbean, but their average equity grew by less. The Basel Accord thus appears to have had a bigger impact on loan growth in the United States and Canada than in Latin America and the Caribbean, and smaller impact in both Asia and Europe. In fact, European banks may have lowered their growth rate, on average, after Basel. Finally, Africa and the Middle East tended to have similar capitalization and lending growth rates to Latin America and the Caribbean before and after Basel.

We also ran the loan equations for the subsample of Latin American and Caribbean countries using the simple specification, the specification with financial development indicators, and the specification with country dummies. Table 12 shows our results for the specification with financial development indicators, and reports the R^2 and F-test for the specification including country dummies.[62] Several of the results are similar to those obtained for the full sample of countries. First, the exercise provides very little evidence of a negative intercept shift indicating an overall decline in either the loan-asset ratio or the growth rate of loans after Basel, with the lone exception being one regression for loan growth in the specification with country dummies. Second, loan growth tends to fit the empirical model better than the loan-asset ratio. It responds positively and significantly to the demand for money, whereas the loan-asset ratio does not, and it seems to more strongly support a credit slowdown after Basel. Third, the level of financial development is positively related to the loan-asset ratio, but negatively related to the loan growth rate. Finally, country-specific characteristics, including the level of financial development, prove to be significant and contribute to an appreciable increase in the R^2 of the regressions.

Some results for Latin America and the Caribbean are different. With regard to the risk retrenchment hypothesis, we find relatively strong evidence that loan growth becomes more sensitive to past equity after Basel; the coefficient of the interaction term between BASELYR1 and EQTA(−1) is positive and significant across all specifications. The sensitivity of loan growth to the nonperforming loan ratio presents no significant change, however. In addition, the effect of Basel on loans

62. Our full results of all three specifications are available on request.

does not seem to depend on the level of financial development in the sample of Latin American and Caribbean countries. An estimated threshold after which Basel leads to a credit decline only arises in a single specification for the loan-asset ratio.[63] In the case of loan growth, financial development ap-pears to have the opposite effect; more developed Latin American and Caribbean countries tend to expand credit by more after Basel vis-à-vis less developed countries in the region, as the last three columns of Table 12 show.

Summary and Policy Implications

Numerous Latin American and Caribbean countries have experienced notable declines in credit growth in recent years. Whether this resulted from a credit crunch or a supply-induced credit restriction is an unresolved issue that many studies set out to test. Such studies point to certain regulatory factors as significant explanatory variables in these declines, but one aspect has not been explored empirically in Latin America until now—namely, whether the adoption of risk-weighted minimum capital requirements in the form of the Basel Accord played a contributing role. The evidence for the United States suggests that Basel may have been at least partially responsible for the credit decline of the early 1990s and the ensuing slow recovery. This may also be the case in Latin America and other regions around the world, given that a total of 125 countries adopted Basel in the 1990s.

We used a cross-country bank data set to test whether the Basel Accord had a significant effect on bank activities. Our means tests showed that after Basel, Latin American banks increased capital to meet the Basel I requirements and also increased the size of their loan portfolios. Since the implementation of Basel, they have tended to hold a capital-asset ratio that is 4 percent above the world average and a loan-to-asset ratio about 1 percent over the world average. A comparison of pre- and post-Basel periods reveals that return on equity decreased quite substantially, by about 7.0 percent in Latin America and the Caribbean, while the world

63. Here, the point estimate suggests a threshold of 34 percent for the financial development indicator, or a private sector credit-to-GDP ratio of 58 percent. This level is achieved by only one country in Latin America and the Caribbean (namely, Panama, with 74 percent).

TABLE 12. Effects of the Basel Accord on Bank Loans in Latin America [a]

Explanatory variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
BASELYR1	11.800	0.894	4.083	0.016	0.022	–0.047
	(4.38)***	(0.22)	(0.92)	(0.54)	(0.60)	(1.07)
Bank risk variable						
EQTA(–1)	0.144		0.038	–0.002		–0.005
	(1.15)		(0.43)	(1.53)		(2.82)***
NPFRAT(–1)		–0.860	–0.837		–0.006	–0.007
		(1.87)*	(1.79)*		(2.17)**	(2.43)**
Interaction term						
EQTA(–1) * BASELYR1	–0.258		–0.229	0.004		0.006
	(1.93)*		(2.08)**	(2.28)**		(2.70)***
NPFRAT(–1) * BASELYR1		0.513	0.478		0.003	0.004
		(1.09)	(1.01)		(1.16)	(1.42)
Macroeconomic control						
RGDPG	0.613	0.595	0.601	0.018	0.022	0.022
	(6.59)***	(5.34)***	(5.38)***	(11.65)***	(11.30)***	(11.30)***
DM3GDP	0.257	–0.111	–0.121	0.015	0.020	0.019
	(3.47)***	(0.66)	(0.72)	(8.25)***	(7.82)***	(7.30)***

FINDEV	43.951	11.240	11.441	–0.055	–0.398	–0.363
	(8.26)***	(0.91)	(0.92)	(0.87)	(2.93)***	(2.75)***
FINDEV * BASELYR1	–34.183	21.513	22.056	–0.090	0.318	0.283
	(4.89)***	(1.56)	(1.60)	(1.04)	(2.02)**	(1.83)*
Summary statistic						
R^2	0.051	0.135	0.142	0.088	0.137	0.147
No. observations	2,908	1,439	1,439	2,591	1,308	1,308
						(*continued*)
OLS regressions with country dummies						
F test for joint significance of country dummies (with *p* values)	50.78	91.13	81.64	5.99	28.50	20.20
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.226	0.249	0.255	0.128	0.202	0.147
No. observations	2,908	1,439	1,439	2,591	1,308	1,308

Source: Authors' calculations.

* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

a. The dependent variable in columns 1–3 is net loans/assets (NLOANTA) and in columns 4–6 is the real growth rate of loans (RLOANGROWTH). The estimation method used is OLS across countries and time, with interaction between FINDEV and BASELYR1; the table also reports summary statistics for OLS regressions that use country dummies in place of the financial development indicators. The figures in parentheses are *t* ratios, calculated from robust standard errors.

average decreased by 3.5 percent. These figures remain stubbornly high by world standards despite a financial development process that took place between the pre- and post-Basel periods, which reduced interest spreads and overhead costs.

Compared with other regions, Latin America's behavior was about average: some regions increased capital and lending by more, some by less. Europe appears to have increased its capital and lending the least, and it may even have reduced lending rates after Basel. Finally, based on the full sample of countries, we found a smaller increase in loans after Basel among countries with a higher level of financial development, together with a threshold of financial development above which credit appeared to decline after Basel. However, this effect was noticeably weaker when we focused on the Latin American region or excluded the early-adopting countries from the sample.

Our results give only weak evidence of a Basel-induced credit crunch in Latin America. We do not find evidence that the loan supply curve shifted, on average, after Basel, but we do find some evidence of risk retrenchment, as loan growth became more sensitive to the lagged equity-asset ratio. The same message generally holds for the full country sample, although the risk retrenchment appears somewhat weaker than in Latin America. Furthermore, our analysis of loan growth tended to be more in line with the credit crunch hypothesis and with our macroeconomic controls than was our analysis of loan-asset ratios, although the results are still far from conclusive.

Based on our empirical results, the role played by financial development in the process of adoption appears to be consistent with the regulatory arbitrage hypothesis, whereby banks have an incentive to develop ways to circumvent the costly new regulations. Although the measure we used refers to the size of banking activities—and is thus only an imperfect indicator of capital market development—our estimated negative effect of financial development on lending is consistent with the idea that banks may artificially reduce their risk-weighted assets more easily to the extent that instruments are available that permit them to do so. Emerging markets, in contrast, either found other, nonmarket ways to arbitrage—such as shifting among types of loans so as to lower their risk-weighted assets or taking advantage of lax enforcement of the regulations—or were effectively forced to raise costly capital to comply with the regulations. Our estimations suggest that the latter did in fact occur, although some partial nonmarket arbitrage may have occurred as well.

The verdict so far is that given the environment under which the Basel Accord was adopted, risk-based capital requirements were not responsible for the widespread reductions in the credit supply in Latin America. Basel I had the intended consequence of making banks more sensitive to changes in their capital ratios, although it does not appear to have influenced banks' sensitivity to other risk factors, such as credit risk—perhaps because credit risk does not affect the regulatory capital ratio directly, but rather does so through its impact on the value of bank assets. Basel II is expected to incorporate a wider range of weights on different types of risk, as well as a more accurate approximation of credit risk, so we would expect loan sensitivity to risk to increase as well. Although our results do not give cause for concern that additional and permanent credit declines might occur when Latin America adopts Basel II, they do suggest that Basel II might cause credit to become increasingly procyclical as loan supply becomes more sensitive to risk factors that vary with the business cycle.

Further work in this area is warranted. One could exploit more disaggregated data to explore whether different types of banks (small versus large, for example) faced different constraints and thus reacted differently to the changes imposed by Basel, and whether changes in the composition of loans took place, even if overall lending might not have declined. Finally, the role of other reforms, most notably liberalizations that might have stimulated increased bank competition and lending during this period, could be addressed systematically.

Comment

María Soledad Martínez Pería: Barajas, Chami, and Cosimano use data for 2,893 banks in 152 countries between 1987 and 2000 to investigate the consequences of the adoption of the Basel Accord for bank capital and lending in developed and developing countries. In particular, the paper examines whether bank capital increased and lending declined as a result of Basel I. While this question has been researched extensively for the United States, it remains largely unexplored for developing countries.[1] This study thus makes an important contribution to the literature by examining the so-called credit crunch hypothesis for a large number of countries. Nevertheless, some areas of the paper could perhaps be improved. My comments concentrate on the empirical approach, the interpretation of the findings, and the lessons from this paper when it comes to anticipating what Basel II might bring.

With regard to the empirical approach, this paper focuses exclusively on the long-run consequences of Basel I: the regressions in this paper test whether Basel I caused a permanent decline in bank lending. This is important for at least two reasons. First, this differs from most existing studies on Basel, and this has to be a consideration when comparing the results from this paper with those of previous studies. Second, the authors' focus on the long-run effects makes it harder to be confident that the model used to study the behavior of bank lending is well specified, since a large number of factors that could affect bank lending are likely to change over the long run. Unless these factors are contemplated in the estimation, it is not clear whether the results are robust. As currently specified, the estimated models do not control for factors like financial liberalization (including foreign bank entry), the adoption of deposit insurance schemes, and differences in local regulations and enforcement over time and across

1. The one exception for developing countries is Chiuri, Ferri, and Majnoni (2002). On the United States, see Berger and Udell (1994); Hancock and Wilcox (1994); Jacques and Nigro (1997); Peek and Rosengren (1995); Shrieves and Dahl (1992).

countries, all of which could influence both the level of capital held by banks and their lending behavior.

Another potential limitation of the empirical approach pursued by the authors is that it does not distinguish between countries and periods for which Basel I was binding and those for which it was not. The impact of the formal adoption of Basel I should presumably vary depending on whether this regulatory change was binding. It would be interesting to see whether changes in capital and lending differ for countries and period of capital shortfalls and surpluses vis-à-vis the Basel I standard.

Regarding the interpretation of the results, the paper overstates the robustness of some of the empirical findings and understates the importance of others. For example, the paper claims to find unequivocal evidence that capital increased following Basel I, no matter the measure of capital used. This result only holds, however, in one out of the six fixed-effects estimations reported for all countries. The authors also report OLS estimations with and without country dummies and a control for the level of financial development. In some of these estimations, albeit less than half, capital does appear to increase following Basel I. Nevertheless, the fixed-effects estimations, which allow for bank-specific intercepts, are probably the best estimators, since they adequately control for the average loan-to-asset ratios for each bank and highlight how the ratio changed after Basel I.

While the paper overestimates the increase in capital following Basel, it sometimes seems to downplay the evidence consistent with a credit crunch in the aftermath of Basel. The paper claims to find little evidence of a credit crunch despite the fact that all the fixed-effects estimations including all countries indicate a decline in loan growth following Basel I, while none of the loan-to-asset ratio fixed-effects estimations show an increase in lending. Here, the growth estimations are probably more reliable, since it is harder to interpret the behavior of bank loans from the loan-to-asset ratios, given that the latter are also driven by changes in total assets. I would therefore encourage the authors to give more weight to the findings from the growth estimations, especially those allowing for bank fixed effects.

Notwithstanding the comments made so far, this paper makes an important contribution to the banking literature by exploring the impact of regulatory changes for a wide set of countries, especially in Latin America, and the authors should be commended for their efforts. Also, the paper

is very timely, since its findings have implications for the likely consequences of Basel II, the new capital accord to be implemented over the next few years. Unfortunately, though, the paper cannot shed light on a number of significant concerns raised about Basel II, such as whether it will lead to higher costs of credit and whether it will foster credit migration toward safe borrowers. These issues are likely to be a great concern for developing countries, and they warrant further research. The authors acknowledge this, and I hope they consider tackling these questions in future work.

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