

Colombia: Selected Issues Paper

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COLOMBIA

Selected Issues

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Approved by the Western Hemisphere Department

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I. DETERMINANTS OF INVESTMENT GRADE STATUS AND IMPLICATIONS FOR COLOMBIA'S PUBLIC DEBT¹

A. Introduction

1. **The Colombian authorities are interested in regaining investment grade status, which was lost during the financial crisis of 1998–99.** Achieving investment grade status would help lower financing costs for the sovereign, and expand the pool of potential buyers of Colombian paper. It would also reduce borrowing costs for corporates with access to international capital markets.
2. **Identifying the main determinants of investment grade status can help guide policies towards achieving this goal.** Colombia's debt levels as of end 2008 were broadly similar to the average for investment grade emerging markets, suggesting that other indicators are taken into account in rating agencies' assessments. Gauging the weights given by rating agencies to alternative macroeconomic variables can be a helpful input for the authorities' overall policy framework, including the role of a medium term debt goal.
3. **The paper finds that, to a large extent, investment grade rating status can be explained by a small number of variables.** The analysis is based on a random effects binomial logit model estimated with data for a sample of 48 emerging market economies during the period 1993–2008. The model identifies a set of five core variables that are relevant for the determination of investment grade status, namely external public debt, domestic public debt, political risk, exports, and broad money (all variables as a share of GDP, except for political risk).
4. **Building on existing literature, the main contributions of this paper consist of:** (i) defining the dependent variable in binary form (investment grade/speculative grade) as opposed to ordinal ratings; (ii) restricting the sample to emerging market economies only, to avoid industrial country bias on investment grade determinants; and (iii) presenting additional explanatory variables not included in previous studies, in particular a breakdown of debt indicators and a measure of financial depth.

B. Background and Literature Review

5. **Sovereign debt ratings are intended to be forward-looking qualitative measures of the probability of default elaborated by rating agencies.** They are summary assessments of a government's ability and willingness to repay its debts in full and on time. The three major credit rating agencies—Moody's Investor Services (Moody's), Standard and Poor's (S&P), and Fitch Ratings (Fitch)—indicate that their assessments of government risk

¹ Prepared by Laura Jaramillo.

are based on the analysis of a broad set of economic, social, and political factors, but are not explicit about the weights given to those variables in their final assessments.² The ratings (and meaning) given by these agencies are summarized in Table 1.

6. Sovereign credit ratings are important for at least three reasons.

First, they are a key determinant of a country's borrowing costs in international capital markets. Second, the sovereign rating generally sets a ceiling for the ratings assigned to domestic banks and companies, and therefore affects private financing costs.³ And third, some institutional investors have lower bounds for the risk they can assume in their investments and will choose their portfolio composition taking into account the credit risk signaled by the rating notations.

	S&P	Moody's	Fitch
Investment Grade			
Highest quality, reliable, stable	AAA	Aaa	AAA
Quality, but a little more risk	AA	Aa	AA
Economic situation can affect finances	A	A	A
Just making the grade	BBB	Baa	BBB
Speculative Grade			
More sensitive to economic changes	BB	Ba	BB
Financial situation varies considerably	B	Ba	B
Vulnerable, dependent on favorable economic conditions to meet payments	CCC	Caa	CCC
Highly vulnerable, speculative	CC	Ca	CC
Close to default, may be in arrears	C	C	C
Defaulted on obligations	D		D

Note: Within rating categories, S&P and Fitch use plus (+) or minus (-) signs to show relative standing, with A+ being better than A or A-.
Moody's uses a modifier of 1,2,or 3 for the same purpose, with A1 being better than A2 or A3.

7. Since sovereign ratings summarize a vast amount of information, empirical studies have tried to predict country ratings based on a parsimonious set of economic variables. The seminal paper by Cantor and Packer (1996), based on a sample of 49 industrialized and developing countries, suggested that six variables were likely to explain ratings: per capita income, GDP growth, inflation, external debt, level of economic development, and default history. Using the same methodology, Afonso (2003) found that GDP per capita was the only relevant determinant of ratings of developed countries, while external debt played a key role for developing countries. In contrast, Mulder and Perrelli (2001) found that for emerging market economies the ratio of investment to GDP was the key variable explaining ratings. Results on the significance of political variables have been mixed: Archer et al. (2007) concluded that political factors had little effect on bond ratings; Mellios and Paget-Blanc (2006) found that indicators of corruption were an

² See http://www2.standardandpoors.com/aboutcreditratings/RatingsManual_PrintGuide.html for criteria used by Standard and Poor's; http://www.moodys.com/moodys/cust/research/MDCdocs/09/2007200000530576.pdf?doc_id=2007200000530576&frameOfRef=corporate for criteria used by Moody's; and http://www.fitchratings.com/creditedesk/reports/report_frame.cfm?rpt_id=474248§or_flag=5&marketsector=1&detail= for criteria used by Fitch.

³ Borensztein et al. (2007) find that sovereign ratings have a significant effect on private ratings even after controlling for country specific macroeconomic conditions and firm-level performance indicators.

important determinant of ratings; and Afonso et al. (2007) found a significant coefficient for an indicator of government effectiveness. (See Table 2).

Study and Regression Technique	Data Sample	Significant explanatory variables
Afonso (2003) OLS	81 countries, June 2001	GDP per capita (+), GDP growth (+) Inflation (-), External debt ratios (-) Economic development (+), Default history (-)
Afonso, Gomes, Rother (2007) Pooled ordered probit, random effects ordered probit	130 countries, 1970-2005 Moody's, S&P, Fitch	GDP per capita (+), GDP growth (+) Inflation (-), External debt ratios (-) International reserves (+), Default history (-) Government effectiveness (+) EU countries (+)
Archer et al. (2007) Linear regression with panel-corrected standard errors	50 developing countries, 1987-2003 Moody's, S&P, Fitch	Trade (+), Inflation (-) GDP growth (+), Default (-)
Cantor and Packer (1996) OLS	49 countries, September 1995 Moody's, S&P	GDP per capita (+), GDP growth (+) Inflation (-), External debt ratios (-) Economic development (+), Default history (-)
Mellios and Paget-Blanc (2006) Ordered logistic model	86 countries, December 2003 Moody's, S&P, Fitch	Per capita GDP (+), Government income (+) Real exchange rate changes (+), Inflation (-) Default history (-), Corruption index (+)
Mulder and Perrelli (2001) Pooled OLS and Feasible GLS	25 emerging market economies, 1992-1999 Moody's, S&P	Debt over exports (-), Rescheduling history (-) Fiscal balance (+), Output growth (+) Inflation (-), Investment to GDP (+)
Rowland (2004) OLS regression	50 developing countries, July 2003 Moody's, S&P	GDP per capita (+), GDP growth (+) Inflation (-), External debt ratios (-) International reserves (+), Openness (+)
Rowland and Torres (2004) Random effects GLS regression	16 emerging market economies, 1987-2001 Moody's, S&P	GDP growth (+), Inflation (-) External debt ratios (-), International reserves (+) Openness (+), Default history (-)

C. Empirical Model Specification

8. **This paper will focus on the determinants of investment grade ratings for emerging market economies.** All the studies listed in Table 2 transformed credit ratings into a linear scale and used this ordinal measure as the dependent variable. In contrast, this paper defines a binary dependent variable for investment grade status, based on ratings data from Moody's, S&P, and Fitch. The rating for any given year is the end-December rating, and the dummy is made equal to 1 for countries that were assigned investment grade status by at least two out of the three agencies.⁴ A panel data framework is used to control for heterogeneity

⁴ The ratings do not differ significantly across the three agencies. Investment/speculative grade status coincided across the three rating agencies for 94 percent of all observations in the sample.

across countries. A random effects binomial logit model produces better results (from an econometric point of view) than those obtained from a pooled regression and a fixed effects regression. The advantage of this technique is that it uses information from all countries in the sample and the marginal effect of any independent variable on the probability is conditional on the values of all covariates.⁵

9. **The model specification can be written as:**

$$IG_{it} = \alpha + \beta X_{it} + \lambda Z_i + a_i + \mu_{it}, \quad i = 1, \dots, N, t = 1, \dots, T \quad (1)$$

Where IG_{it} is the binary variable equal to 1 for countries with investment grade status; X_{it} is a vector containing the time-varying explanatory variables described below; Z_i is a vector of time invariant variables that include regional and default dummies; a_i stands for the individual effects for each country i (that can either be modeled as an error term or as N dummies to be estimated) and μ_{it} represent disturbances that are independent across countries and across time.

10. **Building on the evidence provided by the existing literature, the paper identifies a set of potential determinants of investment grade status.** The selection of the explanatory variables is guided by the rating agencies' reports and previous empirical evidence. Table 3 lists the explanatory variables that were included as regressors (X_{it}) in model.⁶

Macroeconomic Indicators		Government Sector	
GDP per capita (US\$ dollars)	+	Primary balance	+
Real GDP growth	+	External public debt to GDP**	-
Potential GDP growth	+	Domestic public debt to GDP**	-
Inflation rate	-		
Unemployment rate	-	Financial Depth	
		Broad money to GDP**	+
External Sector		Other	
Exports to GDP	+	Political risk index ICRG	
Current account balance to GDP	-	(higher index implies lower risk)	+
Private external debt to GDP**	-	Default history	-
NIR to GDP	+	Regional dummies	

Note: ** denotes variables not included in previous empirical studies

⁵ The pooled estimation does not control for unobserved country effects, while the fixed effects logit model has the disadvantage that only countries where the dependent variable “switches” (from 0 to 1 and vice versa) can be included in the estimation—which in this case would lead to a sizeable number of cases being dropped. In addition, the fixed effects estimations cannot assess the impact of non-time varying country characteristics.

⁶ See Appendix 1 for a description of the explanatory variables and rationale for their inclusion in the regression analysis.

D. Data and Estimation Results

Data

11. **The regression analysis is based on a sample of 48 emerging market countries.** The ratings data are obtained from the three main rating agencies for the 1993–2008 period. Table 4 provides some descriptive statistics of the dependent variable.⁷ Unless otherwise specified, the macroeconomic variables are drawn from the WEO database. The political risk variable is based on the political risk index published by the International Country Risk Guide, where a higher value indicates lower risk. For all the time-varying regressors, lagged values of the explanatory variables are used to avoid endogeneity problems.

Table 4. Descriptive Statistics of Countries in the Sample and Investment Grade Status

	Latin America	Europe	East Asia	Other	Total
Number of countries	15	16	7	10	48
Number of observations	218	222	112	139	691
Percent of observations in the total sample	31.3	33.3	14.6	20.8	100.0
Percent of observations with investment grade status	17.4	63.1	57.9	27.0	40.7
Percentage of countries with a switch in status	40.0	50.0	57.1	30.0	43.8
Percentage of countries with at least one upgrade to investment grade	33.3	37.5	42.9	30.0	37.5
Percentage of countries with at least one downgraded to speculative grade	20.0	18.8	57.1	10.0	22.9

12. **Tests of means and medians show that investment grade countries tend to outperform speculative grade countries on most of the economic dimensions captured by the regressors.** Welch tests were used to test for equality of means across the two groups of observations (investment and speculative grade), and Wilcoxon rank-sum tests were used to test whether the distribution is independent across the two groups of observations.⁸ Table 5 shows that both tests yielded similar results, with investment grade countries showing “better” values for the indicator than speculative grade countries on most accounts in almost all cases.

⁷ The sample of countries consists of: Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Jamaica, Mexico, Panama, Peru, Uruguay, Venezuela, Bosnia & Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Iceland, Israel, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Turkey, Ukraine, China, Indonesia, Korea, Malaysia, Philippines, Thailand, Vietnam, Egypt, India, Jordan, Kazakhstan, Lebanon, Morocco, Pakistan, South Africa, Sri Lanka, and Tunisia.

⁸ A comparison of means only could be misleading in the presence of large outliers.

Variable	Colombia 2008	Mean			Median		
		Investment grade	Speculative grade	Welch test	Investment grade	Speculative grade	Wilcoxon test
Macroeconomic Variables							
GDP per capita (US\$ dollars)	4,763	8,083	3,766	**	4,950	2,800	**
Real GDP growth	2.5	4.8	3.8	**	5.1	4.4	**
Potential GDP growth	4.0	4.4	3.7	**	3.9	3.8	*
Inflation	7.0	5.7	25.9	**	4.4	7.7	**
Unemployment	10.6	8.3	10.5	**	7.5	9.8	**
External Sector							
Exports to GDP	17.7	45.7	30.4	**	40.9	29.1	**
Current account balance to GDP	(2.8)	(3.0)	(2.4)		(2.9)	(2.4)	
Private external debt to GDP	6.9	42.4	19.6	**	32.3	14.3	**
NIR to GDP	9.7	18.7	14.5	**	17.1	11.2	**
Government Sector							
Primary balance	2.6	0.4	0.8	*	(0.1)	0.8	**
External public debt to GDP	12.2	12.8	30.6	**	9.9	25.3	**
Domestic public debt to GDP	19.9	21.7	27.3	**	15.2	19.6	**
Financial Depth							
Broad money to GDP	35.8	64.3	54.6	**	50.4	42.6	**
Other							
Political risk index ICRG (+ is lower risk)	58.5	73.0	64.6	**	74.0	65.5	**

Sources: Authors' calculations based on data from IMF, World Bank, and International Country Risk Guide.
Note: ** stands for statistical significance at the 1 percent level; * stands for statistical significance at the 5 percent level.

Regression results

13. **Table 6 shows the results of estimating equation (1), with three different techniques: pooled, random effects and fixed effects.** For each technique, the first column reports the unrestricted model (i.e. columns A, C, and E), whereas the second shows the results for the restricted model (i.e. columns B, D and F). The unrestricted model incorporates all the variables listed in Table 3, whereas the restricted model contains only the variables which were found to have a statistically significant impact.⁹

14. **The random effects model (column D) is found to be the preferred specification.** The likelihood-ratio test rejected the null hypothesis of no variation in the country specific errors of the pooled regression (columns A and B), indicating the need to control for country-

⁹ Variables that did not reveal any explicative power were dropped based on Wald tests. The restricted models are robust to alternative exclusion procedures. Furthermore, the variables found to be significant in the unrestricted model generally remain significant with the same sign in the restricted model.

specific effects. At the same time, Hausman specification tests did not reject the null hypothesis that the random effects (column D) and consistent fixed effects coefficients (column F) were the same, suggesting that the random effects model is appropriate.

VARIABLES	Pooled regression		Random effects		Fixed Effects	
	A	B	C	D	E	F
GDP per capita (US\$)	0.00 ** (0.00)	0.00 *** (0.00)	0.00 (0.00)		0.00 (0.00)	
Potential GDP growth	0.12 (0.12)		-0.34 (0.42)		-0.59 (0.53)	
Inflation	-0.05 (0.03)		-0.02 (0.04)		-0.01 (0.01)	
Unemployment	0.06 * (0.04)		0.19 (0.14)		-0.03 (0.17)	
Exports to GDP	0.02 * (0.01)	0.01 (0.01)	0.10 (0.07)	0.08 *** (0.03)	0.23 * (0.12)	0.10 ** (0.04)
Current account balance to GDP	0.06 * (0.04)		0.01 (0.12)		-0.02 (0.16)	
Private external debt to GDP	0.02 (0.02)		-0.02 (0.03)		-0.05 (0.04)	
Net international reserves to GDP	0.00 (0.03)	0.01 (0.02)	0.16 (0.12)		0.29 (0.18)	
Primary balance to GDP	0.05 (0.08)		0.03 (0.18)		-0.31 (0.26)	
External public debt to GDP	-0.09 *** (0.02)	-0.09 *** (0.01)	-0.38 *** (0.10)	-0.25 *** (0.04)	-0.45 *** (0.11)	-0.22 *** (0.04)
Domestic public debt to GDP	-0.06 *** (0.01)	-0.05 *** (0.01)	-0.18 *** (0.05)	-0.09 *** (0.02)	-0.24 *** (0.06)	-0.08 *** (0.03)
Broad money to GDP	0.02 ** (0.01)	0.02 *** (0.01)	0.11 ** (0.06)	0.04 *** (0.02)	0.24 *** (0.08)	0.07 ** (0.03)
ICRG political risk index	0.09 ** (0.04)	0.10 *** (0.03)	0.09 (0.08)	0.15 *** (0.05)	0.11 * (0.06)	0.15 ** (0.06)
Latin America and Caribbean dummy	-1.06 (0.72)	-1.69 *** (0.38)	1.60 (3.81)			
Europe dummy	0.35 (0.66)		4.56 (4.28)			
East Asia dummy	-0.25 (0.73)		-0.27 (4.40)			
Default dummy	-1.82 *** (0.56)		-3.27 (4.85)			
Constant	-7.53 ** (2.96)	-6.44 *** (1.80)	-10.55 (8.25)	-10.10 *** (3.83)		
Observations	483	536	483	540	248	284
Number of countries			35	37	17	19

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

15. The results in Table 6 suggest that investment grade status can be modeled parsimoniously with a handful of regressors.¹⁰

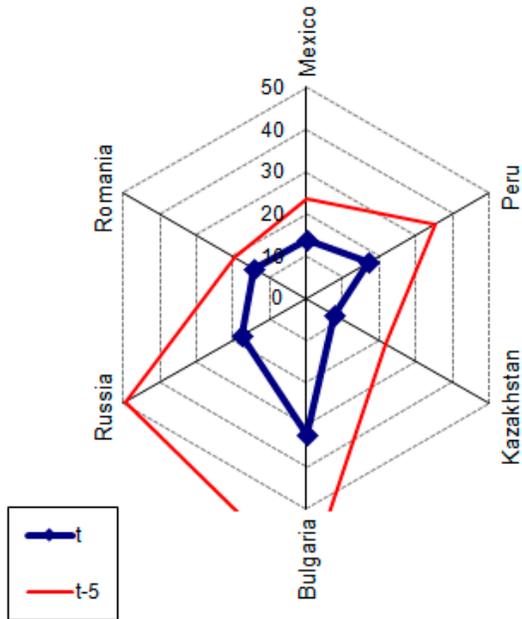
- *In line with other studies (e.g. Afonso (2003)), the results show that the level of debt matters for determining investment grade.* However, the findings suggest that rating agencies do distinguish between types of debt. They tend to see risk in high public debt indicators, but do not seem to assign a significant weight to private external debt. Furthermore, rating agencies seem to attach greater risk to external public debt than to domestic public debt, with the coefficients of the former being more than 2½ times bigger.
- *The political risk index was found to be significant and positively related to the investment grade rating.* This is in line with the findings of Mellios and Paget-Blanc (2006), though contrary to the findings of Archer et al. (2007) who used as regressors different proxies for democratic rule (such as executive party tenure, undivided government, and election cycles).
- *Exports to GDP and broad money to GDP were also found to be significant.* The positive effect of exports on investment grade is line with the findings by Rowland (2004). The significant and positive impact of broad money on the determination of investment grade is a new finding as previous studies had not included measures of financial depth as regressors.

16. The random effects model provides a good fit, as it performs well in predicting both investment grade status and “switches”. Using the overall in-sample probability of being investment grade (0.4) as the cut-off point, the number of times the models correctly predicts zeroes and ones was computed. The model correctly classifies 86 percent of all observations, with Type I error (failing to predict investment grade status) of 8.9 percent, and Type II error (failing to predict speculative grade status) of 5.2 percent. In terms of “switches”, the model correctly predicts 6 out of 9 downgrades (68 percent), failing to predict the downgrades of Korea, Malaysia and Thailand—which happened in the context of the Asian crisis and were reversed within two years. The model also predicts correctly 11 of the 17 upgrades in the sample (65 percent). Among the upgrade cases that the model fails to predict are those of Mexico and South Africa (which are predicted with a three year lag) and those of Colombia and Uruguay (which lost their investment grade status within 4–5 years of the upgrade). Figure 1 depicts the behavior of the regressors in some of the cases that experienced an upgrade to investment grade during the sample period.

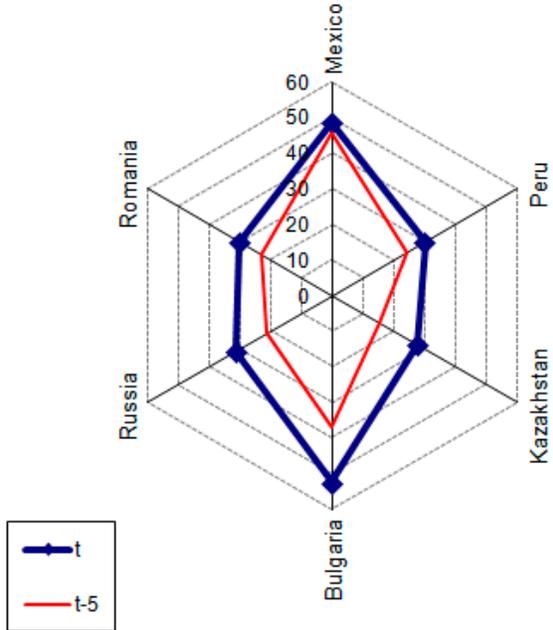
¹⁰ Although rating agencies may assign substantial weight to other factors in determining specific rating assignments to a particular country at a given point in time, no systematic relationship between those variables and investment grade status was detected in the sample.

Figure 1. Emerging Markets: Value of Explanatory Variables at Time of Upgrade to Investment Grade and Five Years Earlier 1/

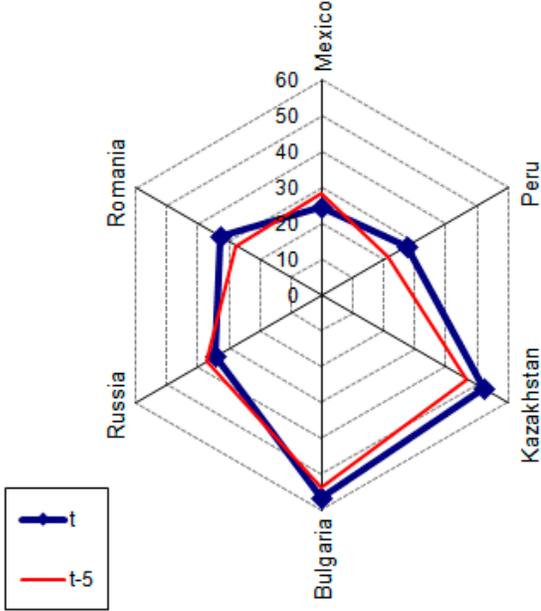
External Public Debt
(Percent of GDP)



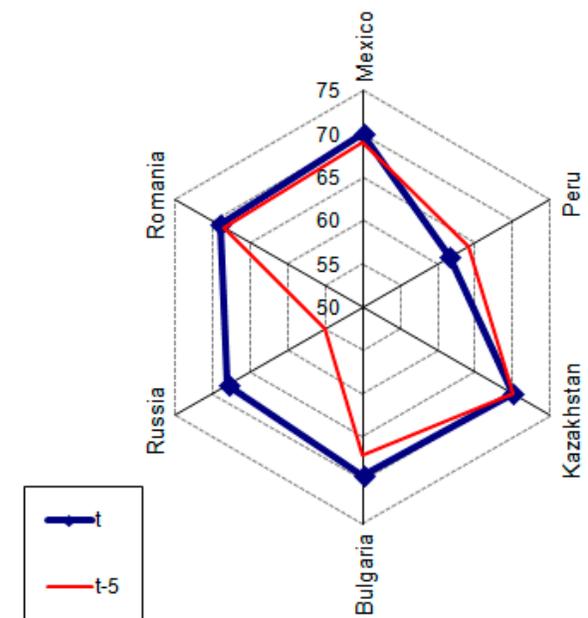
Broad Money
(Percent of GDP)



Exports
(Percent of GDP)



ICRG Political Risk Index
(+ indicates less political risk)



1/ Domestic debt to GDP was not graphed as there was not a significant change in this variable for the particular country examples shown.

Table 7. Average Partial Effects on the Probability of Investment Grade Status

	Average Partial Effects	APE by Quartile			
		1	2	3	4
External public debt to GDP, 10 percentage point decline	0.16	0.09	0.30	0.20	0.04
Domestic public debt to GDP, 10 percentage point decline	0.06	0.05	0.07	0.06	0.05
Political risk index, 10 point increase	0.10	0.05	0.12	0.14	0.08
Exports to GDP, 10 percentage point increase	0.05	0.04	0.08	0.08	0.02
Broad money to GDP, 10 percentage point increase	0.03	0.02	0.03	0.04	0.02
Memorandum items:					
Quartile cut-off points					
External public debt to GDP	26	12	21	37	120
Domestic public debt to GDP	26	10	19	33	141
Political risk index	67	63	69	73	87
Exports to GDP	36	23	32	45	120
Broad money to GDP	59	34	45	67	279
Percentage of investment grade observations in each quartile					
External public debt to GDP		56.4	27.7	8.2	7.7
Domestic public debt to GDP		39.5	27.2	17.4	15.9
Political risk index		7.2	21.0	24.6	47.2
Exports to GDP		12.8	17.4	27.7	42.1
Broad money to GDP		11.3	26.2	33.8	28.7
Percentage of speculative grade observations in each quartile					
External public debt to GDP		7.6	25.3	36.1	31.0
Domestic public debt to GDP		16.1	23.7	28.8	31.3
Political risk index		35.4	28.8	24.1	11.7
Exports to GDP		32.9	30.4	21.2	15.5
Broad money to GDP		32.3	25.9	19.0	22.8

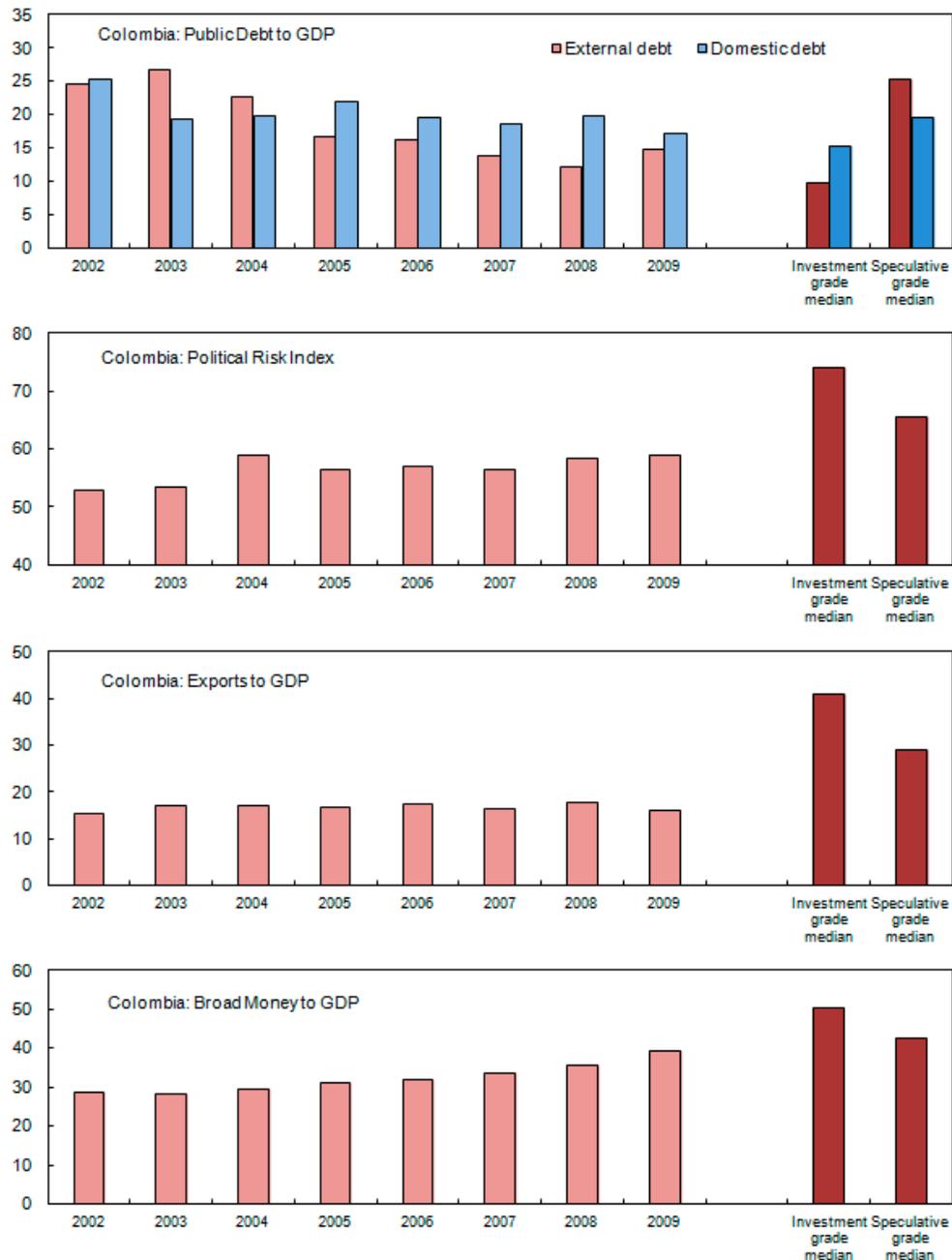
17. **An analysis of marginal effects provides further insights on the impact of the regressors on the probability of investment grade status.** Table 7 shows the average partial effects¹¹ for alternative levels of debt, openness, financial development and political risk. As expected in a binomial logit model, the marginal effects of each variable are nonlinear and are therefore larger for values in the middle of the distribution. For example, a 10 percentage point decrease in external public debt to GDP would increase the probability of investment grade by 16 percentage points on average, with the effect being almost double for those countries in the second quartile of the distribution. Similarly, a 10 point increase in the political risk index (implying an improvement in risk perception) would increase the probability of investment grade by 10 percentage points on average, with somewhat greater impact for countries in the middle of the distribution. Table 7 also shows that there are investment grade observations throughout the distribution of each variable, implying that there is not necessarily a minimum threshold for each of the regressors.

¹¹ Calculated as the partial effects averaged across the population. See Wooldridge (2002).

E. Implications for Colombia

18. **The above results suggest that Colombia’s efforts to increase the likelihood of a rating upgrade should focus on improving its debt indicators.** Colombia’s public debt indicators are not too far away from the median of investment grade emerging market countries. However, there is a significant difference in terms of the other indicators between Colombia and other emerging markets (see Figure 2). For example, Colombia’s ratio of

Figure 2. Colombia: Factors Affecting Investment Grade Status



exports to GDP (17.7 percent) is significantly below that of investment grade countries, and is in the lowest quartile for emerging market countries overall. Similarly, Colombia's political risk index and broad money to GDP are well below those for investment grade countries, and also in the lower quartiles of emerging market countries. While these indicators have been improving in recent years, further progress is likely to be gradual and not directly linked with macroeconomic policies. In contrast, a strong process of fiscal consolidation could result in a steady reduction in debt levels.

19. **A marginal effects analysis for Colombia shows that reducing public debt, in particular external public debt, would increase substantially the probability of an upgrade.** Based on the marginal effect analysis reported in Table 7 and holding other values at their 2008 levels, a decline in Colombia's public debt ratio to 20 percent (including by halving its external public debt to 6 percent of GDP) would increase the probability of attaining investment grade status to 40 percent (the sample cut-off point).

F. Summary and Conclusions

20. **The paper finds that investment grade ratings by the three major credit agencies can be explained by a small number of variables.** The panel random effects framework identifies a set of five core variables that are relevant for the determination of investment grade status, in particular external public debt, domestic public debt, political risk, exports to GDP, and financial depth. Overall, the specification correctly predicts 86 percent of investment grade status of all observations, and two thirds of the upgrades and downgrades from and to investment grade.

21. **The findings suggest that Colombia's efforts to increase the likelihood of an upgrade to investment grade should focus on a faster pace of debt reduction.** While Colombia's public debt figures are not too far away from those of emerging market investment grade countries, it faces weaknesses on other determinants that appear to have significant weight in credit rating agencies decisions, namely political risk, financial depth, and exports to GDP. A stronger process of fiscal consolidation that results in a significant decline in public sector debt, in particular external public debt, could help compensate these structural weaknesses and improve the prospects for an upgrade in the near term.

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Appendix 1. Explanatory Variables

Macroeconomic variables

- *Per capita income in U.S. dollars.* Higher per capita income tends to suggest a larger potential tax base and a greater ability to repay debt. It also serves as a proxy for the level of economic development, which might influence default risk.
- *Real GDP growth and potential GDP growth.* Higher economic growth tends to decrease the relative debt burden and may help in avoiding insolvency.
- *Inflation rate.* A low inflation rate reveals sustainable monetary and exchange rate policies. It can also be seen as a proxy of the quality of economic management.
- *Unemployment rate.* A country with low unemployment tends to have more flexible labor markets making it less vulnerable to changes in the global environment.

External sector variables

- *Exports to GDP.* A higher ratio suggests a greater capacity to obtain hard currency to repay foreign currency denominated debt. Unlike most previous studies, where exports are included only as a metric for external debt, this paper introduces it as an independent regressor.
- *External current account to GDP.* A large current account deficit suggests a high dependence on foreign capital, which can be a source of risk to macroeconomic stability.
- *Private and public external debt to GDP.* The higher the external indebtedness, the higher the risk of fiscal or balance of payments stress. In contrast to existing literature, this paper distinguishes between private and public external debt to allow for differences in the weight assigned by rating agencies to each one.
- *Net international reserves to GDP.* The higher the ratio, the more resources are available to service foreign debt. It reduces a country's vulnerability to liquidity shocks.

Government sector variables

- *Primary balance to GDP.* A low primary balance indicates that the government lacks the ability or the will to increase taxes to cover current expenses. A weak fiscal position also implies a higher likelihood that external shocks result in a default. In contrast to previous studies, the regressions use the primary balance instead of the overall balance to avoid possible endogeneity with the credit rating.
- *Public debt to GDP.* The higher the debt burden, the larger the transfer effort the government will have to make over time to service its obligations, and therefore a

higher risk of default. In contrast to existing literature, this paper distinguishes between domestic and external public debt to allow for differences in weights.

Financial depth

- *Broad money to GDP.* Countries that have access to a deep and diversified pool of finance are in a better situation than those whose private savings are low and whose financial system is repressed. For this reason, financial depth is a useful indicator of government financial flexibility. High levels of financial intermediation, as proxied by broad money to GDP, can be associated with a greater capacity to sustain a given domestic debt burden. Existing literature has not included this variable.

Other regressors

- *Political risk.* Rule of law and respect for property rights provide confidence that political (and civil) institutions have a strong commitment to honoring financial obligations. As summarized by the International Country Risk Guide (ICRG), the political risk index is used as a proxy to measure a country's willingness to repay.
- *Default history.* A country's default history tends to influence its rating. A binary variable is set equal to 1 when the sovereign has defaulted on its external debt at least once in the previous ten years.
- *Regional dummies.* Dummies are included for the Latin America and the Caribbean, Europe, and East Asia.

Appendix 2. Robustness Analysis

The results reported in Table 6 were robust to alternative measures of the explanatory variables. In order to compare the results with those of previous studies, the model was estimated using debt scaled by exports as a regressor (as opposed to having debt and exports to GDP enter separately in the regression). Table A1 (column A) shows that the coefficient for the debt to exports ratio was found to be negative and significant, without altering the sign or significance of the other coefficients; however, this specification deteriorates the fit of the model. The political stability index of the World Bank

Governance Indicators was used as an alternative measure to the ICRG political risk indicator. This coefficient was positive and significant, did not affect the sign or significance of the other coefficients, but the fit of the model deteriorated (column B).

Alternative measures of financial depth, in particular net credit to the private sector and market capitalization of listed companies as a percent of GDP, did not prove to be significant, implying that broad money to GDP is the variable that best captures rating agencies' concerns regarding financial depth.

	Random effects	
	A	B
External public debt to GDP		-0.41 *** (0.08)
External public debt to exports	-0.04 *** (0.01)	
Domestic public debt to GDP	-0.10 *** (0.02)	-0.10 *** (0.04)
Exports to GDP		0.07 ** (0.03)
Broad money to GDP	0.04 *** (0.01)	0.07 *** (0.03)
ICRG political risk index	0.14 *** (0.05)	
WGI political stability index		3.90 *** (1.15)
Constant	-8.11 ** (3.45)	-7.68 ** (3.88)
Observations	540	553
Number of ccode	37	41

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The model also yielded similar results when the dependent variable was defined based on the investment grade ratings of each individual credit agency. The results in Table A2 suggest that S&P, Fitch and Moody's broadly share the same criteria for determining investment grade, although they weigh some variables differently. The broad similarity in criteria is not surprising given that the agencies agree on the classification of countries across investment/speculative grades in 94 percent of the cases. In all cases, the agencies attribute more weight to external public debt over domestic public debt. However, while Moody's seems to put more weight on the political risk variable than the average, this variable was not significant for S&P. The ratio of exports to GDP was significant for Moody's and with a lower coefficient for S&P, and broad money to GDP was significant for S&P and with a lower coefficient for Fitch.

Beyond the set of core regressors, credit agencies appear to rely on a few additional variables. In the case of Moody's, private external debt was found to have a positive significant effect on the investment grade rating, reflecting the view that steady private

access to international markets serves as an indicator of market confidence in the soundness of the corporate sector (column B). In the case of S&P, inflation was found to have a negative significant effect, which serves as a proxy for the quality of macroeconomic management (column D). Finally, in the case of Fitch, net international reserves were found to have a significant and positive effect, while the export variable was not significant (column F).

VARIABLES	Moody's		Standard and Poor's		Fitch Ratings	
	A	B	C	D	E	F
GDP per capita (US\$)	0.00 (0.00)		0.00 * (0.00)		0.00 (0.00)	
Potential GDP growth	0.18 (0.51)		-1.88 ** (0.75)		-1.57 ** (0.74)	
Inflation	0.00 (0.01)		-0.18 * (0.10)	-0.11 ** (0.06)	-0.11 (0.08)	
Unemployment	-0.55 ** (0.23)		0.17 (0.21)		0.06 (0.22)	
External public debt to GDP	-0.39 *** (0.09)	-0.29 *** (0.08)	-0.55 *** (0.11)	-0.44 *** (0.08)	-0.54 *** (0.17)	-0.26 *** (0.05)
Domestic public debt to GDP	-0.15 ** (0.06)	-0.06 * (0.03)	-0.20 *** (0.07)	-0.16 *** (0.04)	-0.32 *** (0.12)	-0.13 *** (0.03)
Primary balance to GDP	-0.97 *** (0.35)		0.33 (0.26)		0.21 (0.25)	
ICRG political risk index	0.36 *** (0.13)	0.28 *** (0.07)	-0.07 (0.12)		0.02 (0.12)	0.15 *** (0.06)
Private external debt to GDP	0.06 (0.04)	0.05 ** (0.02)	0.06 (0.05)		-0.04 (0.05)	
Net international reserves to GDP	0.00 (0.14)		0.16 (0.15)		0.43 ** (0.21)	0.17 *** (0.06)
Current account balance to GDP	-0.04 (0.14)		0.02 (0.19)		-0.05 (0.19)	
Exchange rate volatility	-0.23 ** (0.11)		0.04 (0.12)		0.03 (0.13)	
Broad money to GDP	0.13 ** (0.06)		0.20 *** (0.06)	0.15 *** (0.03)	0.27 ** (0.12)	0.06 ** (0.02)
Exports to GDP	0.25 ** (0.11)	0.10 *** (0.03)	0.03 (0.08)	0.06 ** (0.02)	0.13 (0.13)	
Latin America and Caribbean dummy	-0.46 (4.97)		-0.60 (4.10)		-5.13 (5.89)	-2.78 * (1.55)
Europe dummy	2.69 (4.89)		8.64 ** (4.32)	8.02 ** (3.21)	-1.53 (4.76)	
East Asia dummy	-9.13 (5.82)		-4.02 (5.61)		-24.70 (15.88)	-5.81 ** (2.82)
Default dummy	-2.55 (6.48)		-10.38 (8.89)		-4.61 (6.50)	
Constant	-26.42 ** (10.34)	-17.21 *** (5.05)	11.99 (11.00)	0.47 (2.55)	4.65 (12.38)	-7.61 * (4.06)
Observations	479	595	431	487	404	436
Number of ccode	35	41	35	38	33	35

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

II. FINANCIAL SOUNDNESS AND CREDIT GROWTH¹

Colombia's financial system weathered the global crisis well despite a moderate weakening of banks' asset quality indicators. This paper assesses whether Colombia's financial soundness will support economic recovery. It finds that the sound loan portfolio and profitability of Colombia's banking system bode well for future credit and output growth, especially compared to other emerging markets and to Colombia's average performance during 1998–2008.

A. Macro-Financial Linkages in Colombia

1. **Colombia's bank credit growth declined sharply in 2008–2009 in line with a slowdown in GDP growth.** Following a period of rapid growth in 2006 and 2007, when banks expanded consumption loans aggressively, bank credit slowed starting in the second quarter of 2008. The slowdown in output growth was the result of a tighter monetary stance (a response to overheating concerns) and, subsequently, the global crisis. The earlier expansion to riskier assets had weakened somewhat financial soundness indicators—capital to risk-weighted assets, performing loans to total loans, the share of liquid assets, and the return on average assets—from their 2005 levels (Figure 1). The weaker financial soundness may have contributed (though surely not driven) the ensuing slowdown in credit growth.

2. **The link between financial soundness and credit and output growth seemed fairly strong during Colombia's 1998 banking crisis.** In that episode, performing loans declined from 93 percent of total loans in 1997 to 86 percent in 1999 and return on assets fell from a healthy 2.4 percent to -1.7 percent. In the four years following the inception of the crisis, cumulative output losses were in the order of 33.5 percent of trend GDP—substantially larger than the average estimated output loss estimated for banking crises in other countries. The impact on credit growth and financial intermediation was also very pronounced, with credit-to-GDP decreasing from 38.2 percent in 1998 to 22.4 percent in 2001.²

3. **The 1998 crisis led to a substantial strengthening of financial regulation and supervision, and a restructuring of Colombia's banking system.** Insolvent banks, largely stated-owned, were privatized, liquidated or recapitalized.³ Financial soundness was also

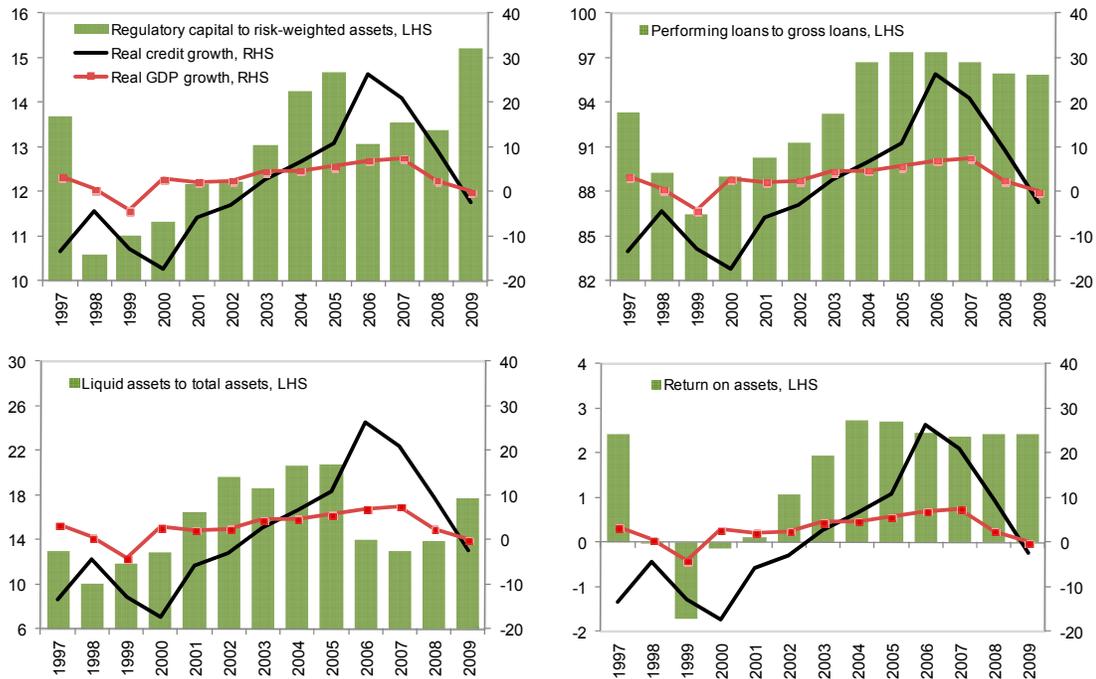
¹ Prepared by Iva Petrova and Enrique Flores.

² Fondo de Garantías de Instituciones Financieras, Fogafin (2009).

³ According to Fogafin (2009), 24 financial institutions were liquidated between 1998 and 2001. State-owned financial institutions comprised about 20.3 percent of the total financial system assets in 1998. Ten of the eleven state-owned credit institutions existing at the time of the crisis were recapitalized between 1998 and 2005.

strengthened through improvements in financial regulation, such as (i) the introduction in 2000 of risk-adjusted deposit insurance premiums, (ii) the issuance of new guidelines for banks' credit risk management in 2002, and (iii) the expansion of the supervision perimeter in 2005 (which established an integrated financial supervisor by merging the banking, insurance, pensions, and securities' supervisory agencies).

Figure 1. Colombia: Financial Soundness, Credit and GDP Growth, 1997-2009



Sources: Superintendencia Financiera de Colombia; IMF Staff calculations.

4. **Measures taken in the wake of the global financial crisis further helped to strengthen the resilience of Colombia's financial sector.** At the end of 2008, banks reached an agreement with the financial supervisor to retain a portion of their 2008 profits as reserves until end-2010; this agreement helped to increase the capital to risk-weighted assets by about 1.4 percentage points. Later, in early 2009, the authorities raised the effective coverage of the deposit insurance, and refined the risk-adjusted premiums.⁴ In addition, the liquidity risk management system was modified to increase its transparency, improve reporting procedures, and extend the perimeter of financial institutions obliged to comply

⁴ The deposit insurance agency refunds part of the premium based on ratings associated with banks' capital adequacy, asset quality, management quality, earnings, and liquidity (CAMEL ratings). The authorities revised the weights of the rating categories to give more prominence to capital adequacy and profitability.

with this regulation. Despite some weakening, banks' asset quality indicators remain strong, while profitability remains solid, reinforced by capital gains on banks' investment portfolios.⁵

5. Colombia's ability to weather the global financial crisis without any of the disruptions it experienced in past episodes of global shocks raises the question of whether its financial sector is better equipped to jump start credit and output growth than in the past. The analysis in this paper seeks to shed light on this question.

B. Brief Review of the Literature and Evidence

6. **The international evidence supports the view that financial soundness affects output and credit growth.** The analysis of systemic banking crises provides support for this view—output losses (measured as deviations from trend GDP) in the first four years of the crisis have averaged about 20 percent of GDP, and in some cases were as high as 98 percent of GDP.⁶ Rescuing financial system institutions also has had substantial fiscal costs—on average 13 percent of GDP—which increased public debt and reduced the scope for expansionary fiscal policies. The associated increase in sovereign risk premia typically increased funding cost for the whole economy, including the financial system, further stifling credit and output growth.

7. **The link between financial soundness and credit and output growth has also been explored in the literature on the real effects of financial stress.** Recent studies using aggregate country data have found that financial fragility has a significant impact on real activity. For example, Claessens et al. (2008) found strong evidence that a deterioration of financial variables—such as a drop in house and equity prices—increases the amplitude of recessions, and some evidence that financial crises (banking, currency, or both) increase the cost of recessions. More recently, based on a sample of seven advanced European countries, Tieman and Maechler (2009) showed that financial sector fragility leads to credit contraction, and estimated the potential real cost of an increase in financial fragility at over 1 percent of GDP on average.⁷

8. **There is also evidence that financial soundness impacts the credit channel.** Altunbas et al. (2002) and Gambacorta (2005) found evidence that an adverse monetary shock would produce a smaller decline in lending by well-capitalized European banks due to their higher access to wholesale deposit funding. In the same line, Matousek and

⁵ An easier monetary stance and the slowdown in credit demand prompted banks to increase their government bond portfolios, which stood at 21.4 percent of assets in November 2009.

⁶ Laeven and Valencia (2008).

⁷ In the same paper, Tieman and Maechler (2009) report results obtained with bank-level data showing that credit contractions are more severe for banks under greater financial stress.

Sarantis (2009) found that more liquid banks are less sensitive to monetary shocks in Central and Eastern European countries. A Colombia-specific study also found evidence that greater financial soundness allows banks to buffer liquidity shocks. Using bank-level data, Gómez-González and Grosz (2007) showed that indicators of financial strength of the Colombian banking system—such as capitalization and liquidity—ameliorate the effect of an increase in the policy interest rate. This suggests that monetary contractions could have less severe implications for credit growth when the banking system is better capitalized and has liquidity cushions to compensate a potential reduction in deposits with other financing sources.

9. **In what follows, we explore this type of work by estimating a simple model that relates financial soundness with the growth of credit and GDP.** We test the model using a panel dataset of a sample of 52 emerging market economies over a period of 11 years. We use the results of the model to assess the impact of the relative strength of Colombia’s financial system in 2009—compared to previous periods and to other emerging market economies—on real credit and output growth.

C. Framework and Estimation

10. **Better capitalized banks tend to have less difficulties in raising funds, and thus are less likely to decrease lending.** Gómez-González and Gross (2007) present a model that illustrates this relationship. In their model, banks have market power in the wholesale deposit market, and capital markets are imperfect—i.e. larger and more capitalized banks need to increase their deposit rates by less in order to raise the same amount of deposit funds as smaller, less capitalized banks. A key implication of the model is that when liquidity conditions tighten, better capitalized banks reduce loans by less (than other banks). Those banks therefore cushion the impact of monetary contractions on borrowers who are dependent on bank lending. In an environment where borrowers have limited access to other sources of finance, this feature of the banking system buffers the short-term impact of monetary shocks on economic activity.

11. **Following a similar logic, we have sketched a credit allocation model to explore the implications of bank loan performance, capitalization, liquidity, and profitability on bank credit and output.** The model, presented in Appendix 1, assumes capital market imperfections and informational asymmetries. Capital market imperfections are necessary to establish a relation between banks’ financial soundness, credit supply, and economic activity.⁸ Informational asymmetries, on the other hand, are needed to create a wedge between the marginal cost of financing as perceived by the borrower and the marginal benefit to the creditor.

⁸ See Bernanke and Gertler (1995).

12. **In the model, banks' borrowing in the interbank money market is subject to a risk premium.** The premium is assumed to be lower for more capitalized banks with higher quality loan portfolios, larger liquidity buffers, and higher profits, i.e. for banks with better financial soundness indicators. In particular, a higher level of capitalization is indicative of better collateralization of bank borrowing, and ultimately increases banks' creditworthiness. Higher quality portfolios and large liquidity buffers imply better risk-adjusted bank capitalization, while higher profitability provides a greater capital buffer. In the end, greater financial soundness reduces the risk premia of banks, and thus results in a positive impact on bank lending (Equation 5 in Appendix 1).

Estimation

13. **We estimate a system of simultaneous equations (similar to the one specified by Tieman and Maechler (2009)) to examine the link between financial soundness and credit and GDP growth.** The system consists of equations for credit growth and GDP growth, as a function of financial soundness indicators (FSI), the policy interest rate, and the real effective exchange rate. It is assumed that the FSI variables only influence GDP growth indirectly through their effect on credit growth. Since all macroeconomic variables in the model are contemporaneous, their lagged values are used as instruments to correct for the potential simultaneity bias. FSIs enter the model with a lag because the risk premia of banks is assumed to be a function of past bank performance.⁹

$$\begin{aligned}\Delta\ddot{C}_{i,t} &= c_1 + c_2 F\ddot{S}I_{i,t-1} + c_3 M\ddot{M}IR_{i,t} + c_4 \Delta G\ddot{D}P_{i,t} + \varepsilon_{i,t} \\ \Delta G\ddot{D}P_{i,t} &= c_5 + c_6 \Delta\ddot{C}_{i,t} + c_7 \Delta R\ddot{E}ER_{i,t} + c_8 M\ddot{M}IR_{i,t} + \eta_{i,t}\end{aligned}\quad (1)$$

Where,

ΔC_t = annual real credit growth in year t ;

ΔGDP_t = real GDP growth in year t ;

$\Delta REER_t$ = annual change of the real effective exchange rate in year t ;

$MMIR_t$ = real money market interest rate, approximating for the policy rate, in year t ;

FSI_t = financial soundness indicator(s) in year t ; and

$\ddot{X}_{i,t}$ denotes that the variable is expressed as a difference from the sample mean in order to exclude country specific fixed effects.

⁹ There is a strand of literature that analyzes the impact of macroeconomic factors on financial soundness. For Colombia, IMF (2009) found that macroeconomic and financial shocks have important bearings on banks' soundness. This raises issues of endogeneity, albeit somewhat ameliorated by the lagged FSIs.

14. The marginal effects of interest are represented in the reduced form equations:

$$\begin{aligned}\Delta\hat{C}_{i,t} &= a_1 + \alpha_1 F\ddot{S}I_{i,t-1} + \beta_1 M\ddot{M}IR_{i,t} + \gamma_1 \Delta R\ddot{E}ER_{i,t} \\ \Delta G\hat{D}P_{i,t} &= a_2 + \alpha_2 F\ddot{S}I_{i,t-1} + \beta_2 M\ddot{M}IR_{i,t} + \gamma_2 \Delta R\ddot{E}ER_{i,t}\end{aligned}\quad (2)$$

Where the effect of FSIs on credit growth is $\alpha_1 = \frac{\hat{c}_2}{1 - \hat{c}_4 \hat{c}_6}$, and the effect on GDP growth

$$\text{is } \alpha_2 = \frac{\hat{c}_2 \hat{c}_6}{1 - \hat{c}_4 \hat{c}_6}.$$

15. **An alternative specification seeks to assess the impact of financial soundness on the credit channel.** Following Gomez-Gonzalez and Grosz (2007), this alternative specification of the system includes as regressors interaction terms between the FSIs and the money market rate. In this case the marginal effects, evaluated at specific values of the FSIs, indicate whether those FSI values mitigate or magnify the impact of an increase in the money market rate.

16. **The problem of omitted variables in the estimated equation is not expected to be serious.** The model represented in (1) clearly does not contain all the determinants of credit and GDP growth, and thus omit a number of relevant variables and unobserved country effects. To control for the latter, as noted, we express all variable as differences from the sample mean, and include then time dummy variables. In addition, we try to control for outliers with dummies or by excluding them from the sample. Due to the high correlation among the various FSIs, an alternative specification of the model includes only one FSI indicator at a time. The systems of equations are estimated using Two-Stage Least Squares (TSLS).

Data

17. **Table 1 shows summary statistics for the variables used in the estimations.** The sample comprises data from several sources.¹⁰ The dataset includes 52 emerging market economies (EMs), including 14 Latin American countries, and covers the period 1998–2008. Preliminary FSI data for 2009 are also available and are used in the analysis of the model's implications for Colombia (Table 2). A larger dataset of 84 countries, including advanced and developing economies, is also available and used for robustness tests.

¹⁰ Real GDP data from the IMF's World Economic Outlook (WEO), credit growth data from the International Financial Statistics (IFS) and the Economist Intelligence Unit (EIU), REER data from the EIU, and FSI indicators from the Global Financial Stability Report (GFSR) and the World Bank's World Development Indicators (WDI).

18. **Financial soundness is proxied through indicators that measure bank capitalization, loan quality, liquidity and profitability.** Concretely, the indicators used in the estimations include capital to assets, capital to risk-weighted assets, performing loans to total loans, provisions to nonperforming loans, return on assets, and return on equity (all from the Global Financial Stability Report), and liquid reserves to total assets (from the World Development Indicators). The results we report are those based on the indicators with longer time series: capital to risk-weighted assets (CAR), performing loans to total loans (PL), liquid reserves to total assets (LR), and return on assets (ROA).

D. Results and Implications for Colombia¹¹

19. **Overall, the results provide evidence that asset quality and profitability have a positive impact on credit and GDP growth in emerging market economies.** When the system of equations is estimated using all FSIs (Table 3, Equation 1), the ratio of performing loans and the return on assets have the expected positive sign but only PL is statistically significant, while CAR and LR have negative signs but are not significant. Even then, however, the joint marginal effect of all FSIs is positive and significant, suggesting that an improvement of all FSIs by one percentage point would lead to a 1.3 percentage point increase in credit growth and a 0.2 percentage point increase in GDP growth. The estimation of the system using one FSI at a time (Equations 2–5) results in positive and significant coefficients for PL and ROA, while CAR and LR continue to yield negative but insignificant coefficients.¹² PL's marginal effect is about 0.6 percentage points on credit growth, and about 0.1 percentage points on GDP growth. The marginal effects of changes in ROA are more than two times those of changes in PL (though it is rare to see ROA changing by one percentage point in a year).¹³

20. **The macroeconomic variables of the regressions have the expected signs.** In the credit equation, GDP growth has a positive and significant effect. In the GDP equation, credit growth has a positive and significant coefficient of about 0.13, which allows transmission of the FSI effect to GDP growth. The marginal effect of the interest rate is negative and significant, implying a reduction of 0.3 percentage points in both credit growth and GDP growth. The latter result suggests that the impact of the interest rate through other channels tends to be stronger than the direct credit channel effect.

¹¹ The results are broadly robust to changes in the sample of countries, as well as to alternative estimation methods (see Appendix 2).

¹² Regulatory requirements for capital adequacy and liquidity impart persistence to indicators like CAR and LR, which may explain their lack of significance.

¹³ In our data, the standard deviation of the nonperforming loans ratio is 7.1 percentage points, compared to 1.6 for the return on average assets (see Table 2).

21. **The results also suggest that financial soundness buffers the effect on monetary shocks.** In Table 4, the coefficients of the interaction terms of PL and ROA with the money market interest rate are positive and significant (equations 3 and 5). This implies that an increase in the money market rate would reduce credit growth and GDP growth, but the impact would be smaller the higher the level of performing loans. These results are not entirely consistent with the evidence in Gómez-González and Grosz (2007) of significant effects of bank capitalization and liquidity. Nonetheless, they are suggestive of the existence of a bank lending channel, and of banks' ability to secure funding from alternative sources when liquidity conditions tighten.

Application to Colombia

22. **The previous results are helpful to assess whether the relative soundness of Colombia's banking system would help boost credit and GDP growth in 2010.** We replace FSI values for Colombia for 2009 in the estimated equations and compare the results against three benchmarks: (i) the average of the FSIs in Colombia during 1998–2008; (ii) the average level of the FSIs in Latin American countries during 2009; and (iii) the average level for emerging markets during 2009. The main results of the exercise were as follows:

- ***The FSI levels for 2009 suggest that the contribution of financial soundness to Colombia's economic performance in 2010 would be stronger than it was in the previous 10 years.*** Text Table 1 shows the FSI contribution to credit growth and GDP growth relative to the period average. The combined FSI effect brings credit growth almost two percentage points above the 1998–2008 average of around 5 percent, and GDP growth about 0.26 percentage points above the average during the previous decade. The individual effects of PL and ROA are somewhat smaller, but statistically significant. We therefore find strong evidence that the higher financial soundness will support economic recovery.

Text Table 1. Impact of Colombia's 2009 Financial Soundness Indicators
(In percentage points)

	All FSIs (1)	Performing Loans (3)	Return on Assets (5)
<i>Evaluated at the level of Colombia's FSIs in 2009 relative to Colombia's average in 1998-2008</i>			
Impact on credit growth	1.978 **	1.717 ***	1.636 ***
Impact on GDP growth	0.255 *	0.221 ***	0.211 **

Note: Wald test for the significance of the effect evaluated at the specified values.

*** indicates significance at 1 percent level, ** at 5 percent level, and * at 10 percent

- ***The benefits of strong financial soundness are broadly in line with those of other Latin American countries.*** Evaluating the effects at the difference between FSIs in

Colombia and in other Latin American countries in 2009 does not show a significant difference in credit and GDP growth (Text Table 2), as soundness indicators are roughly similar. In terms of individual indicators, Colombia's PL ratio suggests weaker economic prospects than in other countries in the region, whereas the ROA indicator suggests stronger prospects.

- ***Compared to all other emerging markets, financial soundness in Colombia predicts a stronger economic performance.*** Colombia's FSIs provide stronger support for credit and GDP growth through both PL and ROA.

Text Table 2. Comparison with Other Emerging Markets
(In percentage points)

	All FSIs (1)	Performing Loans (3)	Return on Assets (5)
<i>Evaluated at the difference of Colombia's FSIs from average for Latin American countries</i>			
Relative impact on credit growth	-0.002	-0.880 ***	1.352 ***
Relative impact on GDP growth	0.000	-0.113 ***	0.174 **
<i>Evaluated at the difference of Colombia's FSIs from EM average</i>			
Relative impact on credit growth	2.054 **	0.855 ***	2.320 ***
Relative impact on GDP growth	0.265 **	0.110 ***	0.299 **

Note: Wald test for the significance of the effect evaluated at the specified values.

*** indicates significance at 1 percent level, ** at 5 percent level, and * at 10 percent

23. Greater financial soundness also reduces the impact of monetary shocks.

Evaluating the marginal effect of the interaction between FSIs and the money market rate (Table 4) at the difference between the 2009 FSIs and their 1998–2008 averages shows the cushion provided by banking system soundness in the event that liquidity conditions tighten. For example, if performing loans are one percentage point higher than the 1998–2008 average, credit growth would decline by 0.14 percentage points less, while GDP growth would fall by 0.018 percentage points less. Similarly, if ROA is one percentage point above the 1998–2008 average, credit growth would decline by 0.29 percentage points less, and GDP growth would decline by 0.04 percentage points less. Given Colombia's 2009 levels of PL and ROA relative to the 1998–2009 average, credit growth would be cushioned by up to a percentage point, and GDP growth by up to 0.14 percentage points if the money market rate were to be raised by one percentage point (Text Table 3).

Text Table 3. Financial Soundness and Monetary Shocks
(In percentage points)

	All FSIs (1)	Performing Loans (3)	Return on Assets (5)
<i>Evaluated at the level of Colombia's FSIs in 2009 relative to Colombia's average in 1998-2008</i>			
Joint impact of a positive monetary shock and FSIs on credit growth	1.048 **	0.396 **	0.286 **
Joint impact of a positive monetary shock and FSIs on GDP growth	0.135 **	0.051 *	0.037 *

Note: Wald test for the significance of the effect evaluated at the specified values.

*** indicates significance at 1 percent level, ** at 5 percent level, and * at 10 percent

E. Concluding Remarks

24. **The robustness of Colombia's financial institutions bodes well for a rapid recovery.** Colombia's efforts to strengthen the financial system since the crisis of 1999 would provide support credit and GDP growth in 2010. The analysis presented in this paper suggests that Colombia's improved financial soundness, compared to the previous decade, will increase credit growth by about 2 percentage points and GDP growth by about 0.3 percentage points. The impact of financial soundness is also stronger than in other emerging market countries.

25. **While there are some risks to financial soundness, their indirect impact on economic activity is small and manageable.** The high level of bank profitability—which has recently relied on valuation gains—may not be sustained. Nevertheless, a lower profitability is unlikely to reduce significantly the relative strength of Colombia's current levels of FSIs compared to other emerging markets.

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Table 1. Variables – Description and Summary Statistics, 2002-2008

1998-2008	Real GDP Growth	Real Credit Growth	Real Effective Exchange Rate	Real Money Market Interest Rate	Capital Adequacy Ratio	Performing Loans to Total Loans	Liquid Reserves to Total Assets	Return on Assets
Mean	0.05	0.08	0.01	2.15	16.21	91.72	11.56	1.23
Median	0.05	0.08	0.01	1.53	14.90	93.93	9.81	1.30
Maximum	0.17	0.53	0.43	44.15	36.00	99.82	57.05	11.00
Minimum	-0.12	-0.70	-0.41	-20.31	-5.91	65.10	0.22	-10.45
Std. Dev.	0.03	0.14	0.08	6.18	5.64	7.06	9.22	1.63
Skewness	-0.78	-0.28	-0.47	1.33	0.95	-1.26	1.77	-1.98
Kurtosis	6.08	6.97	9.05	9.04	5.28	4.19	7.15	18.50
Observations	608.00	569.00	559.00	576.00	464.00	473.00	589.00	541.00
Colombia, mean	0.03	0.05	0.00	3.09	12.57	93.06	16.66	1.42
Description	First difference of the log of the credit stock adjusted by (average) CPI	First difference of the log of gross domestic product at constant prices	First difference of the log of trade-weighted basket of currencies, adjusted for relative price movements	Interbank rate, adjusted with percentage change in (average) CPI. Where not available, replaced with Treasury bill rate, in percent	Capital to risk-weighted assets, in percent	100-banks' nonperforming loans to total loans, in percent		Banks' return on assets, in percent
Source	IFS, EIU	WEO	EIU	IFS, EIU	GFSR	GFSR	WDI	WDI

Table 2. Financial Soundness Indicators

	Capital Adequacy Ratio		Performing Loans to total Loans		Liquid Reserves to Total Assets		Return on Assets	
	2008	2009	2008	2009	2008	2009	2008	2009
Colombia	13.39	15.2	95.96	95.89	13.91	17.70	2.43	2.4
Latin America	14.52	14.85	97.83	97.30	16.80		1.92	1.59
Asia and Pacific	13.30	14.12	96.35	96.58	7.95		1.34	1.28
Emerging Europe	15.62	15.96	95.31	94.01	11.29		1.37	0.82
Middle East, Central Asia	16.72	17.30	93.84	89.43	13.50		1.35	0.31
All Emerging Markets	15.21	15.67	95.76	94.47	12.78		1.49	1.01

Source: Superintendencia Financiera de Colombia; Global Financial Stability Report, World Development Indicators.

Table 3. System of Equations, Emerging Markets Sample

Dep Variable: Real Credit Growth	(1)	(2)	(3)	(4)	(5)
Constant	0.007 (0.006)	0.005 (0.006)	0.010 (0.006)	0.005 (0.006)	0.004 (0.006)
CAR	-0.001 (0.002)	-0.001 (0.002)			
Performing Loans to Total Loans	0.004 *** (0.001)		0.005 *** (0.001)		
Liquid Reserves to Total Assets	-0.001 (0.001)			-0.001 (0.001)	
Return on Assets	0.008 (0.005)				0.014 *** (0.004)
Money Market Interest Rate	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)
GDP Growth	0.927 ** (0.450)	1.394 *** (0.403)	0.805 ** (0.397)	1.400 *** (0.421)	1.159 *** (0.385)
Dep Variable: Real GDP Growth					
Constant	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Credit Growth	0.129 *** (0.032)				
REER Change	-0.006 (0.055)	-0.006 (0.055)	-0.006 (0.055)	-0.006 (0.055)	-0.006 (0.055)
Money Market Interest Rate	-0.003 *** (0.000)				
Credit Growth: Observations	370	370	370	370	370
Credit Growth: R-Squared	0.122	0.064	0.116	0.063	0.093
GDP Growth: Observations	446	446	446	446	446
GDP Growth: R-squared	0.020	0.020	0.020	0.020	0.020

Marginal effects of FSIs, in percentage points

On credit growth	1.261 **	-0.183	0.607 ***	-0.082	1.669 ***
On GDP growth	0.163 *	-0.024	0.078 ***	-0.011	0.215 ***

Note: In all estimations FSI variables are lagged. *** indicates significance at 1 percent level, ** at 5 percent level, and * at 10 percent.

Table 4. System of Equations—Interest Rate Effects, Emerging Markets Sample

Dep Variable: Real Credit Growth	(1)	(2)	(3)	(4)	(5)
Constant	0.016 (0.010)	0.005 (0.007)	0.013 * (0.007)	0.005 (0.006)	0.007 (0.006)
CAR*MMIR	0.002 (0.001)	0.000 (0.000)			
(Performing Loans to Total Loans)*MMIR	0.001 (0.000)		0.001 ** (0.000)		
(Liquid Reserves to Total Assets)*MMIR	-0.001 (0.000)			0.000 (0.000)	
(Return on Assets)*MMIR	0.003 (0.002)				0.002 ** (0.001)
MMIR	-0.001 (0.001)	0.001 (0.001)	0.001 (0.000)	0.001 (0.000)	0.000 (0.000)
GDP Growth	0.492	1.414 **	0.887 **	1.470 ***	1.136 ***
Dep Variable: Real GDP Growth					
Constant	(0.852)	(0.589)	(0.450)	(0.497)	(0.410)
Credit Growth	0.001 0.129 *** (0.032)				
REER Change	-0.006 (0.055)	-0.006 (0.055)	-0.006 (0.055)	-0.006 (0.055)	-0.006 (0.055)
Money Market Interest Rate	-0.003 *** (0.000)				
Credit Growth: Observations	370	370	370	370	370
Credit Growth: R-Squared	-0.48	0.07	-0.03	0.05	0.00
GDP Growth: Observations	446	446	446	446	446
GDP Growth: R-squared	0.02	0.02	0.02	0.02	0.02
Marginal effects of FSIs, in percentage points					
On credit growth	0.214	-0.021	0.140 **	-0.021	0.292 **
On GDP growth	0.028	-0.003	0.018 *	-0.003	0.038 *

Note: In all estimations FSI variables are lagged. *** indicates significance at 1 percent level, ** at 5 percent level, and * at 10 percent

APPENDIX 1. THE MODEL

Consider a model with the following features:

- At the beginning of each period, firms borrow from banks to finance production costs. They use the bank loans immediately to pay those costs.
- Banks raise deposits from domestic residents and make loans to domestic firms, and borrow or lend additional funds in the domestic and international interbank markets.
- At the end of the period, firms receive cash flows and repay bank loans. Banks pay interbank loans, interest to domestic depositors, and dividends to shareholders.

1. Firms

26. There is a large number of identical firms in the economy that borrow from domestic banks to finance the cost, ωk , of k units of input producing $f(k)$ units of the final good with probability ϕ , and 0 with probability $(1 - \phi)$. If a firm does not produce any output, it defaults on the bank loan. The production function is increasing, $f'(\cdot) > 0$, and concave, $f''(\cdot) < 0$, with respect to the input. Firms have no initial funds and limited access to alternative sources of external finance. Assuming that the price of the input is one, firms' profits are

$$\Pi_t^f = \phi_t (p_t f(l_t^f) - r_t^L l_t^f) \quad (1)$$

where l_t^f denotes loans, r_t^L is the gross lending interest rate, and p_t is the price of the final good.

2. Banks

27. There is a large number of identical banks in the economy that raise deposits from domestic residents, d_t , and extend loans to firms, l_t^b , or hold bonds, b_t . Banks have access to an inter-bank market where they borrow funds, m_t , and have capital, c_t . At the beginning of period t , banks' balance sheet condition is $l_t^b + b_t = d_t + m_t + c_t$, and banks' profits are:

$$\Pi_t^b = \phi_t r_t^L l_t^b + r_t b_t - r_t^D d_t - r_t^M m_t - r_t^N c_t \quad (2)$$

where r_t denotes the risk-free rate on government bonds, r_t^D is the interest rate paid on deposits, r_t^M is the inter-bank market rate, and ϕ_t is the repayment rate on bank loans, and r_t^N is the (normal) return on equity.

28. Further, we denote the bank liquidity ratio—bonds to total assets—as $LR_t = \frac{b_t}{b_t + l_t^b}$,

the capital-to-asset ratio as $CA_t = \frac{c_t}{b_t + l_t^b}$, and the capital adequacy ratio as

$CAR_t = \frac{c_t}{l_t^b} = \frac{CA_t}{1 - LR_t}$, giving a 100 percent weight to loans and 0 percent weight to

government bonds in the risk-weighted assets. We also denote the return-on-asset ratio

as $ROA_t = \frac{r_t^N c_t}{b_t + l_t^b} = r_t^N CAR_t (1 - LR_t)$. Therefore, substituting for bank borrowing in the

money market, the bank balance sheet condition and profits become:

$$m_t = l_t^b + b_t - d_t - c_t \quad (3)$$

$$\Pi_t^b = (\phi_t r_t^L - r_t^M) l_t^b + (r_t - r_t^M) b_t + (r_t^M - r_t^D) d_t + (r_t^M - r_t^N) c_t \quad (4)$$

Assuming that $m_t > 0, d_t > 0, c_t > 0, l_t > 0$, zero-profit conditions imply that

$r_t^D = r_t^M = r_t^N = \phi_t r_t^L$. Furthermore, we assume that there is a premium, x_t , on interbank funding

over the risk-free bond rate, where $x_t = \chi_t(CAR_{t-1}, \phi_{t-1}, LR_{t-1}, ROA_{t-1})$ is a decreasing function of

every financial soundness indicator. The firms' first order condition and the market clearing

condition, $l_t^f = l_t^b = l_t$, indicate that

$$p_t f_t'(l_t) = r_t^L = \frac{1}{\phi_t} (r_t + x_t) \quad (5)$$

Therefore, $\frac{\partial l_t}{\partial CAR_{t-1}} > 0, \frac{\partial l_t}{\partial \phi_{t-1}} > 0, \frac{\partial l_t}{\partial LR_{t-1}} > 0$, and $\frac{\partial l_t}{\partial ROA_{t-1}} > 0$.

Equation 5 suggests that an increase (decrease) in capital-to-risk-weighted-assets, performing loans, liquidity, and in the return on asset, would reduce (increase) premium on the lending rate over the risk-free rate, and therefore results in higher lending and output.

APPENDIX 2. ROBUSTNESS TESTS

29. **The results reported in Table 3 and 4 are broadly robust to an increase in the number of countries in the sample.** We expanded the sample to 84 countries by including some advanced and developing economies, but the results remain broadly unchanged (Table A1). PL and ROA remain the only variables with coefficients that are both positive and significant. When the system of equations is estimated using all FSIs, the FSI marginal effects of financial soundness are slightly larger. This is also the case when only PL is included. When only the return on assets is included, its marginal effect is slightly smaller. Therefore, it seems that there is little difference between the FSI effects in EMs and other countries, although some regional difference may exist. For example, using only the sample of 14 Latin American countries, yields a larger marginal effect of PL—about 0.8 percentage points increase—on credit growth. This implies less favorable growth prospects in Colombia relative to other countries in the region based on the weaker PLs.

30. **The results are also robust to other estimation methods.** The main results are virtually the same with a Three Stage Least Squares estimator, and when using second rather than first lags as instrumental variables, including for FSIs. A fixed effects estimator of credit growth on FSIs also shows similar results. The effect of PL is about 0.6 percentage points, while the effect of ROA is about 1 percentage point. The results from a dynamic panel data estimation of credit growth (controlling for potential autocorrelation and using first and second lags as instrumental variables) are somewhat different, however.

Table A1. System of Equations, Sample of 84 Countries

Dep Variable: Real Credit Growth	(1)	(2)	(3)	(4)	(5)
Constant	0.002 (0.004)	0.002 (0.004)	0.003 (0.004)	0.002 (0.004)	0.001 (0.004)
CAR	-0.001 (0.001)	-0.001 (0.001)			
Performing Loans to Total Loans	0.004 *** (0.001)		0.005 *** (0.001)		
Liquid Reserves to Total Assets	-0.001 (0.001)			-0.001 (0.001)	
Return on Assets	0.008 ** (0.004)				0.012 *** (0.003)
Money Market Interest Rate	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.001 (0.000)	0.000 (0.000)
GDP Growth	0.953 *** (0.367)	1.319 *** (0.343)	0.914 *** (0.332)	1.339 *** (0.355)	1.094 *** (0.331)
Dep Variable: Real GDP Growth					
Constant	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Credit Growth	0.181 *** (0.035)				
REER Change	0.000 (0.068)	0.000 (0.068)	0.000 (0.068)	0.000 (0.068)	0.000 (0.068)
Money Market Interest Rate	-0.002 ** (0.000)				
Credit Growth: Observations	556	556	556	556	556
Credit Growth: R-Squared	0.115	0.067	0.108	0.066	0.087
GDP Growth: Observations	699	699	699	699	699
GDP Growth: R-squared	-0.250	-0.250	-0.250	-0.250	-0.250
Marginal effects of FSIs, in percentage points					
On credit growth	1.357 ***	-0.118	0.621 ***	-0.078	1.558 ***
On GDP growth	0.246 **	-0.021	0.113 ***	-0.014	0.283 **

Note: In all estimations FSI variables are lagged. *** indicates significance at 1 percent level, ** at 5 percent level, and * at 10 percent