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COLOMBIA

Selected Issues

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Approved by the Western Hemisphere Department

October 13, 2006

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A. Introduction

1. **In recent years Colombia has found several innovative ways to improve the efficiency of its public enterprise sector.** Since the mid-1990s, over 150 public entities, spreading over 19 different sectors, have been restructured, merged or liquidated, and now 62 enterprises—which operate in a variety of sectors, including the energy, communications, and social sectors—are owned by the government. As a result, net profits for these enterprises as a whole swung from a deficit of 0.3 percent of GDP in 2003 to a surplus of 0.7 percent of GDP in 2005, and the average return on equity went from -3.2 percent in 2003 to 14.6 percent in 2005.

2. One option used by Colombia to reform public enterprises has been to enhance their commercial orientation and limit the fiscal risk. This approach has been adopted for some enterprises that have been difficult to privatize and involves reforms that increase the private sector orientation in the decisions of the enterprise and reduce the political influence. The Fund's Fiscal Affairs Department (FAD) developed a framework to assess the commercial orientation and fiscal risks of public enterprise operations using five broad areas of performance: (i) managerial independence; (ii) relations with the government; (iii) governance structure; (iv) financial conditions and sustainability; and (v) other risk factors (Box 1).[2] The criteria are designed to assess whether the operations of a PE could give rise to losses that would have to be covered by the government through raising tax revenues or compressing other spending.

3. **If a public enterprise is considered commercially run, it could be removed from the country's fiscal indicators and targets**. This would allow the enterprise to undertake investments without regard to the target for the overall public sector deficit. This decision is particularly important in many Latin America countries, which set targets of the deficit for a broad definition of the public sector to provide for effective control over public debt. Colombia is the first country to transform a public enterprise in this direction and then remove it from the definition of the public sector. Specifically, in 2004 ISA—an electricity transmission company (ISA) where the government has a majority stake—was found to be commercially run and was excluded from fiscal indicators and Fund program targets. Thus it was able to expand its investment based solely on business considerations.

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[1] Prepared by Isabell Adenauer.

[2] For a full discussion of these issues, please see "Public Investment and Fiscal Policy—Lessons from the Pilot Country Studies," available via the Internet: http://www.imf.org/external/np/pp/eng/2005/040105a.htm

Box 1. Revised Criteria for Assessing Fiscal Risks of Public Enterprises

I. Managerial independence

Pricing policy. For producers of traded goods and services, were average prices over the last year within 10 percent of the relevant international benchmark? For producers of nontraded goods, are prices set to cover costs? In regulated sectors, is the tariff setting regime compatible with the long-term sustainability of the PE, and is it the same for private firms in the sector?
Employment policy. Is personnel policy independent of civil service laws? Does the government intervene in wage setting and hiring, and, if there is government intervention, is it clearly justified by the need to address specific risks (for example, is it a response to overstaffing pressures)?

II. Relations with the government

Subsidies and transfers. Over the last three years: (i) has the government provided direct or indirect subsidies and/or explicit or implicit loan guarantees which go beyond those given to private enterprises (either in the same industry or elsewhere, as applicable)?; and (ii) has the PE made any special transfers to the government?
Quasi-fiscal activities. During the last three years, has the PE performed uncompensated functions or absorbed costs which were not directly related to its business objective and/or substituted for government spending?
Regulatory and tax regime. Is the PE subject to the same regulations and taxes as private firms in the industry?

III. Governance structure

Periodic outside audits. Are these carried out by a reputable private accounting firm applying international standards, and published? Are large PEs audited by a major international firm?
Publication of comprehensive annual reports. Are annual reports published, and do they include the audited balance sheets, profit and loss statements, information on off-balance sheet liabilities, levels and changes in the PE's overall activity, employment and investment, and comparisons against other firms in the industry and against international benchmarks?
Shareholders' rights. Are minority shareholders' rights protected? What form does this protection take?

IV. Financial conditions and sustainability

Market access. Is the cost of debt over the last three years within one standard deviation of the industry-wide average over the same period? Can the PE presently borrow at rates similar to those faced by private firms without a government loan guarantee?
Less-than-full leveraging. Is the PE's debt-to-asset ratio comparable to the industry average?
Profitability. During the last three years, has the ratio of operating balance to assets been significantly below the industry average? Where no relevant comparator is available, this ratio should be positive and higher than the average cost of debt.
Record of past investments. Can the PE provide evaluations of past investments, demonstrating an average rate of return at least equivalent to that required by cost-benefit analysis to approve new projects?

V. Other risk factors

Vulnerability. Does the PE have sizeable contingent liabilities relative to its operating balance? Is there a currency mismatch between the enterprise's main sources of revenue and its debt?
Importance. Is the PE large in some significant dimension (for example, debt service, employment, customer base)? Does it provide essential services?

4. **The authorities asked Fund staff for its opinion of the steps that might be needed to enhance the commercial orientation of two other PEs—Isagen (electricity generation) and Ecopetrol (oil production, export and refining).** This paper presents the staff's evaluation of these two enterprises. Section II review's the experience of the enterprise, ISA, that was excluded from the fiscal accounts in 2004. Sections III and IV discuss the commercial orientation and fiscal risk of Isagen and Ecopetrol, respectively. The last section offers some policy recommendations and conclusions.

B. Performance of ISA

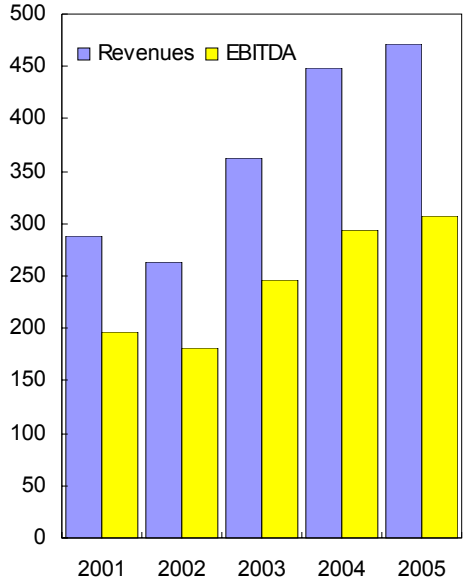
5. **The ISA was found to qualify as a commercially run enterprise, according to the criteria developed by FAD.** ISA was the first company of the electricity sector to offer shares to the public in 2000, and by March 2004, private investors owned 28 percent of the company, the government 60 percent and local public enterprises the remaining 12 percent. A law gave strong rights to minority shareholders, including to veto strategic decisions. Moreover, ISA's operations were governed by a code of good governance, a code of ethics, transparent procurement guidelines, and a clear auditing system. Prices were set in line with cost considerations, and ISA's financial conditions were sound. As a result, ISA was removed from the overall public sector in mid-2004. Fiscal targets under the Stand-By Arrangement were left unchanged at the time, since ISA's overall balance and operating surplus were very low in relation to GDP.

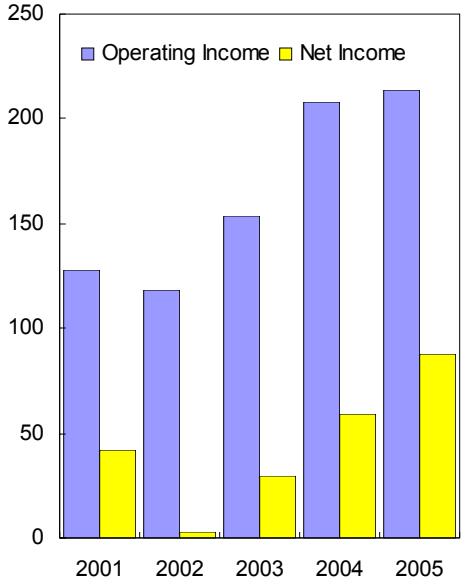
6. **Since 2004, ISA has performed well and has expanded its position in the Latin American electricity and telecommunications sectors.** In the last two years, it has increased its ownership of the electricity transmission network in Peru from 50 to 85 percent, and in Bolivia from 25 to 52 percent. In Colombia, it now owns 84 percent of the network, up from 80 percent in 2004. It also owns 10 percent of the grid in Brazil. Moreover, it provides telecommunications services, both domestically and internationally, and exports electricity to Ecuador. ISA has an ongoing project of expanding the electrical grid in Central America, spreading out from El Salvador to Panama. Over the last few years, it increased its transmission infrastructure from 10,196 km in 2003 to 35,703 km today. In 2006, the company plans to invest US$611 million (0.5 percent of GDP).

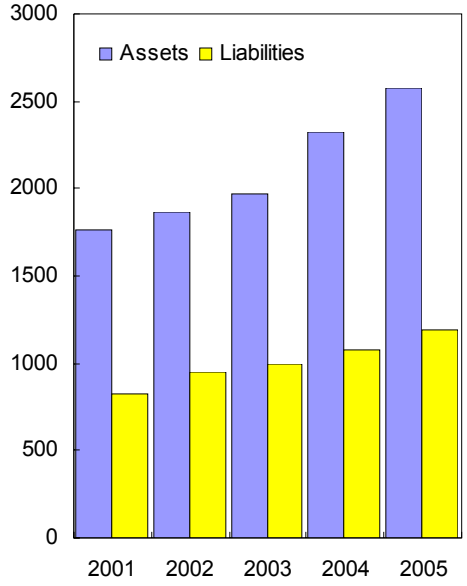
7. **The company's financial position has strengthened significantly over the last two years.** Revenues were up from US$363 million in 2003 to US$471 million in 2005, and net income increased from US$30 million to US$88 million over the same period. Its EBITDA[3] increased from US$246 in 2003 to US$307 in 2006. Its assets increased by 30 percent, while liabilities increased only by 19 percent between 2003 and 2005. Finally, its public offerings were oversubscribed, and the company's share prices were among the market's most profitable, increasing by 110 percent in 2004, and 170 percent in 2005.

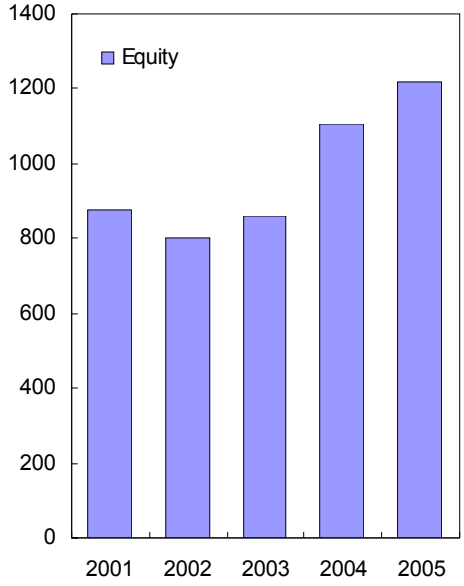
[3] Earnings before interest, taxes, depreciation, and amortization.

Operations of ISA Group
(In millions of U.S. dollars)





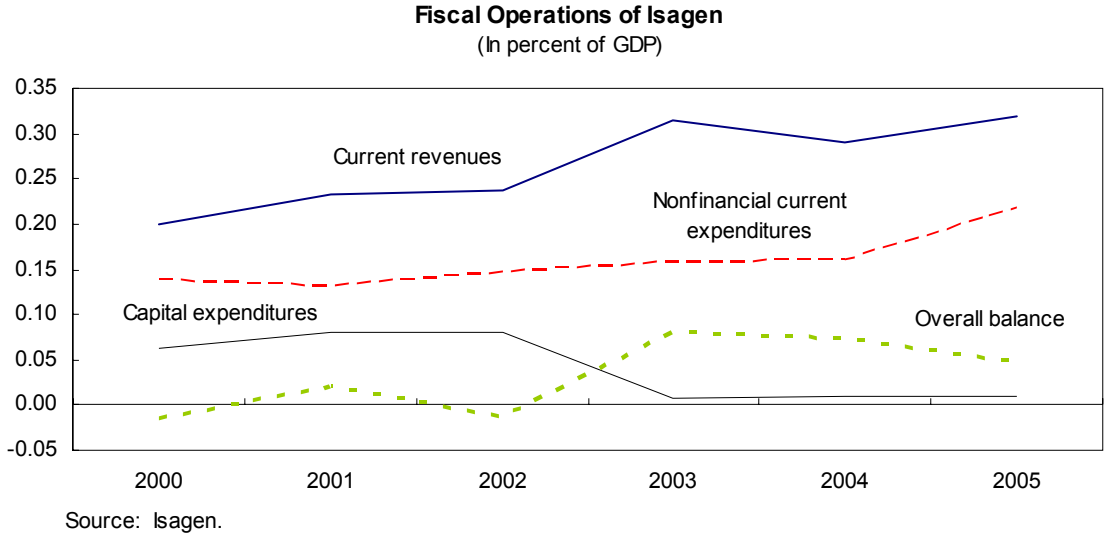




Source: ISA.

C. Assessment of fiscal risk of Isagen

8. **Isagen's main activities are the generation and sale of electricity.** With its five power plants, it produced 8,701 GWh in 2005—17 percent of electricity generated in Colombia—and was the country's the third largest electricity generation company in Colombia. It is a company of mixed public ownership, with the government holding 76.88 percent of the shares and other PEs holding the rest. Private shareholders own less than 1 percent.



Source: Isagen.

9. **The government plans to sell 20 percent of its Isagen shares in November 2006, as part of a "democratization of stock ownership" program, inspired by the example of ISA.** Isagen would then be listed on the Colombian stock exchange. The sale is well underway and is expected to enhance the commercial orientation of the company further.

10. **In the medium-term, Isagen plans to carry out significant investment to increase its market share.** By law, no electric generator in Colombia can hold more than 25 percent of the market. Accordingly, Isagen is currently evaluating several investment scenarios, which would allow them to increase their market share from 17 percent today to the maximum by 2019. The company estimates that it would need to upgrade its generation capacity by 25 percent during the next 13 years, requiring investment of about US$600 million, to retain its current market share. Alternatively, in order to reach 25 percent of the market 2019, they would have to increase capacity by 85 percent, investing US$1.8 billion. By comparison, total investment over the last five years amounted to US$128 million.

Managerial independence

11. **Isagen's employees are governed by private sector law.** Isagen is subject to collective bargaining agreements.

12. **The prices that Isagen charges its clients reflect market conditions.** Its clients are large enterprises, with which the company establishes bilateral contracts, and other agents in the energy sector, to whom Isagen sells electricity on the wholesale market through an auction mechanism.

13. **The board of directors is composed of five members, one of whom represents the Ministry of Mines, another one the Ministry of Finance, a third a territorial enterprise. There are two independent members.** The president of the board is one of the independent members. Members of the board are determined by voting of the shareholders, and have to adhere to a demanding set of criteria relating to their education, experience and performance. In turn, the board nominates the director of Isagen.

Relations with the government

14. **Isagen pays dividends to the government and is subject to standard taxation.** It receives no subsidies or other transfers from the government. However, the government guaranteed a loan of US$212 million in 2005, so that Isagen could restructure its debt service payments. Given the profitability and solvency of Isagen, the risk that this guarantee will give rise to costs for the government in the future is low. Finally, Isagen has not carried out any quasi-fiscal activity on behalf of the government.

Transparency

15. **Isagen regularly publishes a comprehensive annual report and is subject to oversight by the controller general.** Annual reports, together with reports on governance, are posted on the Internet. Moreover, it is audited both internally, and by an international firm (KPMG in 2005).

16. **The company has drawn up and implemented a good governance code, according to international standards.** To prepare for the sale of 20 percent of the government's shares to the public, Isagen is also in the process of adapting its code to ensure that minority shareholders' rights are protected appropriately.

Financial health

17. **Isagen is in a sound financial position.** Over the last five years, revenues from sales increased on average by 19 percent, reflecting high energy demand, increased domestic price levels, and higher electricity generation (Table 1). The company's return on equity stood at 4.4 percent in 2005, well above that of selected electricity firms on other Latin American

counties (see Tables 2 and 3). Its long-term liabilities over assets have come down from 37 percent in 2000 to 22 percent in 2005 (Table 4). Reflecting the debt restructuring operation, Isagen's total debt over EBITDA decreased from 5.5 in 2001 to 2.1 in 2005, and EBIT over interest rates expenditure increased from 1.5 percent in 2000 to 3.2 in 2005. A domestic credit agency ranked Isagen's debt as AAA in mid-2006.

18. **Isagen has a robust system to analyze investment projects.** All projects are subject to a rigorous cost-benefit-analysis, and must fit in the company's overall strategic framework. Isagen also systematically evaluates all investment projects ex post.

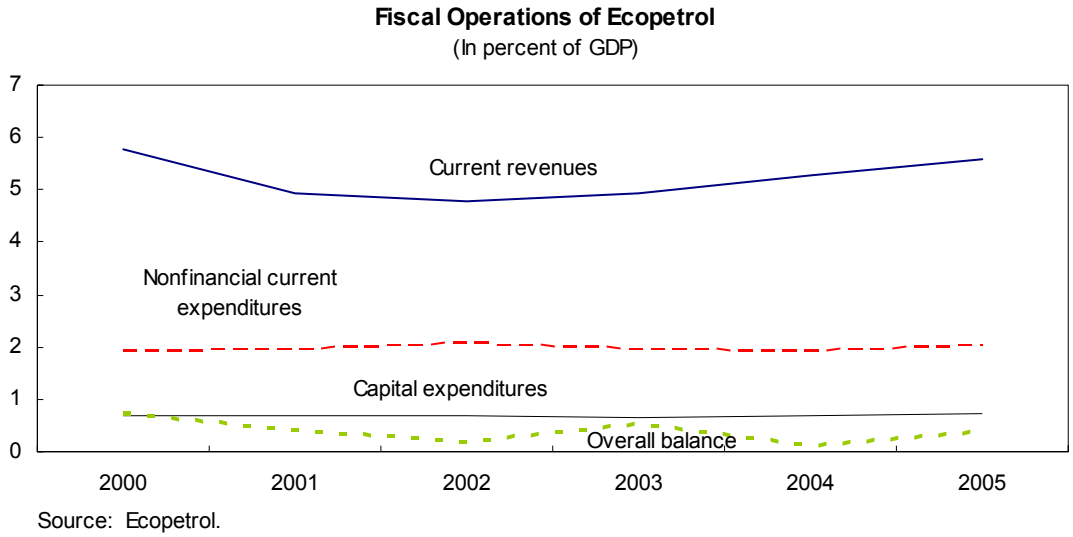
Other risk factors

19. **There are no other risk factors.** The actuarial deficit of the company's pension system amounted to US$20 million at end-2005, but is fully financed through adequate saving by Isagen.

D. Assessment of fiscal risk of Ecopetrol

20. **Ecopetrol is the biggest public enterprise in Colombia and makes a substantial contribution to the fiscal accounts.** Helped by favorable international oil prices, the company generated net profits of US$1.4 billion in 2005. The company's operating surplus, which is consolidated with the fiscal accounts, amounted to 3.6 percent of GDP in 2005 (Table 1). Since 2003, the National Hydrocarbons Agency (ANH) has been responsible for managing exploration contracts and policy making for Colombia's oil resources, while Ecopetrol has concentrated on exploration, production, refining and transport of oil.[4] As a result, the commercial orientation of Ecopetrol has strengthened, as it must compete with other agents in the market for exploration contracts, and its business decisions are driven by profitability criteria. Today, Ecopetrol maintains the rights to 22 exploration blocks, and produces 311 thousand barrels of oil per day. It also produces natural gas.

[4] Previously, Ecopetrol was responsible for developing and promoting Colombia's oil industry, both through direct exploration and production-sharing agreements with private energy companies.



21. **However, the company could disappear over the medium term unless it increases its capital expenditures significantly in the near future.** Based on current trends, Ecopetrol will continue to deplete its proven reserves and needs to develop new wells and fields to maintain production. Since Ecopetrol's investment has been constrained through the limit on the overall public sector deficit, it has suffered from years of underinvestment. Ecopetrol estimates that it needs to increase its investment from US$1.4 billion in 2006 to about an average of US$2.5 billion annually for the next five years to keep the company profitable over the medium term.

22. **Against this background, the government has proposed a plan to enhance the commercial orientation of Ecopetrol.** Inspired by ISA's example, Ecopetrol plans to issue up to 20 percent of its current value in additional shares on the Bogota and perhaps the New York stock exchanges, reducing the government's ownership stake to 80 percent. It would give its board greater independence from the government, phase out all subsidies, and take other steps to become a strictly commercially-run enterprise. Ecopetrol has already entered into a joint venture to upgrade one of its principal refineries in Cartagena to raise production to 140 thousand barrels per day. It sold 51 percent of the shares in the refinery for US$630 million to a Swiss firm, privatizing this refinery.

Managerial independence

23. **Ecopetrol aims to increase the independence of its board of directors.** Currently, the board is composed of seven members—three selected by the President of Colombia and the remaining four by vote of the shareholder assembly. To increase the independence of board members, the company intends to elect all board members by vote of the shareholder assembly. It will also allow Ecopetrol's president to be chosen by the company's board, rather than as currently, Colombia's president.

24. **Ecopetrol also wants to ensure that all of its employees will be governed by private sector law.** Currently, the president of Ecopetrol and the internal controller are civil servants. The government also defines a ceiling for yearly wage growth for the enterprise and sets the wage for the president. Ecopetrol asserts that these ceiling have limited the company's ability to attract the best-qualified staff, and the government agreed to giving the enterprise more wage setting flexibility to prepare it for the share offering.

25. **Ecopetrol has drawn up a good governance code with protections for minority shareholder rights.** While this code has been binding since 2004, it is has recently been strengthened to provide better protection of minority shareholder rights, which will be especially important after Ecopetrol's capitalization.

Relations with the government

26. **The government intends to phase out domestic fuel price subsidies by mid-2008.** In 2007, the subsidies will be maintained but will be recorded as an explicit expenditure item in the government's budget. As a result, it will receive higher dividend and tax payments from Ecopetrol. Currently, the price for gasoline and diesel products that Ecopetrol sells on the domestic market are regulated and set below international levels. Ecopetrol estimates that its revenues would have been 1.3 percent of GDP higher in 2004, and 1.8 percent of GDP in 2005, if prices were set freely.

27. **The company also manages Colombia's oil stabilization fund (FAEP) and royalties.** Private oil producers in Colombia pay their royalties in kind to Ecopetrol, Ecopetrol monetizes the commodity, and transfers the funds to ANH, which distributes the royalties to the oil producing regions. Resources are paid into the stabilization fund on the basis of a formula that reflects both oil production and prices. The fund currently holds assets equivalent to US$1.5 billion. By law, local governments can also draw on FAEP to pay down their debt.

28. **Ecopetrol is subject to the same taxes as private firms in the oil sector and made a substantial contribution to government finances over the past years.** In 2005, its dividend and income tax payments equaled almost one percent of GDP, and royalties to local governments amounted to over 1 percent of GDP. As mentioned above, its operational surplus, which is consolidated with the fiscal accounts, amounted to 3.6 percent of GDP in 2005, and is projected at 4 percent of GDP in 2006.

Transparency

29. **Comprehensive annual reports are regularly published for Ecopetrol.** They include balance sheets, profit and loss statements, levels of and changes in Ecopetrol's overall activities, information on employment, investment and outlook for the near future. This information is audited by an internally recognized firm and is also posted on the

Internet. Ecopetrol is the only Colombian company that is rated internationally, and received a rating of BB in June 2006 by Fitch Ratings.

Financial health

30. **Ecopetrol's current financial situation is very favorable, mainly reflecting current international oil prices.** Despite stagnant crude oil production levels, Ecopetrol's revenues in 2005 were US$6.55 billion, up from US$4.96 billion in 2004. EBITDA for 2005 amounted to US$2.55 billion, and net earnings increased to US$1.4 billion, a 75 percent increase over 2004. Moreover, sales in the domestic markets grew by almost 40 percent, and the policy of reducing the implicit fuel price subsidy also benefited Ecopetrol's financial position. Total assets increased by 20 percent in 2005, reaching US$14.5 billion, and its financial debt decreased to only around US$100 million (Tables 5 and 6), as investment and other spending is constrained by the overall ceiling for the combined public sector.

31. **Ecopetrol's system for analyzing investment projects appears solid.** All projects are assessed on the basis of a rigorous cost-benefit analysis, and must yield a well-defined expected rate of return. Moreover, they are subject to risk analysis, and must fit into Ecopetrol's strategic framework.

Other risk factors

32. **Ecopetrol has sizable pension liabilities that are almost completely funded**. The actuarial deficit of the company's pension system amounted to US$3.8 billion in mid-2006, with funding for 92 percent of these obligations.

33. **Threats from the security situation on Ecopetrol's capital stock have also diminished,** as the security situation has improved significantly through the past few years.

34. **However, Ecopetrol is Colombia's largest public enterprise, with a significant impact on the operations of the public sector.** Excluding Ecopetrol from fiscal indicators and targets could widen the headline deficit for the combined public sector, even after accounting for the income taxes, dividends and royalties that still be paid by Ecopetrol, and this could affect the credibility of fiscal policy. Also Ecopetrol might be considered "too big to fail."

35. **Ecopetrol's operations are also closely linked to the international oil price developments.** A negative oil price shock could compromise its financial outlook, in particular if production is not being increased to counteract the current declining trend.

E. Policy recommendations

36. **Isagen appears to present a low fiscal risk and could be removed from fiscal indicators and targets in the near term, preferably after it has sold 20 percent of its**

government shares to the public. This measure is likely to increase its commercial orientation even further. It is important to ensure that minority rights will be protected. Isagen will benefit from the exclusion from the fiscal accounts to carry out the investment it needs to stay competitive. However, the government should continue to monitor Isagen's financial situation closely, in particular since the government guaranteed a loan with an international bank for the enterprise. Removing the enterprise from the current coverage of the public sector would have a minimal effect, widening the overall fiscal deficit by 0.1 percent of GDP.

37. **It might be possible to exclude Ecopetrol from fiscal indicators and targets in the medium term, provided certain reforms are adopted.** These steps include: (i) appointing all board members through a vote of the shareholder assembly; (ii) phasing out the current subsidy for domestic fuel prices; (iii) establishing strong protections to minority shareholders; and (iv) giving the company the flexibility to set wages and other personnel costs at it see fit. However, it will be crucial to assess carefully the effect of removing Ecopetrol from the fiscal accounts on the overall public sector deficit.

38. **Continued strong monitoring of both enterprises is crucial.** The authorities' current system of monitoring enterprises is effective. They collect detailed data on the financial results of all public companies, their debt, their liquidity position, and their investment. The authorities should continue to seek to minimize any potential fiscal risks by ensuring that the companies' operations are on a sustainable footing. Both companies should continue to develop, finance, and execute investment projects in a robust system to help mitigate risk and ensure long-term profitability. In any event, the accounts of both enterprises should continue to be reported in the annual budget, possibly in an annex, and an additional measure of the fiscal balance presented.

Table 1. Fiscal operations of Ecopetrol and Isagen, 2000–2005
(In millions of pesos)

	Ecopetrol					Isagen				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Current revenues	9,330,015	9,696,352	11,296,176	13,431,671	15,890,698	437,518	481,596	720,031	737,265	903,313
Nonfinancial current expenditure	3,691,380	4,220,626	4,464,786	4,841,284	5,738,702	247,544	299,393	360,194	409,592	614,605
salaries	348,800	369,843	313,035	285,956	334,752	18,617	20,408	23,371	24,684	28,395
goods and services	292,454	297,439	227,358	252,436	282,887	61,226	72,398	78,868	64,941	93,895
taxes	749,256	711,599	426,626	930,475	887,532					
other						137,777	164,829	205,023	251,304	314,510
Capital expenditure	1,288,717	1,379,292	1,487,146	1,747,224	2,047,651	150,399	164,005	15,103	24,274	25,251
Primary balance	716,530	356,507	1,207,466	274,873	1,121,215	10,529	-71,892	49,993	65,749	16,044
Interest payments	62,092	51,014	38,925	20,744	13,149	27,669	46,296	136,166	123,002	116,602
Overall balance	**778,622**	**407,521**	**1,246,391**	**295,617**	**1,134,365**	**38,198**	**-25,596**	**186,159**	**188,751**	**132,646**

Source: MEF.

Table 2. Selected Financial Indicators for Ecopetrol and Isagen

Sector	Company	Year	Return on Equity (Net)	EBIT / Sales	Sales / Total Assets	Total Liabilities / Equity	Long-Term Liabilities / Assets	Current Assets / Current Liabilities	EBIT / Interest Expenditures
Oil	Ecopetrol	2000							
Oil	Ecopetrol	2001	0.22	0.34	0.41	2.21	0.54	0.75	48.37
Oil	Ecopetrol	2002	0.21	0.40	0.46	2.35	0.54	0.80	76.87
Oil	Ecopetrol	2003	0.17	0.38	0.43	1.84	0.51	1.16	111.33
Oil	Ecopetrol	2004	0.19	0.41	0.42	1.80	0.52	1.09	257.09
Oil	Ecopetrol	2005	0.24	0.41	0.47	1.46	0.49	1.53	478.89
		Average	**0.21**	**0.39**	**0.44**	**1.93**	**0.52**	**1.07**	**194.51**
Electricity	Isagen	2000	0.00	0.24	0.13	0.74	0.37	1.29	1.46
Electricity	Isagen	2001	0.05	0.35	0.14	0.67	0.37	2.39	3.22
Electricity	Isagen	2002	0.02	0.34	0.14	0.72	0.33	0.88	3.58
Electricity	Isagen	2003	0.05	0.36	0.19	0.63	0.31	1.31	1.83
Electricity	Isagen	2004	0.07	0.32	0.21	0.52	0.26	1.62	2.03
Electricity	Isagen	2005	0.05	0.32	0.24	0.47	0.22	1.50	3.21
		Average	**0.04**	**0.32**	**0.18**	**0.62**	**0.31**	**1.50**	**2.56**

Sources: Isagen and Ecopetrol.

Table 3. Selected Financial Indicators for Public Electricity Enterprises in Other Countries

Country	Company	Year	ROE (Net)	EBIT / Operating Assets	EBIT / Sales	Sales / Total Assets	Total Liabilities / Equity	Long-Term Liabilities / Assets	Current Assets / Current Liabilities
Argentina	Capex	2003	0.04	...	...	0.16	2.91	0.06	0.09
Argentina	Capex	2004	-0.01	0.07	0.33	0.19	2.33	0.07	0.08
Argentina	Capex	2005	-0.17	0.04	0.19	0.22	2.93	0.06	0.07
Argentina	Central Costanera	2003	0.04	0.09	0.32	0.22	0.43	0.03	0.62
Argentina	Central Costanera	2004	0.07	0.12	0.29	0.36	0.26	0.06	0.74
Argentina	Central Puerto	2003	-0.03	0.01	0.07	0.17	2.36	0.14	0.19
Argentina	Central Puerto	2004	-0.07	0.02	0.05	0.24	2.80	0.12	0.37
Argentina	Transener	2003	0.12	0.08	0.64	0.12	3.30	0.19	0.19
Argentina	Transener	2004	-0.34	-0.01	-0.06	0.13	4.74	0.00	0.17
Argentina	Transener	2005	0.57	0.34	1.82	0.18	0.73	0.35	1.15
Brazil	AES Tiete	2003	0.44	0.26	0.53	0.36	3.43	0.65	2.03
Brazil	AES Tiete	2004	0.64	0.36	0.59	0.42	3.46	0.62	2.14
Brazil	AES Tiete	2005	1.18	0.66	0.79	0.49	3.10	0.53	1.53
Brazil	Caiua Electricidade	2003	-0.51	0.12	0.25	0.42	5.47	0.29	0.66
Brazil	Caiua Electricidade	2004	0.27	0.16	0.25	0.49	9.76	0.21	0.73
Brazil	Celesc-Sta Catarina	2003	0.22	0.15	0.13	0.81	0.06	0.01	1.30
Brazil	Celesc-Sta Catarina	2004	0.22	0.19	0.12	0.96	0.21	0.05	1.50
Brazil	Centrais Elet Matogr (CEMAT)	2003	-0.11	0.14	0.27	0.44	1.33	0.25	0.73
Brazil	Centrais Elet Matogr (CEMAT)	2004	0.05	0.18	0.28	0.52	0.88	0.12	0.66
Brazil	Centrais Eletricas (Electrobras)	2003	0.00	0.05	0.26	0.16	0.49	0.26	1.30
Brazil	Centrais Eletricas (Electrobras)	2004	0.02	0.04	0.22	0.17	0.46	0.25	1.18
Brazil	CESP	2003	0.09	0.10	1.10	0.09	1.52	0.44	0.18
Brazil	CESP	2004	0.01	0.05	0.46	0.10	1.53	0.42	0.31
Brazil	Cia de Minas Gerais (CEMIG)	2003	0.31	0.17	0.37	0.38	0.97	0.15	0.73
Brazil	Cia de Minas Gerais (CEMIG)	2004	0.30	0.19	0.33	0.44	0.92	0.17	0.86
Chile	Chilectra	2003	0.12	0.09	0.18	0.40	0.03	0.00	0.95
Chile	Chilectra	2004	0.17	0.10	0.21	0.45	0.00	0.00	1.36
Chile	Chilectra	2005	0.17	0.14	0.21	0.58	0.00	0.00	1.18
Chile	Empresa Nacional de Electricidad (Endesa)	2003	0.05	0.09	0.40	0.19	1.46	0.38	1.27
Chile	Empresa Nacional de Electricidad (Endesa)	2004	0.07	0.09	0.39	0.23	1.19	0.33	0.54
Chile	Enersis	2003	0.02	0.07	0.24	0.26	1.43	0.31	1.49
Chile	Enersis	2004	0.03	0.09	0.24	0.31	1.31	0.26	0.88
Chile	General de Electric (CGE)	2003	0.11	0.09	0.21	0.40	2.22	0.33	0.42
Chile	General de Electric (CGE)	2004	0.13	0.10	0.21	0.43	2.14	0.44	0.87
Peru	Edegel	2003	0.06	0.09	0.50	0.17	0.33	0.18	0.48
Peru	Edegel	2004	0.07	0.09	0.48	0.19	0.37	0.15	0.42
Peru	Edegel	2005	0.09	0.10	0.49	0.19	0.47	0.17	0.46
Peru	Electrica de Lima (Edelnor)	2003	0.08	0.09	0.18	0.48	0.38	0.13	0.57
Peru	Electrica de Lima (Edelnor)	2004	0.06	0.10	0.18	0.51	0.41	0.18	0.92
Peru	Electrica de Lima (Edelnor)	2005	0.09	0.08	0.13	0.56	0.69	0.13	0.44
Peru	Luz del Sur Servicio	2003	0.28	0.21	0.25	0.72	0.80	0.27	1.07
Peru	Luz del Sur Servicio	2004	0.20	0.15	0.22	0.59	0.70	0.26	1.05
		average	**0.01**	**0.09**	**0.23**	**0.32**	**1.49**	**0.22**	**0.85**

Sources: Companies' annual reports.

Table 4. Balance Sheet of Isagen, 2001–2005
(millions of pesos)

	2001	2002	2003	2004	2005
TOTAL CURRENT ASSETS	**237,031**	**278,124**	**365,371**	**464,081**	**558,211**
LONG TERM ASSETS					
Long- term investment	-	-	-	-	-
Deposits	-	-	-	-	-
Loan receivable	9,520	26,667	31,366	8,171	9,126
Unquoted investment	18,070	182	177	160	326
Deferred taxation	-	-	9,503	10,624	11,260
Fixed & Other Assets at cost	3,162,315	3,475,278	3,485,215	3,490,398	3,496,633
Accumulated depreciation & Amortization	-752,315	-815,493	-912,259	-1,003,771	-1,100,742
TOTAL LONG TERM ASSETS	**2,437,590**	**2,686,634**	**2,614,002**	**2,505,582**	**2,416,603**
TOTAL ASSETS	**2,674,621**	**2,964,758**	**2,979,373**	**2,969,663**	**2,974,814**
CURRENT LIABILITIES					
Domestic	98,105	317,157	278,664	286,495	373,055
Foreign					
TOTAL CURRENT LIABILITIES	**98,105**	**317,157**	**278,664**	**286,495**	**373,055**
LONG TERM LIABILITIES					
Domestic	1,198,587	1,234,961	1,162,064	975,914	239,412
Foreign					571,055
TOTAL LONG TERM LIABILITIES	**1,198,587**	**1,234,961**	**1,162,064**	**975,914**	**810,467**
TOTAL LIABILITIES	**1,296,692**	**1,552,118**	**1,440,728**	**1,262,409**	**1,183,522**
TOTAL EQUITY AND RESERVES	**1,377,929**	**1,412,640**	**1,538,645**	**1,707,254**	**1,791,292**
TOTAL LIABILITIES AND EQUITY	**2,674,621**	**2,964,758**	**2,979,373**	**2,969,663**	**2,974,814**

Source: Isagen.

Table 5. Balance Sheet of Ecopetrol, 2001–2005
(millions of dollars)

	2001	2002	2003	2004	2005
CURRENT ASSETS					
Cash and cash equivalents	39.71	66.64	73.04	75.81	316.04
Investments	81.84	202.90	596.75	521.24	799.12
Accounts and documents receivable	310.22	300.82	274.04	272.74	420.07
Inventories	342.47	267.84	230.67	238.73	332.57
Advances and Deposits	236.57	236.27	325.53	487.59	483.09
TOTAL CURRENT ASSETS	**1,010.81**	**1,074.47**	**1,500.04**	**1,596.11**	**2,350.89**
LONG TERM ASSETS					
Investments	505.20	520.69	418.99	712.32	707.74
Accounts and documents receivable	49.37	47.11	50.24	56.65	75.97
Property, plant and equipment, net	2,785.73	2,287.82	2,303.09	2,407.94	2,558.87
Natural and environmental resources, net	1,157.63	979.68	1,061.51	1,458.01	1,381.47
Resources given for administration	1,408.48	1,315.80	1,652.45	2,645.51	3,773.15
Fondo de Ahorro y Estabilización Petrolera -FAEP	1,081.89	1,059.59	1,028.67	1,147.70	1,395.61
Advances and Deposits	-	-	-	77.57	116.19
Deferred charges and other assets	647.31	776.87	593.22	897.25	1,119.38
Valuations	517.14	446.11	817.47	702.75	820.93
TOTAL LONG TERM ASSETS	**8,152.74**	**7,433.69**	**7,925.65**	**10,105.70**	**11,949.32**
TOTAL ASSETS	**9,163.55**	**8,508.15**	**9,425.68**	**11,701.81**	**14,300.21**
CURRENT LIABILITIES					
Accounts payable and related parties	325.82	375.15	387.25	547.68	296.25
Financial obligations	98.66	215.33	44.24	43.20	43.98
Labor obligations	143.23	122.43	147.03	188.73	214.35
Taxes payable	592.17	472.43	527.43	556.47	759.61
Estimated liabilities and provisions	193.41	155.42	184.95	122.88	218.04
TOTAL CURRENT LIABILITIES	**1,353.28**	**1,340.76**	**1,290.90**	**1,458.97**	**1,532.23**
LONG TERM LIABILITIES					
Accounts payable, long-term	13.50	28.47	7.50	2.88	32.68
Financial obligations, long term	243.89	131.25	93.75	56.25	27.33
Labor obligations, long term	2,972.02	2,655.31	2,981.25	3,633.40	4,005.20
Deferred income - Fondo de Ahorro y Estabilización Petrolera - FAEP	1,081.89	1,059.59	1,028.67	1,147.70	1,395.61
Estimated liabilities and provisions	-	-	342.24	764.35	1,022.54
Other liabilities, long term	643.07	755.54	359.50	453.35	468.52
TOTAL LONG TERM LIABILITIES	**4,954.37**	**4,630.17**	**4,812.91**	**6,057.93**	**6,951.88**
TOTAL LIABILITIES	**6,307.65**	**5,970.93**	**6,103.81**	**7,516.90**	**8,484.11**
TOTAL EQUITY	**2,855.91**	**2,537.23**	**3,321.87**	**4,184.90**	**5,816.10**
TOTAL LIABILITIES AND EQUITY	**9,163.55**	**8,508.15**	**9,425.68**	**11,701.81**	**14,300.21**

Source: Ecopetrol.

Table 6. Selected Financial Indicators for State Oil Firms on Other Countries

Country	Company	Year	ROE (Net)	EBIT / Operating Assets	EBIT / Sales	Sales / Total Assets	Total Liabilities / Equity	Long-Term Liabilities / Assets	Current Assets / Current Liabilities	EBIT / Interest Expenditures
Brazil	Petrobras	2001	0.34	0.41	0.27	0.79	0.65	0.19	1.55	7.35
Brazil	Petrobras	2002	0.24	0.24	0.20	0.72	0.90	0.26	1.31	5.79
Brazil	Petrobras	2003	0.36	0.35	0.30	0.71	0.84	0.25	1.42	11.56
Brazil	Petrobras	2004	0.29	0.31	0.26	0.75	0.59	0.22	1.51	10.78
		average	**0.31**	**0.33**	**0.26**	**0.75**	**0.75**	**0.23**	**1.45**	**8.87**
Spain	Repsol	2001	0.07	0.11	0.10	0.84	1.43	0.27	0.92	2.55
Spain	Repsol	2002	0.14	0.16	0.12	0.95	0.88	0.22	1.24	3.06
Spain	Repsol	2003	0.15	0.16	0.11	0.97	0.78	0.17	1.18	4.82
Spain	Repsol	2004	0.13	0.16	0.10	1.07	0.64	0.16	1.29	5.84
		average	**0.12**	**0.15**	**0.11**	**0.96**	**0.93**	**0.20**	**1.16**	**4.07**
Chile	ENAP	2001	...	...	0.10	...	...	...	...	4.24
Chile	ENAP	2002	...	0.18	0.09	1.23	2.29	0.36	1.12	5.91
Chile	ENAP	2003	...	0.14	0.06	1.55	2.54	0.42	1.21	3.78
Chile	ENAP	2004	...	0.15	0.05	1.59	2.91	0.43	1.38	3.42
		average		**0.16**	**0.08**	**1.46**	**2.58**	**0.40**	**1.23**	**4.33**

Sources: Companies' annual reports.

II. Inflation Persistence in Colombia[5]

A. Introduction

1. **Since 1999, inflation in Colombia has declined to 4½ percent, the lowest level in decades.** This represents a sharp change from Colombia's decades-long track record of persistent inflation of about 20–30 percent a year (Uribe, 1994; Dornbusch and Fischer, 1993). The shift in inflation performance can be explained largely by the adoption of a new policy framework in 1999–2000. In September 1999, Colombia decided to abandon the crawling peg exchange rate regime that had been in place since 1967 and to introduce a flexible exchange rate regime. In 2000, the country formally adopted an inflation-targeting framework.

2. **This paper looks at the effect of this new policy regime on the persistence of inflation and whether expected inflation now has a larger effect on current inflation.** A central bank facing inflation that is largely determined by past inflation will probably have to tighten monetary policy more to achieve an inflation target. Moreover, a successful inflation-targeting framework should enhance the credibility of monetary policy and make current inflation a function largely of expected inflation. This makes monetary policy more effective, requiring less tightening to achieve a given inflation target.

3. **Some studies have measured the extent of price stickiness in Colombia**. Bejarano (2005), using data between 1982 and 2002, identified that about 70 percent of firms kept their prices fixed for about three quarters. Moreover, Gomez and Julio (2003); Gomez, Vargas and Uribe (2002); and Hamann, Perez and Rodriguez (2006); have recognized the existence of persistence and incorporated in the formulation of the core model of the monetary transmission mechanism used by the central bank. These studies do not present evidence on whether inflation persistence in recent years has changed and by how much.

4. **This paper measures persistence using two methodologies**. First, it identifies the statistical importance of the autoregressive component of inflation, according to several measures of inflation. Second, it estimates the separate effects of backward and forward looking inflation as well as of marginal costs on current inflation by estimating a hybrid new Keynesian Phillips curve (NKPC). This approach builds on the work of Bejarano (2005) by estimating a reduced form hybrid NKPC and extending the sample until the first quarter of 2006.

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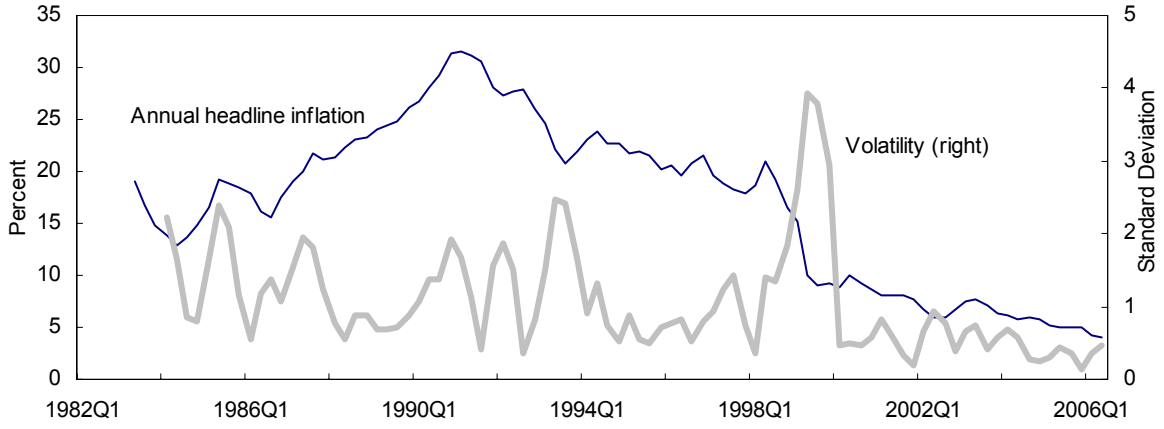
[5] Prepared by Roberto García-Saltos. The paper benefited from comments by Herman Kamil, Steffen Reichold, and Robert Rennhack. Bergljot Barkbu provided the GMM code used in section III and Jesus Bejarano generously provided his estimates of unit labor costs.

5. **The findings of this chapter are as follows.** First, the importance of the backward-looking component of inflation appears to have declined after the introduction of the inflation targeting framework and the adoption of a flexible exchange rate regime. Second, forward looking inflation expectations have gained importance in explaining observed inflation after Colombia adopted a floating exchange rate regime in 1999. The remainder of this chapter is organized as follows. Section II provides a brief review of the disinflation strategy. Section III presents the empirical results. Section IV concludes.

B. The Disinflation Strategy

6. **Since the formal adoption of the inflation targeting regime in 2000, inflation has declined consistently.** The average headline inflation rate between 1982 and the second quarter of 1999 was 21 percent and has declined to 7 percent from the third quarter of 1999 through the second quarter of 2006. At the same time, inflation volatility, measured by its standard deviation, has decreased across all measures of inflation, and there have been a number of times that prices—especially the tradable component—have fallen (Table 1, Figure 1).

Figure 1. Level and Volatility of Annual Headline Inflation



Sources: Central Bank of Colombia; and Fund staff calculations.

Table 1. Descriptive Statistics on Inflation Measures

	Inflation Measures				
Measure	Headline	Food	Tradable goods	Non-tradable goods	Regulated goods
1983.Q2-1999.Q2					
Average	21.4	22.3	20.6	20.5	26.6
Standard Deviation	4.8	6.5	5.8	6.7	7.0
1999.Q3-2006.Q2					
Average	6.9	7.3	6.8	4.8	13.0
Standard Deviation	1.6	2.0	3.6	1.0	5.5

Sources: Central Bank of Colombia; and Fund staff estimates.

7. **This disinflation process has not been free from difficulties.** First, the long period of moderate inflation stretching from the 1970s through the 1990s created institutional structures that contributed to inertia.[6] This inertia, in turn, increased the short-run costs of adopting a credible disinflation strategy, as there was little support for embracing the costs embedded in breaking with the *status quo*. Second, while the central bank moved to informal inflation targeting in the early 1990's, other reforms increased fiscal dominance and complicated monetary policy management.[7] Third, the turbulence in financial capital markets during 1998–99 and in 2002 affected the risk perception toward Colombia and had the potential to interrupt the disinflation strategy.

8. **Several reasons help to explain the drastic fall in inflation**. Some authors (Clavijo, 2000) characterize this shift as an opportunistic disinflation, as the sustained rise in unemployment following the 1999 crisis virtually eliminated all demand pressures. Nevertheless, inflation has continued to decline even after economic growth recovered to 5 percent a year in 2004–06 and unemployment fell to about 10 percent—close to its estimated natural rate. This probably reflects the strengthening of economic policies since 2002 that improved confidence and the climate for investment and supported faster growth in potential output.

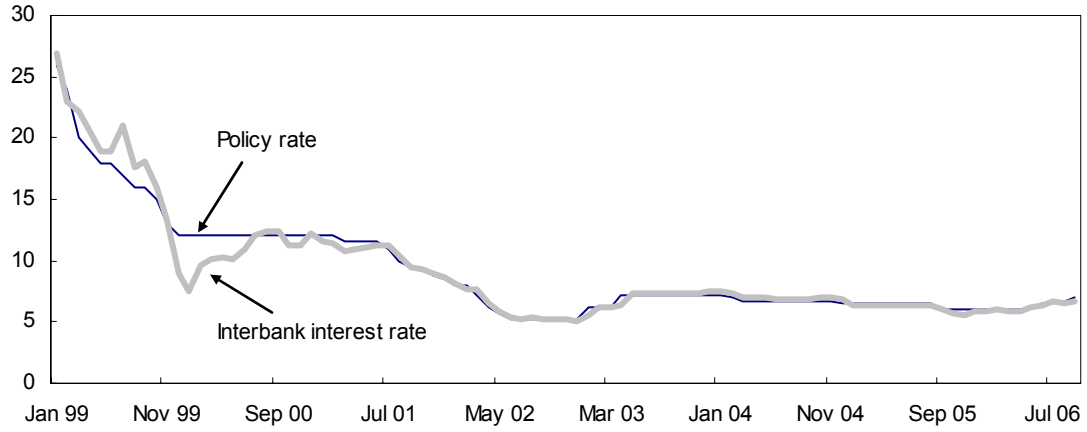
[6] Mainly associated with the backward indexation of wages, taxes and mortgages rates, as described in Uribe (1994) and Gomez (2003).

[7] The constitution adopted in 1991 generated significant pressures to expand social expenditures that were not appropriately matched by additional revenues. For instance, between 1990 and 2002 public spending as percentage of GDP increased by 12 percentage points of GDP.

9. **The decline in inflation can also be explained by several reforms to strengthen monetary policy implementation**. First, the 1999 adoption of a floating exchange rate regime provided enough flexibility to help the economy weather turbulent international capital markets episodes and broke the indexation created by the crawling peg exchange rate regime. Second, the introduction of an explicit inflation target in 2000 as the operational monetary framework enhanced the *de facto* independence of the central bank, originally granted by the 1991 Constitution. Third, the clear hierarchy given to inflation control over any other monetary policy goal gave the central bank more protection from political pressures than in the past. Fourth, the central bank has had the independence to select its policy instrument since 2000. Fifth, a number of mechanisms have been adopted in recent years to increase the transparency of monetary policy.[8]

10. **The Colombian inflation-targeting framework has been one of inflation forecast targeting, with the interest rate as the policy key instrument**. Under this scheme, whenever the inflation forecast deviates from the inflation target, the central bank modifies the interest rate accordingly. In operational terms, the central bank sets the minimum and maximum interest rates on auctions for overnight repo and reverse-repo operations, and provides or withdraws liquidity accordingly. These policy rates affect the rate on the overnight interbank money market, on which banks borrow and lend money. The expected evolution of this short-term rate, in turn, affects interest rates at longer horizons, which in the presence of nominal price rigidities, can influence households and firms' savings and investment decisions. This co-movement of the overnight interbank rate with the rates on three, six and twelve-month certificates of deposit is evident over the period 1999–2006.[9]

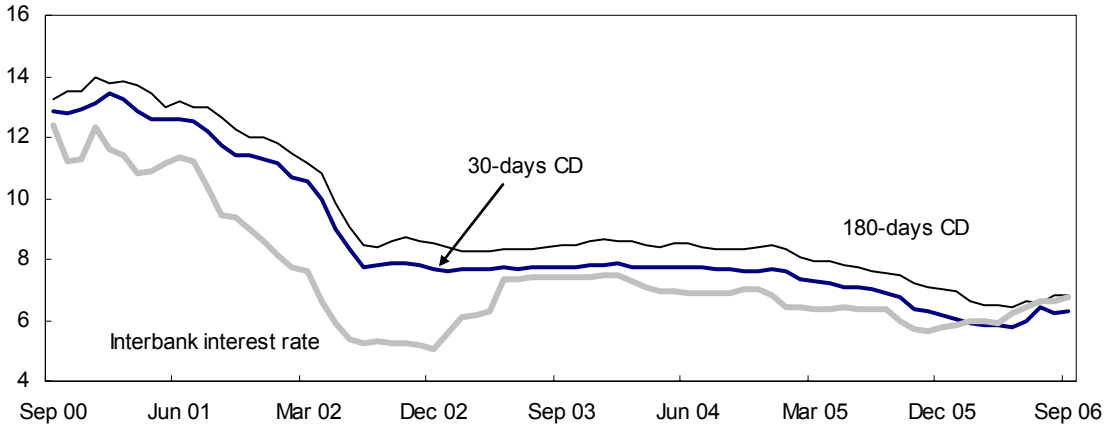
Figure 2. Interbank Interest Rate and Policy Rate
(In percent)



Source: Central Bank of Colombia.

[8] These include the publication of the quarterly inflation report, the report to congress and the release of the main model used to forecast inflation.
[9] An empirical study that documents this relationship is Huertas, and others (2005).

Figure 3. Certificates of Deposit and Interbank Interest Rate
(In percent)



Source: Central Bank of Colombia.

C. Measuring Inflation Persistence

11. **In this paper, we seek to explain the sources of inflation using the theoretical framework embedded in the hybrid New Keynesian Phillips Curve (NKPC),** as presented in Gali and Gertler (1999) (GG). GG assumed staggered price setting framework *a la* Calvo (1983), where firms have a probability of receiving a signal to reset prices each period. This signal is independent of the time elapsed since the last signal was received and there are firms that maintain their prices unchanged in any given period. GG modified the Calvo pricing scheme by allowing only a fraction of firms to adjust prices according to expected future marginal costs. The remainder of firms set prices by a rule of thumb formula that combines newly adjusted prices and expected inflation that is based on lagged inflation. GG obtain a hybrid NKPC that is equal to

$$\pi_t = \lambda mc_t + \gamma_b \pi_{t-1} + \gamma_f E_t \pi_{t+1} + \varepsilon_t \qquad (1)$$

where π_t is the inflation at time t; $E_t \pi_{t+1}$ is the expected inflation at time *t+1,* conditional on information at time *t*; mc_t is the deviation from trend of the marginal cost at time *t*, and ε is an exogenous marginal cost shock. When all firms set prices according to expected marginal costs, $\gamma_b = 0$ and equation (1) becomes the stylized forward-looking NKPC.

12. **The hybrid NKPC is also used to identify the sources of inflation persistence. I**n particular, each of the three right hand-side terms of equation (1), is associated with different definition of persistence, in turn: extrinsic persistence (λmc_t), which arises from changes in real marginal costs; the intrinsic persistence or inflation inertia ($\gamma_b \pi_{t-1}$) due to the price-setting mechanism existing in the economy; and the expectations-based persistence ($\gamma_f E_t \pi_{t+1}$) that is associated with forward looking inflation expectations. We should keep in

mind that the presence of inflation inertia is usually associated with imperfect credibility of monetary policy, and thus with larger output costs of disinflation.

13. **This chapter uses two approaches to identify persistence.** The first is a statistical approach, and identifies persistence with the autoregressive component of inflation.[10] This is accomplished by estimating the following equation:

$$\pi_t = \alpha + \sum_i^5 b_i \pi_{t-i} + \zeta_t, \quad with \quad \zeta \sim (i.i.d) \tag{2}$$

The sum of the autoregressive coefficients is used to measure of the dependency of inflation on its own past. Equation (2) is estimated using quarterly inflation for each of the price indexes presented in Table 1, as well as for the GDP deflator. The sample is divided in two periods: one through the second quarter of 1999, just prior to the adoption of a free floating exchange rate regime, and the other starting in the third quarter of 1999 through the first quarter of 2006, which also coincides with the implementation of the inflation targeting framework, and the flexible exchange rate regime.

14. **In general, the results show a reduction in inflation inertia (intrinsic persistence) (Table 2).** With the exception of tradable goods inflation and inflation of regulated prices, the inflation measures show a reduction in the sum of the autoregressive coefficients for the period after the adoption of the floating exchange rate regime, which can be taken as evidence of lower persistence. The result of particular interest is the big decline in the persistence of non-tradable goods inflation from 0.96 to 0.37.

[10] Several authors have used this univariate approach to measure inflation persistence, see Batini (2002).

Table 2. Univariate Evidence on Inflation Persistence 1/

Measures of inflation	GDP Deflator	Headline Inflation	Non-Tradable Inflation	Tradable Inflation	Food Inflation	Regulated Prices Inflation
		$\pi_t = \alpha + \sum_{i=1}^{5} \hat{b}_i \pi_{t-i}$				
		Sample Period: 1985Q3 - 1999Q2				
Intercept	0.01	0.00	0.00	0.00	0.02	0.02
	(0.012)	(0.006)	(0.00)	(0.003)	(0.013)	(0.01)
$\sum_{i=1}^{5} \hat{bi}$	0.83	0.96	0.96	0.92	0.55	0.70
	(0.22)	(0.13)	(0.057)	(0.072)	(0.268)	(0.017)
R^2	0.30	0.63	0.87	0.81	0.34	0.29
SEE	0.02	0.01	0.01	0.01	0.02	0.02
DW	1.95	1.98	2.02	1.98	2.07	1.99
		Sample Period: 1999Q3 - 2006Q1				
Intercept	0.009	0.000	0.007	-0.001	0.013	0.001
	(0.01)	(0.002)	(0.002)	(0.002)	(0.009)	(0.006)
$\sum_{i=1}^{5} \hat{bi}$	0.42	0.93	0.37	0.97	0.28	0.88
	(0.51)	(0.17)	(0.169)	(0.09)	(0.5)	(0.19)
R^2	0.11	0.72	0.39	0.85	0.27	0.58
SEE	0.02	0.00	0.00	0.00	0.01	0.01
DW	1.98	1.82	2.03	1.56	2.20	1.87

1/ Standard errors in parenthesis.

15. The second approach assesses the relative importance of economic factors that explain inflation by estimating the hybrid NKPC. In particular, a reduced form of equation (1) is estimated with a GDP deflator as the underlying inflation measure, which follows closely the theoretical foundations of equation (1).[11] Following GG, we assume rational expectations and estimate equation (1) using Generalized Method of Moments (GMM) with lags of the variables as instruments and assuming the error term ε is i.i.d. This procedure allows us to distinguish backward-looking from forward-looking behavior. We also estimate the coefficients of the equation with and without the restriction that the parameters of backward and forward looking inflation (λ_f, λ_b) add to one, which is the condition for monetary policy to be neutral in the long-run.

[11] The GDP deflator covers durable and non durable goods as well as foreign and domestic prices. However, to check the robustness of the results we also estimate equation (1) with the headline inflation as the "right" measure of inflation.

Data

16. **The sample covers from the second quarter of 1986, because of data availability, through the first quarter of 2006.** Unfortunately, after the adoption of the floating exchange rate regime it is not possible to estimate the NKPC by GMM given the short sample period. However, to obtain an indication as to whether the forward looking behavior of inflation has become more important we estimate equation (1) for two samples: one from 1986.III to 1999.II, and the other from 1986.III to 2006.I. We estimate two equations—one with the quarterly variation of the seasonally adjusted GDP deflator as the measure of inflation and the other using headline inflation. Consistent with the CG model, the real marginal cost is proxied by the contribution of labor to total production (labor share[12]). Until 2002 we use the labor share as estimated by Bejarano (2005); from then on we construct the variable using the growth rates of employment provided by Velasco (2006) and the wage rate as reported by the Household Survey published by the National Planning Department (DNP).[13] The wage series used by Bejarano (2004) is based on surveys covering 7 cities, but the series published by DNP covers 13 cities. To interpolate the data from 2002 on wages, we assumed that the growth rate of wages covering either 7 or 13 cities is similar.

Results

17. **The estimation of the hybrid NKPC for Colombia shows that forward looking expectations now play a larger role in determining current inflation (Table 3).** The coefficients on the marginal cost and the expected inflation are statistically different from zero and positive. A positive coefficient in the marginal cost term ($\lambda > 0$) may be associated with higher bottlenecks in the supply side of the economy or with higher demand pressures—a reduction in the output gap—which could create inflationary pressures. The coefficient of expected inflation is significantly different from zero, which can be interpreted as evidence of forward looking behavior in the price setting mechanism. An interesting exercise is to measure whether the importance of this forward looking behavior has changed since Colombia adopted the floating exchange rate regime. This exercise is accomplished by estimating the equation (1) for the restricted sample (before exchange rate floating) and for the whole sample. The increase in λ_f for the whole sample can be taken as an indication that after the adoption of the floating exchange rate regime the importance of the forward looking behavior in inflation dynamics increased.

[12] See Gali and Gertler (1999) for details.

[13] The revised series published by the DNP in September 2006 were used.

Table 3. GMM Estimation of the Hybrid Neo-Keynesian Phillips Curve 1/ 2/

	GDP Deflator			Headline Inflation		
	γ_f	γ_b	λ	γ_f	γ_b	λ
Sample Period: 1986Q2 - 1999Q2						
Unrestricted	0.801	0.047	0.101	0.57	0.31	0.01
	(0.186)	(0.144)	(0.067)	(0.143)	(0.127)	(0.03)
$\gamma_f + \gamma_b = 1$	0.926	...	0.119	0.656	...	0.021
	(0.149)		(0.075)	(0.129)		(0.029)
Sample Period: 1986Q2 - 2006Q1						
Unrestricted	0.9	-0.007	0.136	0.688	0.29	0.042
	(0.182)	(0.130)	(0.081)	(0.135)	(0.127)	(0.028)
$\gamma_f + \gamma_b = 1$	1.01	...	0.13	0.703	...	0.044
	(0.14)		(0.084)	(0.129)		(0.029)

1/ Standard errors in parenthesis.
2/ The instruments used were lags of inflation measures, marginal cost, output gap, exchange rate changes and seasonal dummies. Across regressions the test for overidentification can not be rejected.

D. Concluding Remarks

18. The reduction in inflation obtained since 1999 has been remarkable. This disinflation appears to be associated with a decline in inflation inertia (intrinsic inflation persistence) and an increase in the forward looking component of inflation. These results, together with the decline in the volatility of inflation, suggest that Colombia's inflation-targeting framework has enhanced the credibility and effectiveness of monetary policy. However, a statistical test of the link between the new policy regime and these changes in inflation persistence is a topic for another research effort. Going forward, the reduction in the backward looking component of inflation (intrinsic persistence) could also indicate a lower short-term cost of disinflation in terms of output and employment.

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III. WHO, WHY, HOW? CURRENCY RISK HEDGING BY COLOMBIAN CORPORATIONS[14]

A. Introduction

1. **The financial crises in the late 1990s and early 2000s underscored the importance of risks arising from the balance sheet exposures of different sectors**. The effects of macroeconomic policies, such as a rise in interest rates or a currency depreciation, can be influenced by mismatches in the currency composition, the maturity structure and other aspects of the balance sheets of financial institutions, corporations or the public sector. For these reasons, the macroeconomic and sectoral balance sheets of a number of key emerging market countries, including Colombia, have been analyzed in recent years.[15]

2. **A comprehensive assessment of sectoral and economy-wide vulnerabilities, however, needs to take into account *off*-balance sheet activities.** These can alter the net foreign currency and short-term positions of different sectors and the distribution of risk within the economy. Financial transactions such as exchange rate forwards, for example, are not recorded on a balance sheet, but imply predetermined future flows that will eventually affect the overall exposure. By transferring risk to those that are more willing or able to bear it, such transactions can in principle be used to effectively reduce the risk created by balance sheet currency mismatches. For example, importers and exporters can hedge their exchange rate exposure so that their importing costs and exporting revenues become less volatile. Likewise, firms borrowing in foreign markets with no foreign currency earnings can enter into cross-currency forward contracts to reduce their exposure to exchange rate risk.

3. **The use of currency derivatives contracts by nonfinancial corporations has grown rapidly in several countries in Latin America, especially in those that have recently switched to more flexible exchange rate regimes (BIS, 2005).** Yet to date, firms' motivations and strategies for using hedging instruments in emerging markets are little understood, let alone their broader implications for corporate and macroeconomic vulnerabilities to exchange rate fluctuations. The only cross-country study that focuses exclusively on emerging markets is Allayanis, Brown, and Klapper (2003), which examines the currency hedging practices of non-financial firms from eight East Asian countries over the period 1996–98. The authors find limited support for existing theories of derivative use: liquidity-constrained firms with higher investment opportunities do not hedge significantly more in their sample. They also document that firms in East Asia use foreign cash income as a substitute for derivative hedging.

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[14] Paper prepared by Herman Kamil of the IMF and Ana Fernanda Maiguashca and David Perez Reina of the Banco de la República.

[15] For the case of Colombia, see Lima, Montes, Varela and Wiegand (2005) and Etcheverry, Fergusson, Steiner and Aguilar (2003).

4. **For developed countries, there is a vast literature that examines firms' motives to use financial derivatives to manage currency risk.** Research on derivatives usage largely focuses on understanding *why* firms hedge, by appealing to some form of market imperfection. Froot and others (1993) explain currency risk management with market imperfections that make funding from outside the corporation more costly than internal sources of funds. In this case, the variability in the cash flow (internal funds available) can cause variability in both investment spending and/or external funds raised. Thus, without hedging, firms are more likely to pursue sub-optimal investment projects (Myers, 1977). Hedging mitigates this underinvestment problem by reducing not only the costs of obtaining external funds, but also a firm's dependence on external financing. Evidence on the underinvestment hypothesis is mixed. Mian (1996) and Allayannis and Ofek (2001) find no relation between market-to-book ratios (proxying for growth opportunities) and hedging. Several papers, however, find that R&D expense increases a firm's incentive to hedge (e.g., Geczy, Minton and Schrand, 1997; Dolde, 1995).

5. **Smith and Stulz (1985) show that exogenous bankruptcy costs can create incentives for firms to use currency derivatives**.[16] By reducing the variance of a firm's cash flows (or accounting profits), hedging decreases the probability—and thus the expected costs—of financial distress. Many papers use the debt ratio to measure deadweight costs of financial distress and find that hedging increases with the debt ratio (e.g., Graham and Rogers, 2002; Purnanandam, 2004). Others, however, find no evidence or mixed evidence for the relationship between hedging and leverage (e.g., Nance, Smith and Smithson, 1993; Geczy, Minton and Schrand, 1997). Smith and Stulz (1985) also argue that hedging can reduce expected tax liability of a firm in the presence of a progressive tax schedule, which makes volatility is costly. For these firms, a smoother profit stream creates tax advantages.

6. **This paper represents a first step towards understanding financial currency risk management by emerging market corporations, with a focus on Colombia.** It first documents a dramatic increase in the turnover of forward contracts used by the nonfinancial corporate sector between 1998 and 2005, mostly concentrated in long dollar positions at relatively short maturities. It then analyzes the use of financial derivatives by 1,800 publicly-traded and private companies in Colombia in 2004, drawing on a unique database with information on daily exchange rate forward transactions. It finds strong evidence that the use of derivatives is, in fact, for hedging rather than for speculation. Firms that use FX derivatives have higher proportions of dollar debt, significantly higher leverage, shorter debt profiles, as well as lower liquidity (as measured by current ratios) and are more involved in international trade. The development of cross-currency derivatives has also enabled some large corporations to raise cheaper capital abroad without increasing their exchange rate risk.

[16] These exogenous costs can include, for example, the costs related to loss of long term relationships with suppliers and customers.

7. **The rest of the paper proceeds as follows.** Section B summarizes recent developments in the domestic forward exchange rate market. Section C looks at the determinants of firms' decision to use financial hedging. Section D concludes and draws policy implications.

B. Recent Developments in Domestic Forward Markets

8. **In the last five years, the on-shore market for foreign exchange hedging instruments in Colombia has grown remarkably.** Consistent with the increased flexibility in the exchange rate and deeper trade and financial integration with the rest of the world, activity in on-shore, currency-based derivative contracts have shown rapid and persistent growth.[17] Total turnover reached US$6 billion in December 2005, up from a monthly average of US$884 million in 1998 (Figures 1 and 2). In 2005, total trading volume in the forward market represented 45 percent of GDP and one and a half times total trade (exports and imports) of the whole economy[18].

Figure 1. Total Turnover in Forward Exchange Rate Market in Colombia
(In billions of U.S. dollars)

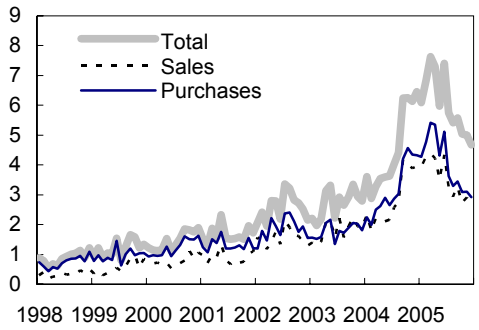
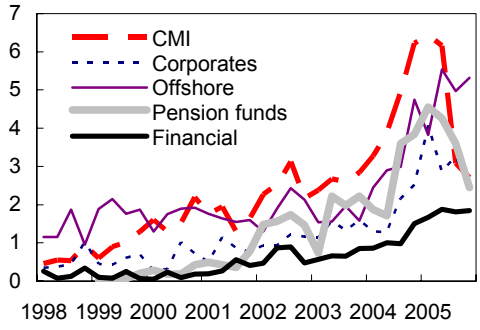


Figure 2. Turnover of Forward Transactions by Sector
(In billions of U.S. dollars)



9. **While the turnover in the forward FX market in the last few years has increased significantly, Colombia's derivatives market is still underdeveloped by international standards.** Colombia's forward market (when measured as a percentage of GDP or total

[17] Two regulatory changes in 2000 encouraged the development of the derivatives markets. On the one hand, the Central Bank allowed credit institutions to use external borrowing to hedge their net exposure in forward markets. On the other hand, the Banking Superintendency imposed a 20 percent limit on the currency exposure of pension fund portfolios, forcing them to actively hedge their foreign investments.

[18] Trading in the offshore market is in the form of NDFs and is not regulated. Tenors for this instrument are for up to one year. The NDF market for the peso is among the smaller ones within the Latin America, with an average daily turnover of US$50 million. Deals are executed in New York, with the tasa de cierre representiva del mercado (TRM) or closing market price rate on Reuters being used for settlement.

trade), is still considerably smaller than in some other regional countries that have a flexible exchange rate regime (Table 1).

Table 1. Size of Domestic US Dollars Forward Market, 2003

	Colombia	Chile	Mexico
Volume (in US$ billions)	27.4	165.8	340.0
As percent of GDP	34.5	225.0	53.2
As percent of foreign trade (X+M, goods)	101.2	418.2	156.5

Sources: Central Bank of Colombia; World Economic Outlook; and Fund staff calculations.

10. **In Colombia, foreign exchange hedging instruments are concentrated in over the counter (OTC) transactions in various types of short-maturity forwards and, more recently, FX swaps.** However, the use of other derivatives remains extremely limited or nonexistent. Interest rate derivatives instruments, OTC interest rate swaps and market-traded fixed income futures are fairly limited and illiquid, and used mainly by banks and institutional investors.

11. **Banks play a major role as market makers in the local OTC market.** In effect, they match corporate end-users and institutional investors' needs to cover (opposing) exchange rate risk. Demand for foreign exchange hedging (to protect against a devaluation) comes mainly from corporations which are net importers or which borrow in foreign currency abroad. Pension funds are the main providers of foreign exchange hedging to corporate end-users, because their liabilities are in pesos and they want insurance from currency appreciation. Minimum coverage requirements of foreign assets makes pension funds the natural providers of foreign currency hedging to firms since they have an incentive to take the foreign currency paying leg of a derivatives transaction.

12. **Table 2 shows the way the forward markets redistributed and reduced the overall exposure to exchange rate risk in 2004 and 2005.** By end-December 2004, for example, institutional investors had an outstanding net dollar-paying position of US$1.18 billion, compared to the outstanding net dollar buying (long) position of US$1.23 billion of corporations. Exporters, however, have not been important providers of foreign exchange hedging to other dollar-indebted corporate end-users. Central bank data shown in Table 2 indicate that foreign-currency paying positions of the corporate sector, mainly supplied by exporters, amounted to US$ 237 million, or only 7 percent of the total amount of foreign-currency paying positions (sales) in the domestic derivatives market in 2004. After trading with residents and non-residents, most banks hedge their net exposure by taking an offsetting position in the cash market.

Table 2. Outstanding Stock of Forward Contracts vis-a-vis the Banking Sector
(In millions of U.S. dollars)

	Sales	Purchases	Net Purchase Position 1/
	December 30, 2004		
Corporates	237	1,468	1,230
Offshore and special purpose vehicules	943	1,370	427
Pension funds	1,919	742	-1,177
Other financial institutions	393	228	-165
Treasury	0	0	0
Banks' Net FX Forward exposure			**316**
	December 30, 2005		
Corporates	465	1,150	685
Offshore and special purpose vehicules	609	1,093	484
Pension funds	1,363	157	-1,206
Other financial institutions	366	335	-31
Treasury 2/	4	0	-4
Banks' Net FX Forward exposure			**-72**

Sources: Central Bank of Colombia; and Fund staff calculations.

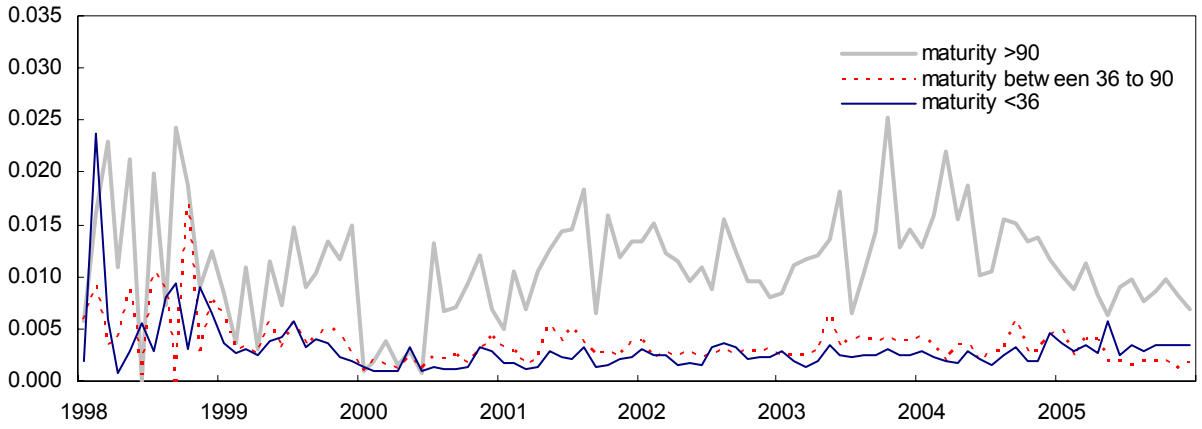
1/ Positive net purchase means long dollar positions.
2/ Trading in currency derivatives in 2005 was mostly done with FX swaps.

13. **Pricing of forward contracts subscribed between banks and their corporate clients, varies widely across firms.** Figure 3 shows the dispersion of settled forward nominal exchange rates for all contracts signed the same day and with same contractual maturity, across firms. Three key factors explain this dispersion: the lack of a reliable forward curve, the importance of bank-client relationships and regulatory restrictions.[19] First, the local money market is under-developed, which makes it hard to find a local short-term interest rate to price FX forwards. Second, firms that enter a forward contract with a bank must have a credit line approved due to counterparty risk. The credit line is costly since it ties up the bank's economic capital. The cost of the credit line is passed on to the end-user at varying forward rates, according to firms' net worth and relationship with bank. Third, limits imposed by the Central Bank on the foreign currency net cash position of banks create distortions when banks approach those limits.[20]

[19] Papaioannou and Vicente (2006) examine the current structure and operations of hedging instruments and derivatives markets, and identify the main impediments to the development of these instruments and markets.

[20] There are some other regulatory issues that create price distortions, such as the limits on net foreign currency exposure of pension funds.

Figure 3. Variation Coefficient for Forward Exchange Rates for Several Tenors[1]



1/ Standard deviation of the forw ard exchange rates divided by the average level of the forw ard exchange rate for each tenor.

14. **The nonfinancial corporate sector has accounted for approximately 25 percent of the turnover in the market throughout this period.** Figures 4 and 5 show the evolution of the monthly flow and net outstanding position on derivatives subscribed between the corporate sector and domestic commercial banks, for the time period January 1998 to December 2005. Even though the percent of holdings attributable to nonfinancial firms is less than a quarter of outstanding market values, the magnitudes are large. The notional value of all types of FX derivatives held by nonfinancial firms was almost US$6 billion at the end of 2004. The number of firms participating in the forward market and the number of contracts signed have also increased dramatically (Figures 6 and 7).[21]

[21] A noticeable fact of Figure 7 is the huge and temporary increase in corporate trading activity in February 2005. That month, the government implemented a subsidy-scheme aimed at promoting the agricultural sector's hedging of their net dollar assets. The government, through the agricultural ministry, provided COP$200 per dollar hedged to certain exported farming sectors. Rent-seeking behavior by many firms led to a spike in market's turnover and in the number of transactions that month, which did not last beyond the period covered by the subsidy.

Figure 4. Turnover in Forward Transactions by Corporates
(In billions of U.S. dollars)

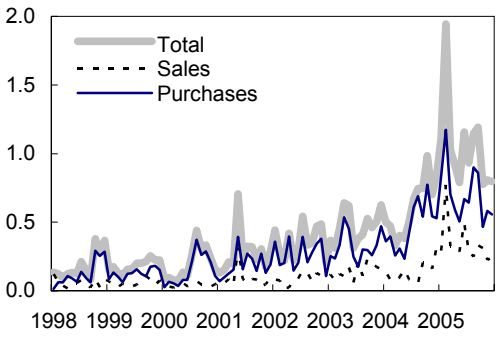


Figure 5. Outstanding Stocks of Forward of the Corporate Sector
(In billions of U.S. dollars)

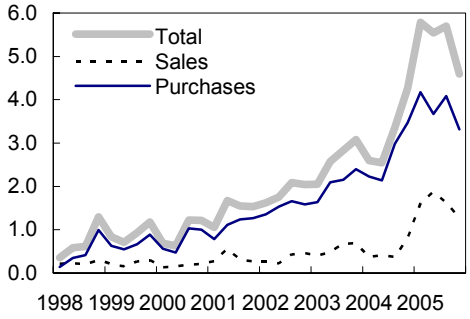


Figure 6. Corporate Firms

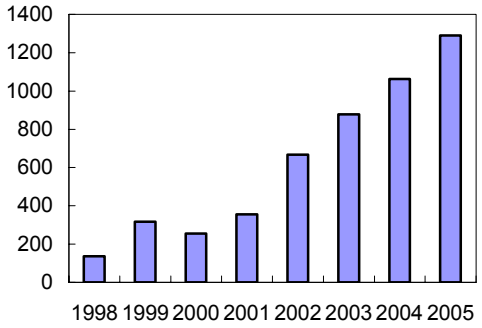
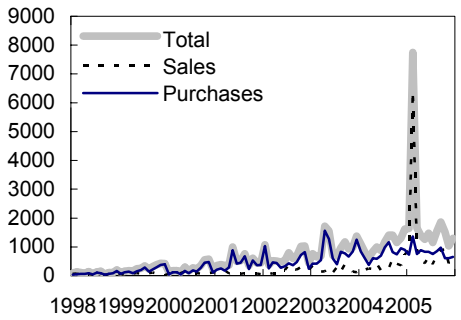


Figure 7. Number of Forward Contracts signed by Corporate Sector



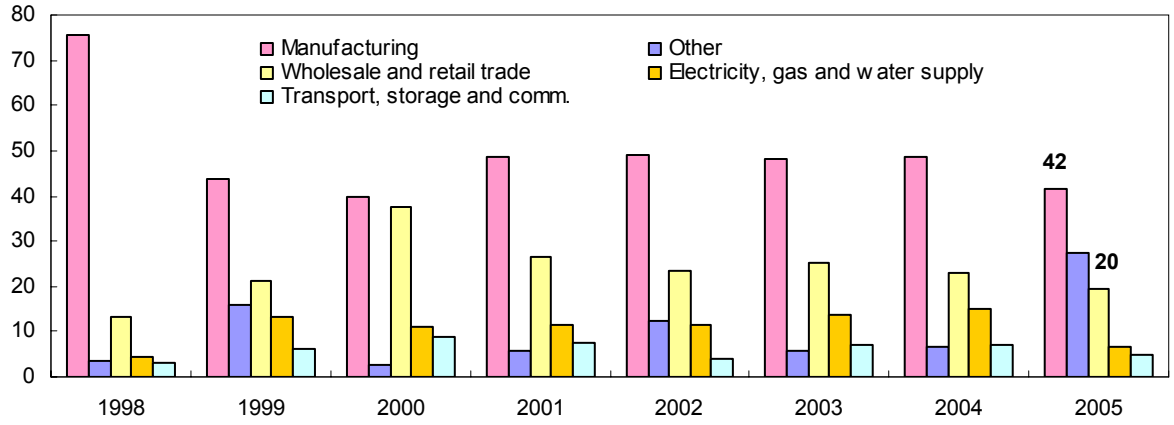
15. **Over this period, the corporate sector as a whole has consistently been a net purchaser of dollar forward contracts.** As shown in Table 2, the notional value of the outstanding FX forward long and short positions in 2004, for example, indicates that purchases of forward dollars by Colombian firms were six times higher than sales.[22] Results are consistent with the notion that for firms from emerging economies that have experienced a currency crisis, such as Colombia, a sharp depreciation in the local currency may be a source of greater concern than its sudden appreciation.

16. **There is wide variation in derivative use across industries (Figure 8)**. Firms in the manufacturing, wholesale and retail sectors are the most frequent users of foreign currency derivatives. In 2004, almost 70 percent of corporate forward trading was concentrated in these industries. The differences in derivative use across industries may reflect industry specific characteristics associated with either increased overseas foreign exchange rate

[22] A long dollar position (net buyer of foreign exchange forwards) is one that benefits from the rise of the dollar during the horizon of the contract.

exposure, or incentives for optimal risk reduction. Because of these differences, the empirical analysis below includes industry indicator variables.

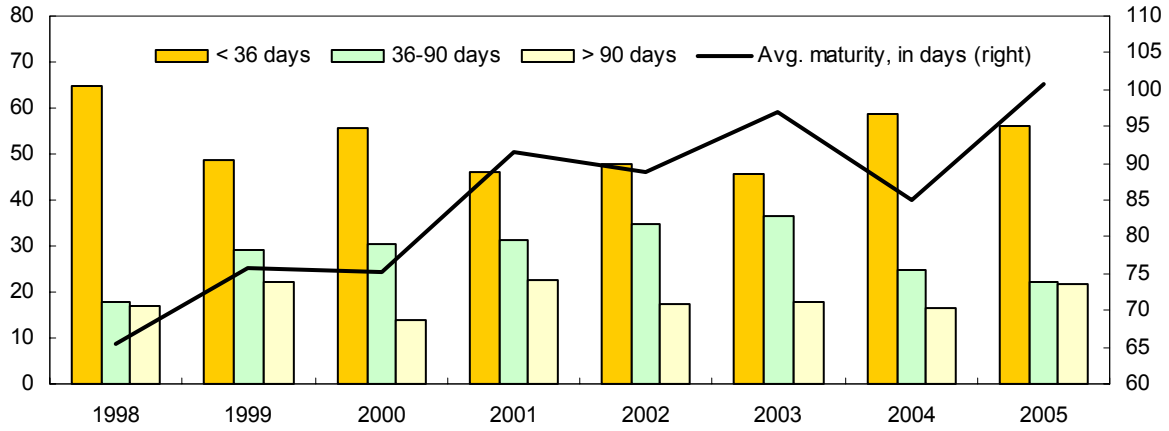
Figure 8. Distribution of Turnover of Corporate Forward Contracts by Sector of Economic Activity
(In percent)



17. **Liquidity in forward contracts is largely concentrated in the 1-month contract, which represents about 80 percent of outstanding contracts.** There is reasonable liquidity up to 3 months, while contracts beyond the 6-month tenor can be found more on a tailor-made basis. Because a majority of contracts have very short maturities, hedging in the forward market may not contribute much to reduce cash flow volatility. This situation, however, is similar to the one in Australia, New Zealand, and Chile.

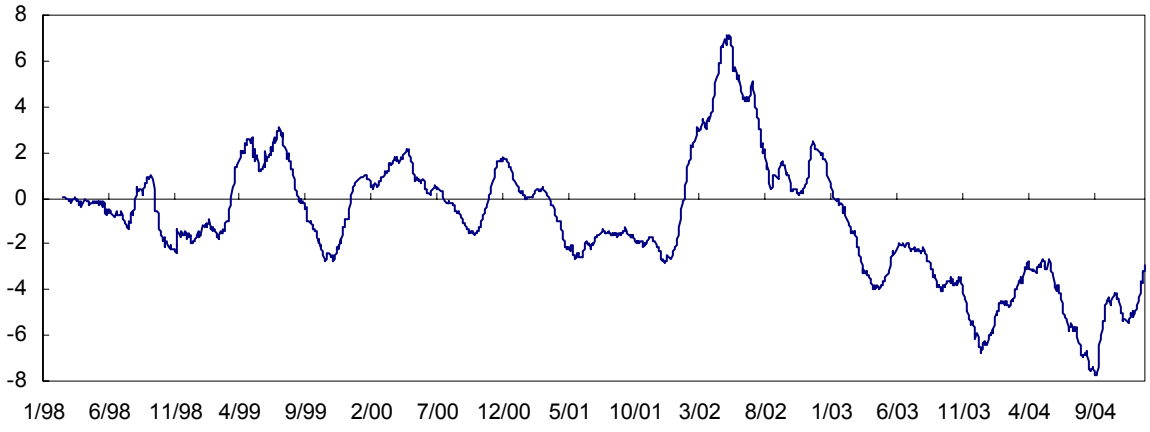
18. **Figure 9 presents the maturity breakdown for onshore forward operations.** During 2005, 2.1 percent of total turnover was associated to contracts of over 1 year, quite close to the world average of 3 percent (BIS, 2003). Also, there has been a decreasing share in contracts of less than 36 days. The maturity breakdown of forward contracts in the onshore market is similar to that observed in Australia and New Zealand (see Chan-Lau, 2005).

Figure 9. Maturity Distribution of Tenors
(In percent)



19. **While forward contract eliminate exchange rate uncertainty, they do not ensure ex-post benefits.** The opportunity cost of entering a forward contract can be measured as the foreign exchange gains foregone by locking in the exchange rate in advance. Figure 10 shows new evidence on the average opportunity cost on firms' trading in forward contracts in Colombia, measured as the difference in percent between the realized spot rate at the time the contract matured and the forward rate settled at the inception of the contract, averaged across firms in each month. For the period starting in 2003 (which coincides with the appreciation of the currency), the average firm incurred systematic ex-post losses in forward market operations.

Figure 10. Forgone Profits: Fraction of Dollar Lost by Locking In the Exchange Rate in Advance
(In percent of spot exchange at maturity; 30-day moving avg. across all firms)



C. What Determines the Decision to Hedge? A Multivariate Analysis

20. **To study the firm-specific determinants of currency-risk hedging, we collected balance sheet information for a large sample of approximately 1,800 publicly-traded and private companies in 2004.** We excluded financial firms and utilities, since risk-management activities of these firms are not directly comparable due to regulatory and business related reasons (e.g., some financial firms also act as dealers in derivative markets). In addition to basic accounting data, the database also contains information on the amount of foreign currency debt contracted abroad, exports and imports by each firm.[23] Using information in derivative trading provided by the central bank, we identified those firms in the sample that engaged in currency forward trading during the year. Of the 1,827 firms in the sample, 36 percent (661 firms) participated at least once in forward markets in 2004.[24]

21. **Like much of the literature on hedging, this paper analyzes the determinants of the decision to hedge, as opposed to the intensity of hedging.** For a country like Colombia—where the use of hedging is relatively limited—it is important to understand why firms decide to hedge. Moreover, an analysis of the intensity of hedging raises complex measurement issues and may reflect short-term considerations, such as expectation of asset prices and their volatility.

22. **Table 3 reports estimates on the determinants of the likelihood of derivative use in 2004.** It presents the results of probit regressions of a dichotomous variable representing derivatives use on the explanatory variables and industry indicator variables. In all cases, regression estimates represent the implied marginal changes in the probability of using forward contracts that result from a unit change in the explanatory variables. To control for possible endogeneity in any of our independent variables, we measure all of them as of fiscal year end-2003, but measure the choice of derivative use during 2004.[25]

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[23] This data comes from SuperSociedades and SuperValores, two government agencies. The Appendix provides a detailed descritpion of sources and procedures to construct the database.

[24] All firm-level analysis was handled within the Central Bank to ensure strict confidentiality of financial information.

[25] Implicit in this construction are two assumptions: First, decisions to use derivatives (measured during 2004) are based on information available to the firm during 2004; second, actual flows in 2004 are the best proxy for management's expectations in 2004.

Table 3. Probit Regression Estimates on Firms' Likelihood of Using Currency Derivatives in Colombia, 2004

Independent Variables 1/	Any Forward (1)	Buying Position (2)	Selling Position (3)
Dependent Variable: Indicator of participation in forward markets in the year 2004			
Net Exports over Sales	-0.03	-0.15	0.18
	(0.03)	(0.04) ***	(0.02) ***
Dollarization of Liabilities	0.27	0.21	0.06
	(0.07) ***	(0.06) ***	(0.04)
Size_Medium	0.24	0.25	0.04
	(0.03) ***	(0.03) ***	(0.02)
Size_Big	0.36	0.38	0.08
	(0.03) ***	(0.03) ***	(0.02) ***
Leverage	0.11	0.11	-0.01
	(0.06) ***	(0.04) **	(0.02)
Residual Short Term Maturity	0.15	0.12	0.08
	(0.05) ***	(0.05) ***	(0.03) ***
Current_Ratio	-0.01	-0.01	0.00
	(0.00)	(0.00)	(0.00)
Fixed Effects			
Economic Sector	Yes	Yes	Yes
Observations	1827	1827	1827
Adjusted R2	0.15	0.18	0.12
Correctly Classified (in %)	70.3	72.2	91.22

Note: A constant and a full set of sector-specific dummy variables are also included but not reported. Heteroscedasticity-consistent standard errors in parentheses. Asterisks denote significance of coefficients, with *** indicating significance at the 1% level, and ** at the 5% level.

Source: Fund staff calculations.

1/ See Appendix for a detailed explanation of the independent variables.

23. **We present results for three probit regressions, each specifying a different indicator of participation in forward markets.** Column 1 displays results when the dependent variable is a binary dummy variable that takes a value equal to one if the firm uses any kind of currency derivatives during the year. In column 2 (3), the dependent variable takes the value of one when the firm was a *buyer* (*seller*) of forward contracts during 2004, and zero otherwise. Results on columns 2 and 3 thus capture both the decision *and* the direction of hedging.

24. **The model provides a very good fit.** Based on the numeric breakdown of model-predicted participation versus actual participation, the model is capable of predicting between 70 and 91 percent of the actual participation choices (with better success rates observed for non-participants), depending on the specification.

25. **Size is an important determinant of participation in forward markets, especially for firms holding long dollar positions (specification 2).** To capture firm size, we sort the sample of firms into thirds based on firm-level total assets. Separate dummies are used for large-sized (top-third) and medium-sized (middle-third) firms (small-sized firms being the excluded category). Moving from the lower to the upper third part of the firm size distribution, increases the probability of participating in forward markets by almost 40 percent. This suggests that over-the-counter forward markets exhibit significant scale economies in the structure of transaction costs, implying that large firms are more likely to hedge with these instruments.[26]

26. **Forward contracts in Colombia have additional costs that can work against their use by smaller corporate end-users.** Corporate end-users that enter a forward contract with a bank may be required to post collateral because of counterparty risk, especially from clients who do not meet internal credit rating requirements. Costs associated to collateral and credit lines are passed on to the end-user as less favorable forward rates.

27. **In specifications (1) and (2), the estimated coefficient on the share of dollar debt is positive and significant at conventional confidence levels, while insignificant in column (3).** In other words, higher shares of dollar debt in firms' balance sheets make it more likely that the firm purchases a forward contract, but has no effect on the probability of taking the dollar-paying side of the forward transaction. Based on the distinct effect on the *direction* of hedging, results suggest that firms use forward positions—at least in part—to offset balance sheet exchange rate exposures.

28. **We can use the estimates of column (2) in Table 3 to calculate the economic significance of debt currency composition as an incentive to hedge.** Our estimate of the marginal effect of foreign currency borrowing on the likelihood of holding a *long* forward contract is 0.21. At the same time, the fraction of firms taking a long forward position (the unconditional mean) in 2004 is almost 36 percent. Thus, an increase in average firm liability dollarization of one-standard deviation above the sample mean increases the likelihood of observing a forward contracting firm by almost 20 percent.[27]

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[26] Risk management involves fixed costs, such as foreign exchange personnel or computer system requirements, the unit cost of which can be reduced with firm size.

[27] A 20 percent point increase in the independent variable "liability dollarization" is, for example, an increase from the mean value of this variable in the sample, which is 0.10, to 0.28. Given the estimated coefficient on

(continued…)

29. **Taken together, the positive and significant effect of size and dollar debt issued abroad on the probability of taking a long dollar forward position, may also reflect a wider financial strategy of using derivative markets to lower borrowing costs.** Bigger corporations are able to borrow internationally in U.S. dollars, at nominal rates that are usually lower than domestic dollar interest rates. Firms then layoff the associated foreign exchange rate risk by purchasing dollar forward in domestic markets. The combination of low external interest rates and low implied forward rate (due to pricing distortions described in Section B) allowed firms to effectively borrow in pesos at a lower rate that would be possible in Colombia's domestic market.

30. **Controlling for dollar debt, firms exporting a larger share of their sales (net of imports) hold significantly lower long dollar derivative positions (column 2).** The negative sign of net exports in column 2 suggests that firms use derivatives as a substitute to natural hedges—that is, firms are less likely to use derivatives to offset the balance-sheet risk of dollar debt when they earn foreign currency revenues. On the other hand, the positive sign on trade exposure in column 3 indicates that net exporters effectively insure themselves against earning volatility by participating in the derivatives market and forward selling their dollars.[28] Finally, it is not surprising that the estimated coefficients on net exports is not significant in column (1), as long positions are treated the same as short positions in the dummy variable.

31. **Our results also suggest that avoiding financial distress is an important consideration in firms' hedging decisions.** The likelihood of participating in forward markets increases with high debt-to-asset ratios and shorter maturities of debt. For example, if firms are frequently rolling over their debt, they will suffer more from a negative shock to the supply of credit. At the same time, a firm with a higher debt load is expected to hedge more, as it needs to reassure external financiers that its probability of financial distress or default is low.

32. **Finally, results not tabulated indicate that foreign ownership has a negative impact on the likelihood of participating in domestic forward markets.** This could be reflecting alternative strategies by multinational companies to hedge exchange rate risk across markets. On the one hand, domestic subsidiaries sometimes hedge through their parent

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liability dollarization, this 0.18 increase in the independent variable increases the left hand side by: 0.18*(0.21) = 0.038. The left hand-side variable is either "0's" or "1's". Because approximately 36 percent of the observations in the sample are 1's, a 0.038 change in the left hand side variable means that there is a increase in the probability of observing a 1 instead of a 0 (i.e. observing a firm taking a forward) of approximately (0.038/0.21)*100 = 18.1 percent .

[28] Note that the hypothesis is that an exporter will be more likely to benefit from a depreciation and an importer will be more likely to be harmed by a depreciation.

companies only in off-shore markets. On the other hand, by using strategies called "leading and lagging," a parent company can bring forward or delay payments or receipts of foreign currency with its subsidiaries to offset the currency risks associated with other foreign currency transactions. This financial strategy may be substituting for financial hedging by its Colombian subsidiaries in domestic markets.

D. Concluding Remarks and Policy Implications

33. **Larger firms are significantly more likely to hedge foreign currency risk.** This result reflects the importance of economies of scale in setting up risk management programs, and probably a higher degree of financial sophistication in bigger firms. Given the key role that bank-client relationships play in OTC forward markets, these results also highlights supply-side, credit access constraints faced by small firms.

34. **The firm's liability structure shapes hedging choices.** Contracting forward positions is significantly motivated by the need to offset the balance-sheet risk of dollar debt and net trade flows. Even in countries like Colombia, typically regarded as a low-dollarized country, we find that the level of foreign currency-denominated debts play a major role in explaining a firm's decision to hedge foreign exchange risk.

35. **The level and source of firms' exchange rate exposure affects both the decision to hedge and the choice between buying or selling forward.** We find that corporations tend to cover their downside risk arising from a currency depreciation and may underestimate the probability of an appreciation of the peso. They may also perceive that the authorities' foreign exchange intervention will be more concerned about limiting an appreciation of the peso, which may slow export growth. We also find the operational currency hedge, that is, the mitigation of risk due to matching of debt and earnings in foreign currency, is an important substitute for derivatives. In other words, firms that hedge dollar debt naturally with their international operations use proportionally less currency derivatives. We take these results to indicate that in our sample firms are hedging, and not speculating, on average.

36. **Firm have structured their cross-border financing to lower their cost of borrowing.** The development of cross-currency derivatives has enabled some large corporations to raise cheaper capital abroad without increasing their exchange rate risk. Firms can borrow abroad in hard currency, and then use derivatives to reverse their foreign currency exposure back into peso liabilities, at an effective peso interest rate that is lower than borrowing directly in the Colombian capital market (see Dodd and Griffith-Jones, 2006 for a similar description for the case of Chile).

37. **The development of a futures market (with standardized contracts and diversification of counterparty risk) could broaden access to smaller firms.** The authorities may want to consider fostering the development of derivatives exchanges as a

complement to the over the counter market. A centralized clearing-house reduces this risk by acting as the sole counterparty to all the exchange members. Risk is also reduced as the clearing-house nets aggregate positions across members. Thus, exchanges do a better job than over-the-counter markets in reducing counterparty risk and its associated costs, facilitating price discovery, and allowing access to risk sharing instruments to small corporations with limited net worth.

38. **A credible reference interest rate would provide an accepted forward differential curve, allowing for standard and fair pricing of risk at longer maturities.** In this vein, current regulation restricting the net cash positions of banks should be subject to a cost/benefit analysis that takes into account the price distortions that they may create, especially at longer tenors. Fostering exchange rate risk hedging at longer maturities would in turn help economic agents deal more effectively with exchange rate uncertainty in the context of flexible regimes. At the same time, more active use of hedging instruments, especially at longer maturities, would help ease pressures for foreign exchange intervention by the central bank during periods of significant exchange rate volatility.

39. Taken together, it follows from our results that the growing importance of forward markets in Colombia should be taken into account seriously when evaluating the financial condition of firms and when assessing their capital structure decisions, and should be an important input in surveillance of country vulnerabilities.

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DATA APPENDIX

1. The firm-level data set used in this paper is compiled from four major sources. We first collected balance sheet and income statement data from all publicly traded firms and a large sample of private companies in Colombia. Data for publicly traded firms comes from *Superintendencia Financiera*. Additionally, the *Superintendencia de Sociedades*, another government agency, collects income statements and balance sheets for a large sample of private firms. In addition to basic accounting data, both databases contain information on the amount of foreign currency debt contracted abroad by each firm and the fraction of its shares hold by foreigners. To identify firms' involvement in international trade, we used *Banco de la República's Balance of Payments* database with information on exports and imports at the firm level. We merged all three datasets using the NIT (*Número de Identificación Tributaria*), a unique identifier for each firm across databases.

2. The final sample contains approximately 1,800 publicly-traded and private non-financial firms, together accounting for 48 percent of total sales and 54 percent of total trade (exports plus imports) of the Colombian economy in 2004. The final sample excludes financial firms, since risk-management activities of these firms are not directly comparable due to regulatory and business related reasons (for example, financial firms also act as dealers in derivative markets). We also excluded public utilities because they are heavily regulated and their accounting statements are not comparable to the rest of the firms in the sample.

3. To identify those firms in the sample that participated in forward markets, we use a unique dataset on exchange rate hedging activity of Colombian firms in 2004. This dataset is compiled at the Colombian Central Bank and covers *all* forward contracts signed between non-financial firms and a domestic bank or financial intermediary over this period. Using the NIT codes of both the party and counter- party involved in forward transactions, we identified those firms in the sample that did foreign exchange forward transactions and the number of contracts they subscribed during the year 2004.[29] Of the 1,827 firms in the sample, 36 percent (661 firms) participated at least once in forward markets in 2004, and together accounted for 83 percent of total turnover in forward market activity of the corporate sector in 2004.

4. For each derivative transaction, the database reports the notional principal, its contractual and residual maturity, and whether the corporate took the buying leg (i.e., went long on dollars) or selling leg (short on dollars) of the transaction. We also calculate notional outstanding values as of December 2004 and classify positions as "long" or "short." A long dollar position is one that benefits for the rise of the value of the exchange rate during the remaining of the contract. Conversely, a short dollar position is one. The net position is the difference between each firm's long and short position. Based on this information, we

[29] All firm-level analysis was handled within the Central Bank to ensure strict confidentiality of financial information.

calculate for each corporate user, the net buying position in foreign currency derivatives outstanding at the end of 2004.

5. Although the data set created for this analysis permits a novel approach for examining the determinants of financial hedging decisions at the firm-level, it also has some shortcomings. For a start, it does not include information on currency derivatives trading conducted by domestic firms in off-shore markets, in particular, the Non-Deliverable Forward (NDF) market in New York.[30] Thus, our strategy may be incorrectly classifying a firm as a non-derivative user, when in fact it is hedging currency risk, but in off-shore markets. Additionally, the database does not identify firms that are hedging interest rate risk.

6. While these caveats should be taken into consideration when assessing the empirical results, several factors suggest that they do not represent an important limitation for our empirical analysis. First, and according to interviews with market participants, those firms that actively manage exchange rate risk in off-shore markets, tend to do so domestically too. Possible exceptions are multinational corporations, which sometimes hedge through their parent companies only in off-shore markets. Second, most median to small-sized firms are unlikely to have access to foreign currency derivative markets, so financial currency risk management (if any), is done on-shore. Third, according to local intermediaries, the peso interest rate derivative market is almost non-existent and concentrated mostly in financial institutional investors.

7. Table 1A provides summary statistics on several indicators of hedging activity by corporations. The average (median) firm traded 8 (1.1) million dollars in forward contracts, with maturity of little more than three months (seventy-six days). Because a majority of contracts have very short maturities, hedging in the forward market may not contribute much to reduce cash flow volatility. However, evidence in Table 3 also indicates that the average firms signed 12 contracts at different times during 2004, suggesting the possibility of roll-over strategies and higher effective duration of hedge. As shown in Panel B, during 2004, most of the firms (81 percent) signed forward contracts by going long on dollars. Panel C shows the average gross (sales plus purchases) outstanding positions at the end of the year expressed in dollars, and as a fraction of total assets and total FX exposure.

[30] The NDF market interacts closely with the deliverable forward market in Colombia. There are no reporting requirements for this off-shore portion of the peso-dollar derivative market.

Table 1A. Descriptive Statistics on Firms' Hedging Activity in 2004

Panel A: Flow Activity

Firm-Level Variables	Mean	Median	Standard Deviation
Total Forward Trading (in millions USD)	8.01	1.01	27.35
Value of Contract (in millions USD)	0.53	0.12	1.25
Number of Contracts Subscribed	12	3	31
Maturity of Contract (in days)	99.4	76.0	87.6

Panel B: Direction of Hedging

	Buying FX Forward (long dollar position)	Selling FX Forward (short dollar position)	Both Buying and Selling FX Forwards
Number of Firms	632	161	91
Number of Contracts	7,258	2,879	

Panel C: Outstanding FX Forward Positions at Year-End

	Mean	Median	Standard Deviation
Total FW Position 1/ (in millions USD)	3.3	0.6	10.2
Total FW Position (as % of Total Assets)	11.5	6.3	16.1
Total FW Position (as % of Total FX Exposure) 2/	42.3	5.1	212.6

Sources: Central Bank of Colombia; and Fund staff calculations.

1/ Notional value of total outstanding forward contracts in December 2004.
2/ Total FX Exposure is defined as total external Dollar Debt plus total international trade (exports plus imports).

Table 2A. Variable Definitions and Sources

This appendix provides a summary of all variables used in the empirical analysis and a detailed description of the method of calculation. The firm-level, explanatory variables are constructed as follows: Flow variables are measured during the year of derivatives use (2004), and stock variables are measured at the beginning of the year (fiscal year end 2003). The source for balance sheet and income statement variables is Superintendencia Financiera and SuperSociedades. Data on firm-level exports and imports comes from Banco de la República.

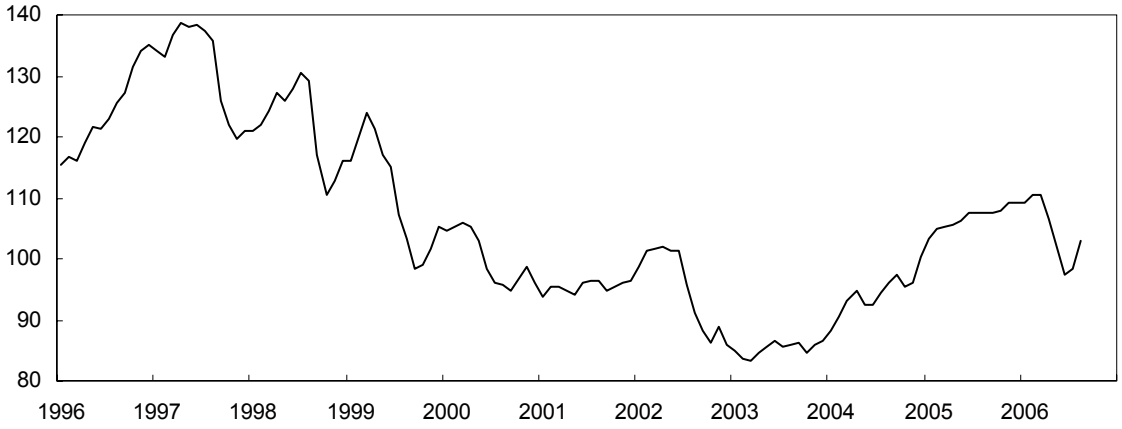
Variable Name	Variable Description
Size Dummies	To capture firm size, we sort the sample of firms into thirds based on the book value of firm's total assets at year end 2003. Separate dummies are used for large-sized (top-third) and medium-sized (middle-third) firms. Small-sized firms is the excluded category.
Investment in Fixed Capital	Change in the real stock of net Property, Plant and Equipment during the year (using CPI as deflator) =[K(t) ─ K(t-1)].
Investment to Total Asset ratio	[K(t) ─ K(t-1)] / Total Assets (t-1).
Leverage ratio	Total Liabilities over Total Assets.
Quick ratio	Current Assets over Current Liabilities.
Foreign Currency denominated Liabilities	Book value of financial debt denominated in foreign currency and contracted abroad. It is converted into local currency using the exchange rate for December.
Total Sales	Revenues from main operating activities.
Sector Affiliation	Sector is the industry in which the firm has its main operations, according to the one-digit ISIC rev2 classification to the one-digit ISIC 2 classification.
Net Exports	Total sales in foreign markets minus total imports.
Foreign Ownership	Dummy variable that takes the value of 1 if 100% of firm's shares are owned by foreign residents, 0 otherwise.

IV. COLOMBIA: ASSESSING REAL EXCHANGE RATE DEVELOPMENTS[31]

A. Introduction

1. **Colombia's real effective exchange rate has fluctuated considerably in recent years.** After reaching its most depreciated level in at least 50 years in early 2003, the real exchange rate appreciated by 33 percent between March 2003 and March 2006. In April 2006, market sentiment changed abruptly and by June, the real exchange rate had depreciated again by 14 percent, although most of that decline reversed again over the following two months (Figure 1).[32]

Figure 1. Real Effective Exchange Rate, 1996/1–2006/8
(Index: 2000=100)



2. **This paper aims to identify fundamental determinants of the real exchange rate and assess how the current level of the real exchange rate relates to those fundamentals.** More specifically, a statistical model is estimated that links Colombia's real exchange rate with potential fundamental determinants in order to answer the following questions:

- What are the fundamental determinants of Colombia's equilibrium real exchange rate?

[31] Prepared by Steffen Reichold. It has benefitted from comments received at Seminars at the Banco de la República and IMF in August 2006.

[32] Throughout this paper, higher values of the real exchange rate index indicate that the Colombian peso is more appreciated in real effective terms.

- To what extent can recent movements be justified by the behavior of economic fundamentals, or to what extent do they represent deviations from those fundamentals?

- Is the current level of the real exchange rate in line with historic patterns, and does it appear to be sustainable based on current and projected future fundamentals?

3. **The remainder of the paper is organized as follows.** Section II provides a brief review of the literature. Section III describes the empirical framework, including the data and the main methodology. Section IV discusses the results of various alternative specification and compares them to previous work. Section V evaluates the model results and discusses its implications. Section VI briefly presents the results of some alternative methods and considerations for assessing the real exchange rate and Section VII concludes.

B. Brief Review of the Literature

4. **The literature on assessing real exchange rates, including estimating empirical models, is extensive but a clear consensus on the appropriate framework and the choice of fundamentals has not yet emerged.**[33] After initially focusing on the traditional Purchasing Power Parity (PPP) hypothesis, the literature has shifted towards estimating the link between the RER and its fundamental determinants. According to PPP, the real exchange rate should remain constant in the long run, as arbitrage in international goods markets leads to price convergence. PPP seems to hold in the long run for developed countries (Froot and Rogoff, 1996; and Rogoff, 1996), but deviations can be large and convergence to the PPP levels very slow, leading to low power of statistical tests. Moreover, the logic of price equalization through arbitrage only applies strictly to individual goods that are tradable internationally, but not for broader indices that include non-tradable goods and services. Most of the recent work thus considers the possibility of non-constant levels of the equilibrium real exchange rate and aims at estimating the long run co-movements between so-called fundamentals and the real exchange rate.

5. **Variables are considered fundamentals if a permanent change in the level of the variable causes a permanent change in the real exchange rate.** In contrast, variables that only have temporary effects on the real exchange rate are not considered fundamentals in this context. The theoretical justification for using certain variables can be illustrated in a simple neoclassical framework with tradable and non-tradable goods that are not perfect substitutes. The model assumes price equalization for tradable goods across countries and wage

[33] Some of this work has been surveyed in MacDonald (1995), Froot and Rogoff (1995), Rogoff (1996), and Edwards and Savastano (1999). Examples of recent applied work are MacDonald and Ricci (2003), and Milesi-Feretti and others (2005). Specific studies on Colombia include Oliveros and Huertas (2003) and Echavarría and others (2005).

equalization across sectors within countries. If the country were small relative to the rest of the world, then it would face a highly elastic supply of imported tradables from the rest of the world and also a highly elastic demand for domestically produced tradables. Demand and supply for non-tradables, on the other hand, would be more inelastic. In such a model, changes in relative demand or relative supply of tradables vs. non-tradables will affect their relative price. With price equalization of tradable goods across countries, such movements in the relative price of tradables and non-tradables cause movements in the real exchange rate and thus explain deviations from PPP. The most important variables that have been used in the literature are:[34]

- **Productivity differential, or Balassa-Samuelson effect** (see Balassa, 1964; and Samuelson, 1964). An increase in productivity in the tradable sector would lead to rising wages in that sector to match the higher marginal product of labor. Wage equalization would then also require higher wages in the non-tradable sector, which implies higher prices of non-tradables to match the increased marginal cost. In equilibrium, the result would be a higher relative price of non-tradables and thus a RER appreciation, assuming no changes in trading partners' economies. The crucial variable is relative productivity in the tradable vs. non-tradable sectors compared to trading partners. Since high-quality productivity data is often difficult to come by for developing countries, various proxies have been used in the literature. Productivity gains are often stronger in the tradable sector, which can help explain the persistent trend of real exchange rate appreciation often observed in countries with sustained high growth.

- **Terms of trade or commodity prices**. Higher commodity prices—or improvements in the terms of trade more generally—would tend to appreciate the real exchange rate through two channels. As in the case of productivity growth, higher export commodity prices would induce higher wages in both sectors and thus a higher price for non-tradables. In addition, higher export prices represent a positive wealth effect in the exporting country which would raise demand, including demand for non-tradables. Given the relatively inelastic supply of non-tradables, prices would have to rise to clear the market. The effect of improving terms of trade can also be illustrated by looking at the current account. Higher export prices would imply a higher current account balance. In order for the current account to move back in line with desired intertemporal consumption and investment, the real exchange rate would have to appreciate, stimulating imports while curtailing exports. Theoretically, the terms of trade should be the better measure, but many studies have achieved better results using commodity prices. However, for countries with a large share of commodity

[34] Other variables frequently used include interest rate differentials, the fiscal deficit, aggregate investment rates, and measures of capital flows.

exports commodity price movements usually dominate the terms of trade and the two measures are often very similar. In Colombia, commodity exports still account for about half of total exports, although the share has declined substantially over the past 40 years.

- **Net foreign asset position.** The net foreign asset position could also affect the real exchange rate through two channels. Higher net foreign assets imply a positive wealth effect that should raise demand for both tradables and non-tradables. Faced with an elastic supply of foreign-produced tradables and an inelastic supply of domestic non-tradables, the relative price of non-tradables would have to increase. Similar to the effect of higher export prices, this effect can also be illustrated by looking at the current account. Higher income receipts from higher net foreign assets imply a higher current account balance which would need to be offset through a lower trade balance, requiring a more appreciated real exchange rate.

- **Government consumption or expenditure**. Higher government consumption would appreciate the real exchange rate if it includes a higher share of non-tradable goods than private consumption or investment. In this case, the relative demand for non-tradables would rise as private consumption and investment are crowded out by an increase in government consumption and the latter is more heavily directed towards non-tradable goods. The ensuing change in relative demand for non-tradables would change the relative price and thus the real exchange rate.

- **Trade liberalization.** Trade restrictions raise the domestic price of tradable goods, and thus the overall price level and the real exchange rate. Conversely, a more open trade regime should be associated with a more depreciated real exchange rate.

C. Empirical Framework[35]

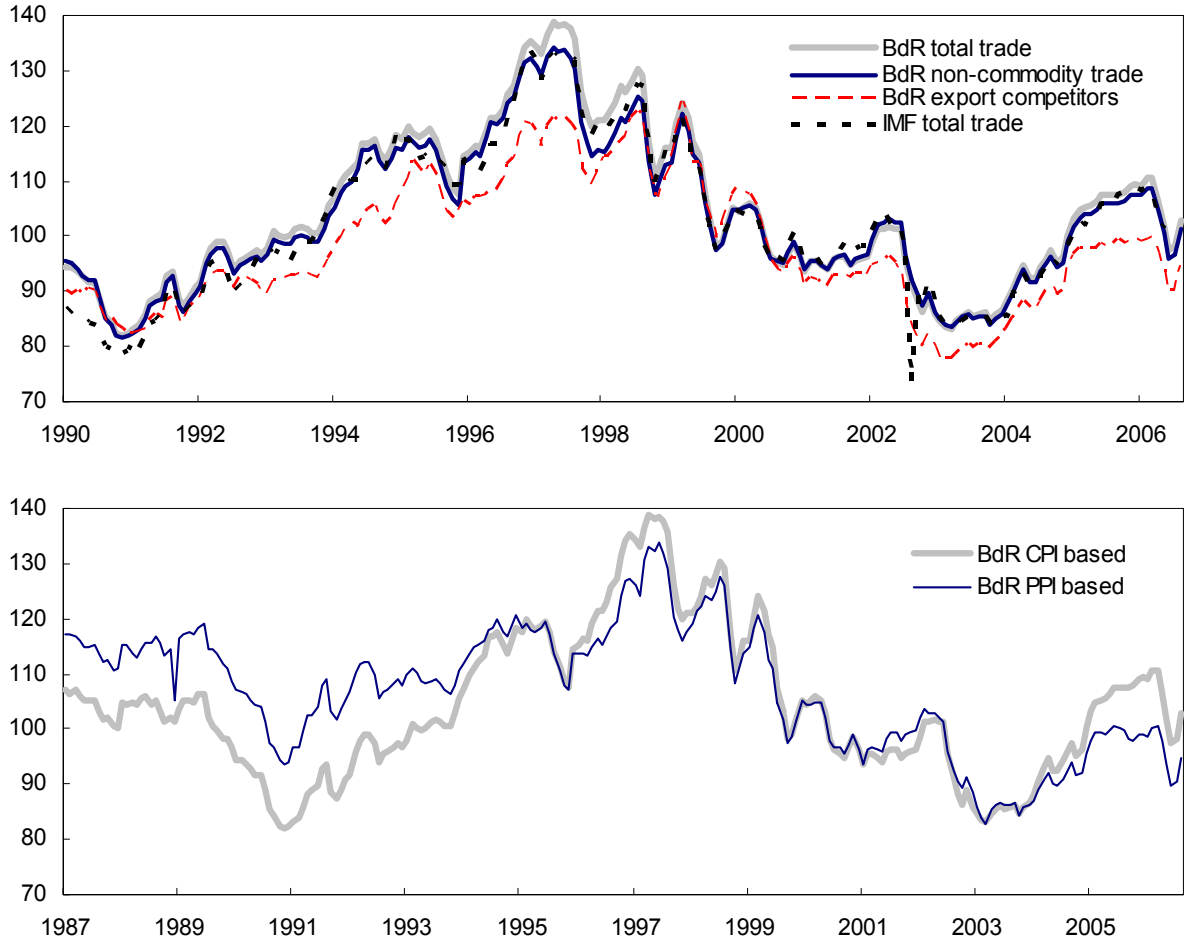
6. **This study uses a measure of the real effective exchange rate that is based on the consumer price index and weighted by total trade**. The CPI-based real exchange rate is the most commonly available and employed measure in the literature, although other measures, such as those based on the producer price index or unit labor costs, have certain merits and are also frequently used. In particular, the unit labor cost-based real exchange rate is a good indicator to assess the competitiveness of the export sector. However, good measures of unit labor costs in Colombia are not available over a sufficiently long time period. To calculate the effective real exchange rate, this study uses a moving average of Colombia's total trade—exports plus imports—with main trading partners—most notably the U.S. with a trade share between one and two thirds. Figure 2 shows the behavior of the

[35] See the appendix for a detailed description of the data sources and the definition of the specific series.

monthly series of various available real exchange rate measures. Using alternative trade weights can lead to small or moderate differences in the real exchange rate index, but such deviations have remained temporary in the past. The PPI-based index shows a somewhat stronger average depreciation over the past 20 years relative to the CPI based index. However, such deviations would be reversed in the long run, provided that the CPI and the PPI do not diverge systematically.

Figure 2. Alternative Real Exchange Rate Measures, 1990/1–2006/6

(Index: 2000=100; CPI based unless otherwise indicated)



7. **With a view to better detect the long-run relation between the real exchange rate and its fundamental determinants, this study uses a long-annual sample (1962 to 2005)**. While some variables, in particular exchange rates and the CPI, are available at higher frequencies, other variables are not, or only over a shorter sample period. There is thus a trade-off between sample frequency and length of the sample. Since most relevant variables are rather persistent and the real exchange rate may deviate from its so-called equilibrium for extended periods, it is important to use a long sample in order to be able to detect the underlying long-run relations.

8. **As a proxy to capture the Balassa-Samuelson effect, this study uses an index of Colombia's per capita GDP relative to that of its trading partners.** The motivation is mainly the lack of available detailed productivity data rather than strong theoretical underpinnings. However, this should be an acceptable measure as long as relative per capita GDP growth mirrors relative productivity growth of tradables and non-tradables in the long run. This seems to be a reasonable approximation. Productivity growth tends to be higher in the tradable sectors compared to non-tradable sectors, as the former has a larger share of manufacturing while the latter contains a higher share of services. It thus seems reasonable to assume that countries that enjoyed higher productivity growth—and therefore higher per capita GDP growth—had a higher share of that productivity growth in the tradable sector.

9. **An export commodity price index is constructed based on price movements of the seven most important export commodities since 1962.** The most important one used to be coffee with a total export share of over 70 percent in 1962, which has since fallen to only about 7 percent. The share of oil has fluctuated historically but has now become the most important export commodity with a total export share of about 25 percent. The share of other commodities is significantly less important (coal 12 percent, nickel 3½ percent, and gold 2½ percent). The index is constructed using price changes weighted by export shares and deflated by the U.S. wholesale price index. Since commodity imports play only a small role in Colombia, import price changes are not considered. An alternative to using the commodity price index would be to use the terms of trade. However, both series are highly correlated and yield very similar results.

10. **The variable for net foreign assets used here is a broad measure including all external assets and liabilities, measured in U.S. dollars**.[36] Net foreign assets are then scaled by exports of goods and services, also measured in U.S. dollars. Another option would have been to scale by nominal GDP. However, nominal GDP depends endogenously on the real exchange rate as the nominal value of non-tradable GDP varies with the real exchange rate, and would thus lead to biased estimates. While exports measured in U.S. dollars could

[36] See Lane and Milesi-Feretti (2006).

also be correlated with the real exchange rate, the correlation should be smaller than with nominal GDP measured in U.S. dollars.[37]

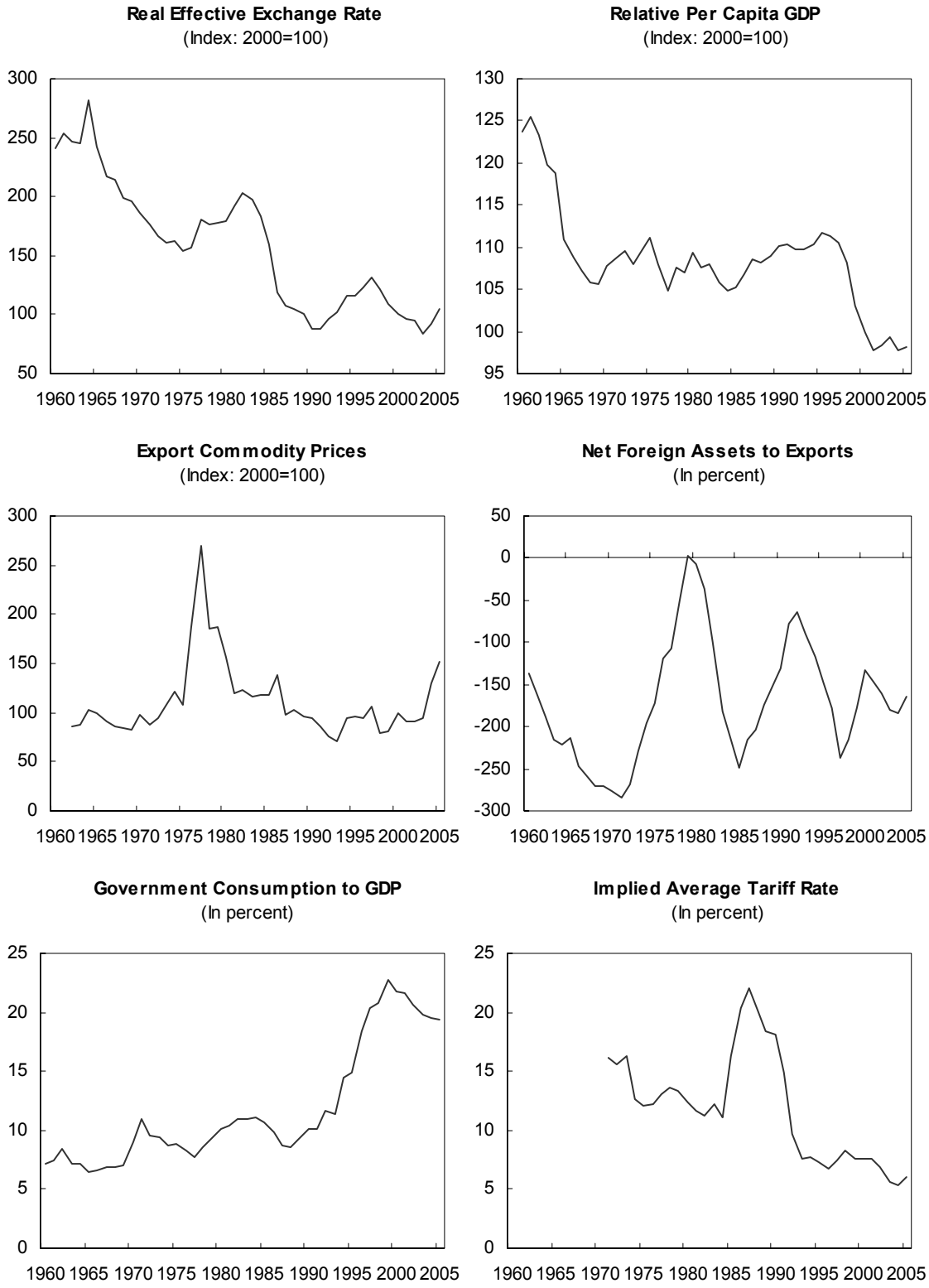
11. **Government consumption is expressed as a share of GDP.** Since both are measured in national currency, correlation between GDP and the real exchange rate should not be a problem.

12. **To measure trade restrictions this study uses the implied weighted average tariff rate, calculated as the ratio of fiscal revenue from import duties and licenses over total imports.** Good measures of trade restrictions are difficult to come by, especially if long time series are needed. One commonly used alternative measure of trade openness is total trade relative to GDP. However, this measure also suffers from the endogenous correlation between the real exchange rate and GDP. Actual tariff rates could also be used, but unfortunately, data is not available for all years and no data is available prior to 1974.

13. **Figure 3 shows the behavior of the key variables described above since 1960.** Key features are: (i) a cumulative depreciation of the real exchange rate by more than 50 percent between 1960 and 2005; (ii) a significant decline in relative per capita GDP that took place in two steps, first the 1960s, and then the late 1990s and early 2000s; (iii) a large spike in export commodity prices in the late 1970s due to oil prices and, to a lesser extent, coffee prices; (iv) large swings in net foreign assets, but no pronounced trend; (v) a dramatic increase in public consumption during the 1990s, in part related to constitutional reforms; and (vi) declining trend in tariffs, interrupted by a sharp increase in the mid 1980s followed by a significant trade liberalization in the early 1990s.

[37] In fact, the sign of the correlation between the real exchange rate and the value of exports is ambiguous. While a more depreciated real exchange rate could boost the value of exports through supply effects (assuming sufficiently elastic demand), a depreciated exchange rate could also be the result of negative shocks to export supply, thus suggesting the opposite relation.

Figure 3. Behavior of Key Variables, 1960–2005



14. **All variables are fairly persistent and, with the exception of the ratio of net foreign assets to trade, appear to have unit roots.** Table 1 shows the results from the augmented Dickey-Fuller unit root test using a specification with trend and intercept. The null hypothesis of a unit root can only be rejected at the 5 (or 10) percent significance level for net foreign assets. Choosing a specification without liner trend does not change the results qualitatively.

15. **The long-run cointegrating relation between the real exchange rate and the fundamentals is estimated using the Johansen (1995) maximum likelihood estimator.** The estimation is based on the following vector error-correction model (VECM) specification: $\Delta y_t = \eta + \Pi y_{t-1} + \sum_{i=0}^{p-1} \Gamma_i \Delta y_{t+i-1} + \varepsilon_t$ where η is an (nx1) vector of constants; n is the number of endogenous variables; p is the number of lags; ε is an (nx1) vector of mean zero normal errors; and Π and Γ_i are (nxn) matrices of parameters. The existence and number of cointegrating vectors depends on the properties of the matrix Γ. If Γ has reduced rank r<n, then it can be written as Γ=AB', where A and B are (nxr) matrices. The number of independent cointegrating vectors is given by the rank r, and the coefficients of B and A express, respectively, the cointegrating relation and the speed of adjustment.

16. **For the set of variables described above, standard tests suggest the existence of one cointegrating vector.** If the tariff variable is excluded, both the maximum eigenvalue test and the trace test suggest the existence of exactly one cointegrating vector at a 5 percent significance level.[38] If the tariff variable is included, the tests are inconclusive in the sense that the maximum eigenvalue test still suggests one cointegrating vector while the trace test suggests three cointegrating vectors. Based on these results and the fact that more than one cointegrating vector is difficult to interpret economically for this set of variables, the following estimations will be based on the assumption of exactly one cointegrating vector.

D. Estimation Results

17. **Estimating the system without the tariff variable generally yields the expected signs of the coefficients, although not all of them are statistically significant.** Excluding the tariff variable (only available since 1971) allows the full sample (1962–2005) to be used. The first column in Table 1 shows the main results.[39] The coefficients on commodity prices

[38] The test results are based on a specification with a linear trend in the cointegrating vector. However, the results do not change significantly if the linear trend is excluded.

[39] For the estimation of the model, the index variables (real exchange rate, relative per capita GDP, commodity prices) are expressed in logs with 2000=0. The other variables (NFA to exports, government consumption to GDP) are expressed as simple ratios.

and on government consumption have the expected signs and are statistically significant. A one percent increase in export commodity prices appreciates the real exchange rate by about 0.4 percent in the long run. An increase in government consumption by one percent of GDP implies an appreciation of about 2 percent. Both coefficients are similar in size to estimates obtained in cross-country studies. The effect of relative per capita GDP has the expected sign, but is not statistically significant. Finally, the estimated coefficient of net foreign assets has the wrong sign, although it is not statistically significant.

Table 1. Estimation Results with Basic Variables

Specification number	(1)	(2)
Coefficients of the cointegrating relation (long term relation)		
Real exchange rate	1	1
Relative GDP index	-0.304 [-0.91]	-0.048 [-0.16]
Commodity price index	-0.431 [-8.49]	-0.296 [-5.12]
Net foreign assets to exports	0.010 [0.45]	-0.006 [-0.27]
Government consumption to GDP	-2.207 [-4.75]	-1.775 [-2.86]
Average tariff rate		0.243 [0.48]
Time trend	0.029 [14.15]	0.029 [14.69]
Constant	-1.035	-1.172
Adjustment coefficients in short term equations (speed of adjustment)		
Real exchange rate	-0.509 [-3.45]	-0.506 [-3.38]
Relative GDP index	-0.071 [-1.91]	-0.088 [-2.27]
Net foreign assets to exports	-1.263 [-2.28]	-1.231 [-2.25]
Average tariff rate		0.092 [3.08]
Likelihood ratio test for weak exogeneity of commodity prices and government consumption		
P-value of LR test	0.68	0.75

Note: t-statistics in parenthesis.

18. **The estimated speed of adjustment of the real exchange rate to deviations from the long run relation is relatively high.** About half of the deviation is reversed in only one year. While other studies have found faster adjustment speeds for developing countries than for industrial economies, estimated half lives are usually longer than one year. Consistent with theoretical considerations, both net foreign assets and relative GDP also react to the level of the real exchange rate. If the real exchange rate is above the level implied by the cointegrating relation, net foreign assets fall and GDP grows slightly slower. Both effects are statistically significant. On the other hand, commodity prices and government consumption appear to be unaffected by the real exchange rate level, i.e., they are weakly exogenous.[40]

19. **The most striking result of this regression is the high value of the time trend, suggesting structural changes unrelated to the included fundamental variables.** The trend indicates an average annual depreciation of 2.9 percent in addition to the estimated effects of the included fundamental variables. The relevant coefficient is highly significant and the model yields poor results if estimated without the time trend. Essentially, Colombia appears to have been experiencing certain structural changes that depreciated the real exchange rate and that are not picked up the fundamentals described above. However, without an economic explanation, it is difficult to judge whether this trend is likely to continue in the future, and, given the size of the trend, the implications for the future real exchange rate are large.

20. **Trade liberalization does not appear to be the main reason for the observed trend depreciation.** As discussed above, a more liberal trade regime should be associated with a more depreciated exchange rate. Column 2 of Table 1 shows the results of the model including the average tariff rate. In order to be able to use the full sample period, this variable was extrapolated back to 1962, by assuming a constant tariff rate until 1971—the first available observation. The estimated coefficient has the expected sign but is not significant. Moreover, it does not help to reduce the estimated time trend in the model. Using other proxies for the trade regime—such as trade over GDP, or a post liberalization dummy—does not yield better results. One reason for the difficulty in finding a robust effect of trade liberalization could be its correlation with the large increase in government consumption—both took place during the early 1990s (see Figure 3).[41] However, the question remains what other structural changes in Colombia's economy could explain the trend depreciation.

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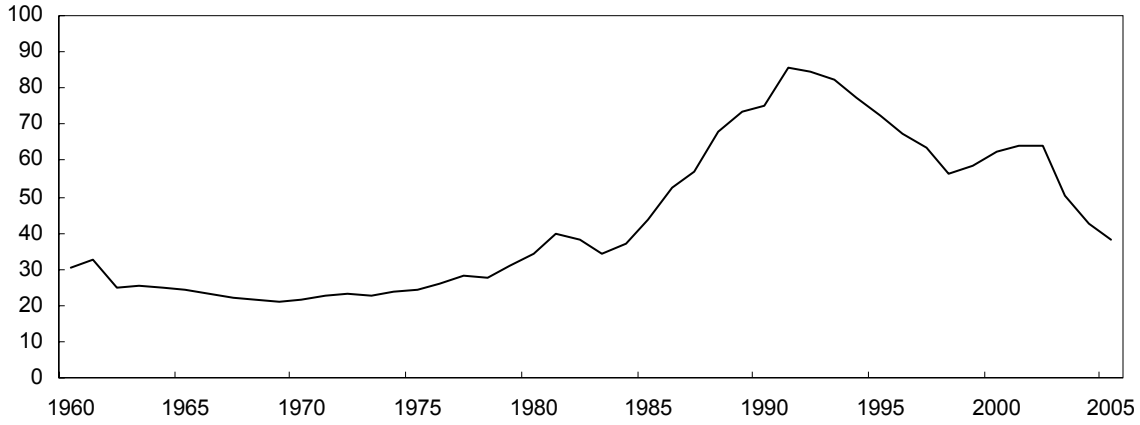
[40] The last row of Table 1 shows that the null hypothesis of weak exogeneity cannot be rejected at reasonable significance levels.

[41] An interesting result related to the tariff rate is the significantly positive adjustment coefficient to misalignments of the real exchange rate. It suggests that tariffs tended to be raised when the real exchange rate was above equilibrium (at time with competitiveness problems) and lowered when the real exchange rate was below equilibrium, which could be explained by political economy considerations.

21. **One issue that has played—and continues to play—a central role in Colombia is the security situation.** It affects economic performance through various channels. Resources are diverted from productive uses, production costs rise, and uncertainty increases. In addition, it affects government finances, politics in general, and probably capital flows. As the relative GDP index is only an imperfect proxy of relative productivity, measures of security conditions may contain additional relevant information, and thus be empirically related to the real exchange rate. Moreover, security conditions may have an important impact on expected productivity in the future.

22. **As a quantitative measure of the security situation, this study uses the homicide rate, for which long time series are available.** Figure 4 shows the homicide rate since 1960. Following violent years in the 1950s, the rate gradually fell until about 1970. The emergence of the guerilla and the drug trade lead to rising rates in the 1970s and especially the 1980s. Violence peaked in the early 1990s. Since then it has fallen significantly, interrupted only by a temporary upsurge in 1999–2002, which was followed by a very sharp decline during the last four years.

Figure 4. Homicide Rate, 1960–2005
(Homicides per 100,000)



23. **Security conditions appear to a have a strong influence on the real exchange rate in Colombia and can explain a significant part of the trend depreciation**. Table 2 presents the estimation results including the homicide rate. If the tariff rate is excluded, all coefficients have the expected signs and are statistically significant. The impact of the homicide rate is fairly large. An increase by 10 per 100,000 depreciates the real exchange rate by 6 percent. It should be noted also that this estimate is robust to excluding other variables. All variables are now statistically significant and the estimated quantitative effects change somewhat when adding the homicide rate. A 10 percent increase in relative per capita GDP implies a 13 percent real appreciation and a 10 percentage point increase in the ratio of NFA to exports raises the real exchange rate by about 0.7 percent. The estimated effects of commodity prices and government consumption are about half of those under specification

(1). The time trend now falls to 1.7 percent annually, but stills remains significant. If the tariff rate is also included (specification (4)), the trend drops to only 1.3 percent, less than half of the initial estimate, although the coefficients of commodity prices and government consumption become small and insignificant.

Table 2. Estimation Results including Security Situation

Specification number	(3)	(4)
Coefficients of the cointegrating relation (long term relation)		
Real exchange rate	1	1
Relative GDP index	-1.282 [-3.46]	-1.253 [-4.45]
Commodity price index	-0.145 [-2.19]	0.043 [0.73]
Net foreign assets to exports	-0.068 [-3.47]	-0.080 [-4.23]
Government consumption to GDP	-1.213 [-2.12]	-0.242 [-0.46]
Average tariff rate		0.310 [0.71]
Security Situation	0.006 [3.56]	0.008 [5.74]
Time trend	0.017 [3.79]	0.013 [3.72]
Constant	-1.112	-1.224
Adjustment coefficients in short term equations (speed of adjustment)		
Real exchange rate	-0.764 [-6.25]	-0.759 [-5.84]
Relative GDP index	-0.058 [-1.50]	-0.076 [-1.92]
Net foreign assets to exports	-0.518 [-0.89]	-0.877 [-1.54]
Average tariff rate		0.127 [4.55]
Likelihood ratio test for weak exogeneity of commodity prices and government consumption		
P-value of LR test	0.29	0.01

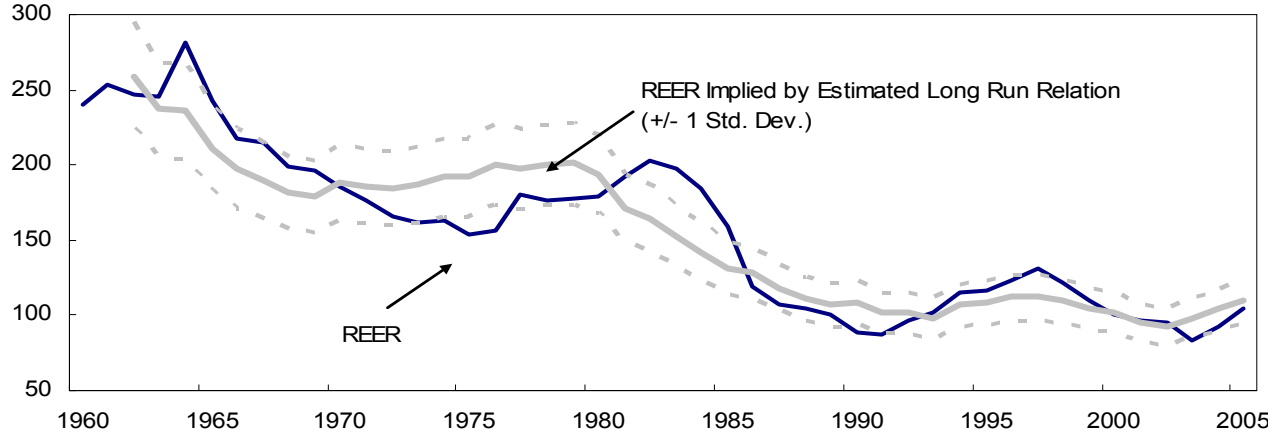
Note: t-statistics in parenthesis.

24. **The estimation results are broadly consistent with other studies on Colombia, although the set of fundamental variables included differs across studies.** A recent study by Echevarria and others (2005) finds similar effects for terms of trade, government expenditure, and net foreign assets. They also find a strong time trend of about 2 percent annually and an adjustment speed of about 50 percent annually. The magnitudes of the coefficients are also broadly comparable to Fund estimates derived from a broad panel of advanced and emerging market countries.

E. Implications and Evaluation of the Model

25. **The real exchange rate implied by the estimated long run relation tracks the main trends of the observed real exchange rate, but, as expected, the series is much smoother and deviations from the long run relation have often been very persistent.** Figure 5 shows the estimated real exchange rate based on the fundamentals, and the interval of plus/minus one standard deviation.[42] Periods of positive and negative deviations alternate, each lasting about 5 to 10 years and coinciding with the main swings in the real exchange rate. The largest deviations took place in the 1970s and 1980s and average deviations have declined since 1999 when Colombia floated the exchange rate and introduced the inflation-targeting framework.

Figure 5. Actual Real Exchange Rate and Rate Implied by Estimated Long Run Relation
(Index: 2000=100)



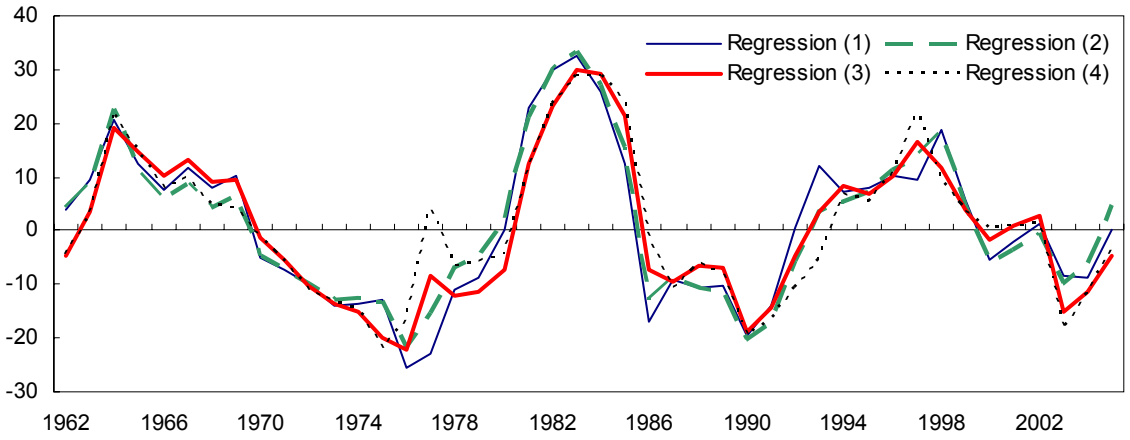
Note: Based on model specification (3).

26. **Model-implied real exchange rate paths are similar across specifications, despite differences in the estimated coefficients for the fundamentals.** Deviations from the

[42] The estimates are based on specification (3). The standard deviation refers to the deviation of the observed real exchange rate from the estimated long run relation. The observed real exchange rate should thus remain within +/- 1 standard deviations of the long run relation about 70 percent of the time.

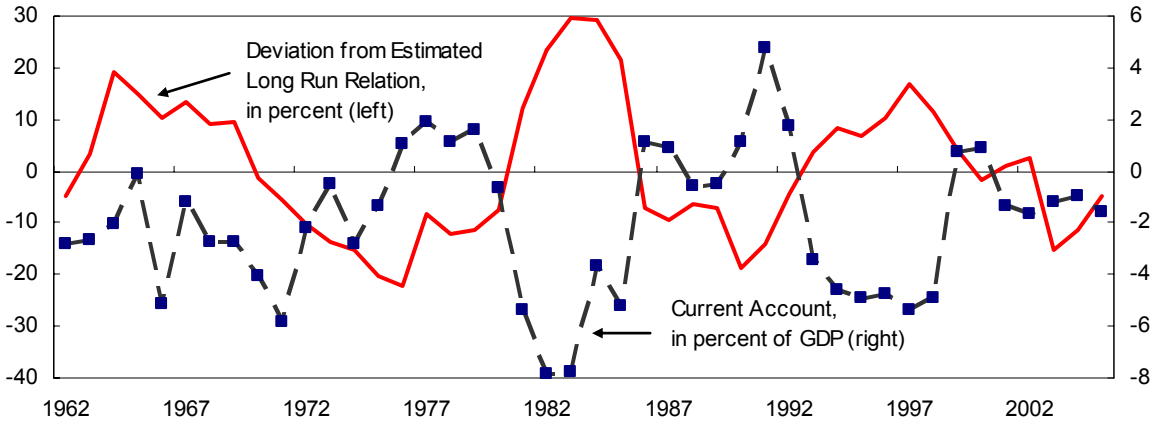
estimated long run relations are provided in Figure 6 for all four specifications presented above. In most years, all specifications yield very similar results and deviations across models are rarely larger than 5–10 percent. However, some individual years show much larger differences, mostly in years with large movements in commodity prices, such as 1976.

Figure 6. Deviation of Real Exchange Rate from Estimated Equilibrium
(In percent)



27. **Deviations from the long run relation have been strongly correlated to current account balances, providing some confidence for the model results**. If the estimated model captures actual exchange rate fundamentals well, then large deviations from the fundamentals-implied real exchange rate should be associated with large current account deficits or surpluses. Figure 7 shows the relation for the estimated model. During periods with a more appreciated (depreciated) rate relative to fundamentals the current account tended to show a deficit (surplus). In fact, the relation is quite strong with the estimated model. The correlation coefficient is about -0.7 over the full sample period and even higher than -0.8 since the mid 1970s. Based on this correlation, a 20 percent appreciation not justified by fundamentals would imply a 2½ percentage point deterioration in the current account. Since the mid 1970s, all periods with unusually high current account deficits (surpluses) clearly coincided with a real exchange rate that was more appreciated (depreciated) than suggested by fundamentals.

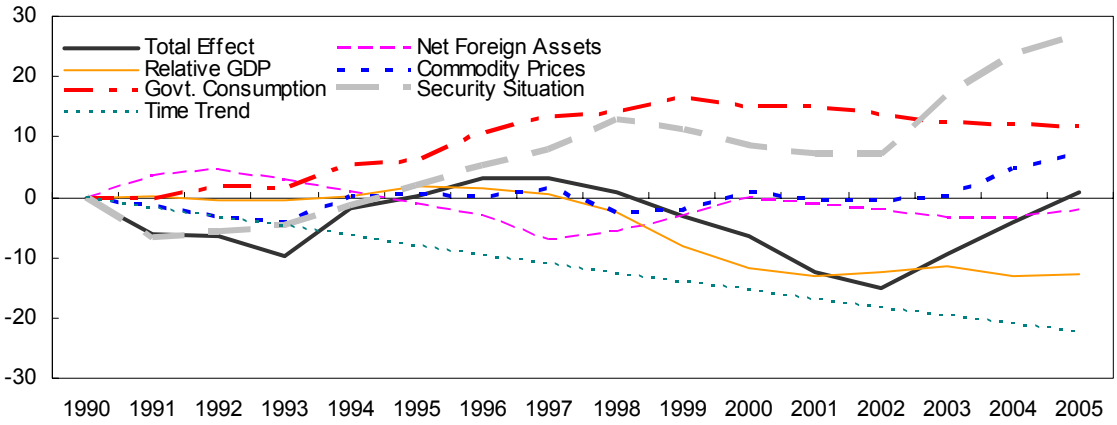
Figure 7. Current Account and Deviation from Long Run Relation



Note: Based on model specification (3).

28. **Recent movements of the real exchange rate have been driven mainly by improving fundamentals and a reversal of the depreciation in 2002-03.** Both commodity prices and the security situation have improved significantly since 2003, while the other fundamentals remained broadly stable. The model suggests that movements in fundamentals justified an appreciation of about 10 percent since 2003 (Figure 8). During the same time, the deviation of the real exchange rate from the long run relation was reduced by about 10 percentage points, as the sharp depreciation of 2003 was gradually reversed.

Figure 8. Equilibrium Real Exchange Rate Movements—Decomposition by Source, 1990–2005
(Cumulative change in percent)



Note: Based on model specification (3).

29. **Based on the model estimates, the average real exchange rate was broadly in line with fundamentals in 2005.** The best fitting model specification (3) suggests that the real exchange rate was 4–5 percent below the estimated long run relation in 2005, which is clearly within the margin of error (Table 3). Alternative model specifications yield similar results, all within +/- 5 percent of the long-run relation. These estimates are based on current

(2005) fundamentals. If medium term projections of the fundamentals are used instead, the range of estimates of the deviation from the long run relation broadens moderately, ranging from about -8 to +10 percent.[43] However, under the preferred model specification the estimate remains at about -4 percent. These quantitative results are also broadly comparable to similar estimates based on a panel of advanced and emerging market economies. Exchange rate developments through August 2006 have not significantly changed this assessment as the real exchange rate in August 2006 remained close to the annual average in 2005, despite the large but temporary depreciation earlier in the year.

Table 3. Deviation of 2005 RER from Estimated Long-Run Relation
(In percent)

	Model specification			
	(1)	(2)	**(3)**	(4)
Based on 2005 fundamentals	0.3	4.5	**-4.6**	-3.4
Based on projected 2011 fundamentals (higher NFA, lower commodity prices, rest unchanged)	9.6	9.1	**-3.8**	-8.1

Note: Positive value means that RER is more appreciated than est. long-run relation.

F. Alternative Approaches

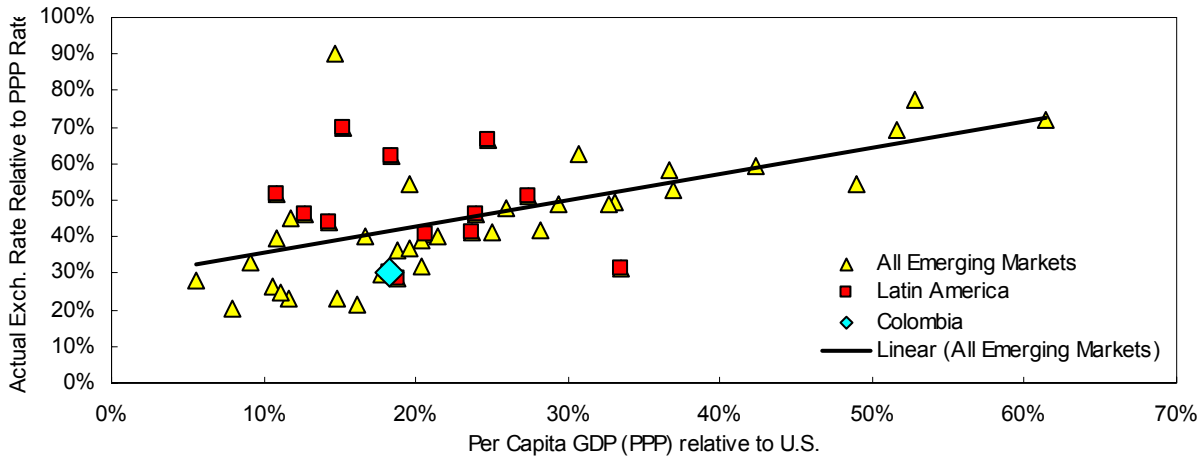
30. **Staff's current account projections broadly confirm these results.** The current account deficit reached 1½ percent of GDP in 2005 and is projected to widen to about 2–2½ percent of GDP over the medium term at the current level of the real exchange rate. Such a current account deficit would be sustainable and would broadly stabilize the net foreign asset position as a share of GDP. Recent trade performance also suggests the absence of competitiveness problems and major imbalances. Growth of non-traditional exports remained at about 15 to 20 percent in U.S. dollars through 2005 and early 2006. While imports have also been growing at similar rates, this has been driven mostly by buoyant investment activity—including foreign direct investment.

31. **A cross-country comparison of absolute price levels also yields similar results.** Inherent in the estimation methodology applied above is the assumption that the real exchange rate was on average correctly aligned with fundamentals. While this should be a reasonable assumption in a relatively long sample, it nevertheless remains an assumption.

[43] The main projected changes in the fundamentals are a moderate decline in commodity prices and an improvement in the net foreign asset position as a share of exports. Relative GDP and government consumption are expected to remain constant. For the purpose of this calculation, security conditions are assumed to remain unchanged. While some studies, especially ones with higher frequency data, base the evaluation of the exchange rate level on the smoothed series of fundamentals (either some moving average or Hodrick-Prescott filter), this approach is not followed here since the annual series are already fairly smooth and backward-looking moving averages are unlikely to better predict future fundamentals.

One way of avoiding such an assumption is to compare absolute price levels measured at current exchange rates across countries using available cross-country PPP estimates. While comparisons across countries that are at different stages of economic development are not very meaningful—mostly because the Balassa-Samuelson effects appear to be strong and more developed countries generally have significantly higher prices of non-tradables—there is some merit in comparing countries with similar per capita GDP. A comparatively high price level, at current exchange rates, indicates that the real exchange rate is more appreciated than in countries with a similar income level and could be an indication that the exchange rate is more appreciated than justified by fundamentals. However, results have to be interpreted carefully since other factors than income levels might justify the level of the price level and the real exchange rate. Figure 9 shows per capita GDP and the price level (both relative to the U.S.) for a broad sample of 46 emerging market countries.[44] Despite several outliers, there appears to be clear relation between the relative per capita income levels (measured at PPP exchange rates) and relative price levels, although that relation appears to be weaker in Latin America than in other regions. In 2004, Colombia's relative price level was about 25 percent below the regression line. Considering the 13 percent real appreciation between 2004 and 2005, this suggests that Colombia's price level still remains about 10 to 15 percent below the level regression line in 2005. While at the lower end of the range observed in most Latin American countries, this is in line with many other emerging markets and indicates neither an excessively high- nor low-price level or real exchange rate.

Figure 9. Cross-Country Price Level and Per Capita GDP, 2004



[44] The x-axis shows the actual exchange rate relative to the PPP rate (with the U.S.). This is equivalent to comparing price levels at the current exchange rate. For example, a value of 30 percent implies that the actual exchange rate is only 30 percent of the rate that would imply PPP with the U.S. Since at the PPP rate, price levels would be equal, this implies that the absolute price level is only 30 percent of the price level in the U.S.

G. Conclusions

32. **Colombia's real effective exchange rate has been subject to large movements over time.** This includes large low frequency swings around a strong depreciating trend. Accordingly, the real exchange rate was much more appreciated in the 1960s than in recent years. In addition to those longer-term movements, the real exchange rate also experienced significant short-term variation. Over the last 10 years, sharp movements were frequently the result of external shocks, often due to financial crisis in other emerging markets.

33. **The statistical model estimated in this paper—linking the real exchange rate to a set of long run fundamentals—yields reasonable results, but cannot fully explain the observed trend depreciation**. The estimated coefficients of standard fundamental variables all have the expected signs and reasonable magnitudes. In addition, observed deviations from the estimated long run relation are highly correlated with the current account balance. However, the standard variables, such as terms of trade, net foreign assets, relative per capita GDP, and measures of trade restrictions, fail to explain the observed time trend. It appears that structural changes have taken place that were not related to the set of standard fundamentals. Including a measure of the security conditions, (the homicide rate) improves the results and lowers the remaining time trend. Moreover, the variable is highly significant and robust across specifications. Nevertheless, the interpretation is somewhat ambiguous. It could be a proxy for productivity effects not picked up by the relative per capita GDP measure, but it could also be picking up waves of optimism and pessimism that have affected economic performance and the exchange rate.

34. **Based on the model estimates, the real exchange rate is currently in line with historical patterns and a significant part of the appreciation since 2003 can be explained by movements in fundamentals.** In 2005, the real exchange rate was close to the estimated long run relation with fundamentals and the current real exchange rate remains close to the average of 2005. About half of the appreciation since 2003 can be explained by higher export commodity prices and improved security conditions. The other half reflects a reversal of the sharp depreciation in 2002-03. Alternative methods, such as an assessment of current account sustainability at the prevailing real exchange rate or a cross-country comparison of the relative price level, broadly confirm this assessment.

Appendix. Data Sources

Exchange rates: Annual average bilateral nominal exchange rates against the U.S. dollar for Colombia's trading partners are from the IMF's International Financial Statistics (IFS). The Colombian peso U.S. dollar bilateral exchange rate is taken from the Banco de la República (BdR), available from 1987 to 2005, and extended back to 1960 with IFS data.

Consumer price index (CPI): Annual average consumer price indices for all countries are from IFS.

Trade weights: Trade weights are calculated based on 3-year moving average total trade with Colombia's top 25 trading partners, using the Fund's Direction of Trade database. The top 25 trading partners cover on average 92 percent of Colombia's trade. In 1960, the trade shares were 63 percent with the U.S. and Canada and 31 percent with Europe. Regional and other trade was small at 6 percent. The shares shifted gradually over time, with Latin America and Asia gaining importance relative to the U.S. and Europe. In 2005, trade with the U.S. and Canada fell to 36 percent and trade with Europe to 19 percent, while trade with Latin America and the Caribbean rose to 30 percent. The rest accounted for 14 percent.

Real effective exchange rate (REER): The BR publishes monthly real effective exchange rate indices based on consumer and producer price indices using a variety of trade weights since 1970. The Fund's monthly CPI-based REER index is available since 1980. To obtain the longer time series used in the econometric estimations, an annual CPI-based REER index was calculated. The index is constructed from weighted average annual growth rates of relative CPIs expressed in a common currency.

Net foreign assets (NFA): The series for NFA from 1970 to 2004 is from Milesi-Feretti and Lane (2006). This series is extended to 2005 and backwards to 1960 using the current account balance as an approximation. NFA is then calculated as a percent of the three-year moving average of exports of goods and services from IFS.

Terms of trade: Terms of Trade are form the WEO database.

Commodity price index: The index of commodity export prices is constructed for the seven most important export commodities since 1962: oil, coal, ferronickel, coffee, bananas, sugar, and cotton. Export data for each commodity is taken from the UN's COMTRADE database, commodity prices in US dollars from WEO. The weights are three-year moving averages of the relative export shares and the index is constructed using annual weighted average growth rates of commodity prices deflated by the US wholesale price index.

Average Tariff Rate: A weighted average effective tariff rate is calculated as the ratio of fiscal revenue from import duties to total imports of goods. Revenue data is from the Fund's

Government Finance Statistics (GFS) database (1971–1999) and from the Colombian ministry of finance website (2000–2005). Data on imports is taken from IFS. This series is only starts in 1971. The series is extended back to 1961 using the closest available observation, i.e. 1971. An unweighted average tariff rate is also calculated as the simple average tariff across ISIC categories using tariff data from the Departamento Nacional de Planeación (DNP). Several missing data points between 1974 and 1988 interpolated. No data is available for 1961–1973 and for 2005. Those data gaps are filled by using the closest available observation, i.e. 1974 and 2004 respectively.

Index of relative per capita real GDP: The data for Colombia and its top 25 trading partners until 2000 are from the World Penn Tables (Heston and others, 2002). The series are extended through 2005 using real GDP growth from the WEO database. For each country an index of real per capita GDP is calculated with the base year 2000 and a weighted average I calculated using the 3-year moving average trade weights described above. The index of relative per capita GDP is then calculated as the ratio of Colombia's per capita real GDP index and the weighted average index of its trading partners.

Homicide rate: The murder rate serves as a proxy for the security situation. The series of annual murders per 100,000 people until 1999 is taken from Brauer and others (2004). Data from 2000 to 2005 are from the Policía Nacional de Colombia.

General government consumption: General government final consumption data is from WEO for the period 1990–2005. For some earlier years, the WEO data appears unreliable as it shows some implausible movements that are uncorrelated with data on government expenditure. For the period 1965–1990 government consumption is thus taken from the World Bank's World Development Indicators (WDI) database. The series is extended back to 1961 by applying the annual growth rate of government expenditure from IFS. Government consumption is then expressed as a share of GDP using data on nominal GDP from IFS.

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