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Juan Carlos Echeverry
Jaime Navas
Verónica Navas
María Paula Gómez

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Carrera 1 No. 18 A – 12, Bloque C.
Bogotá, D. C., Colombia
Teléfonos: 3394949- 3394999, extensiones 2400, 2049, 2474
infocede@uniandes.edu.co
http://economia.uniandes.edu.co

Ediciones Uniandes
Carrera 1 No. 19 – 27, edificio Aulas 6, A. A. 4976
Bogotá, D. C., Colombia
Teléfonos: 3394949- 3394999, extensión 2133, Fax: extensión 2158
infeduni@uniandes.edu.co
http://ediciones.uniandes.edu.co/

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proceditor@etb.net.co

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OIL IN COLOMBIA: HISTORY, REGULATION AND MACROECONOMIC IMPACT

Juan Carlos Echeverry¹
Jaime Navas
Verónica Navas
María Paula Gómez

March, 2009

Abstract

Colombia's oil history began in 1918 and reached its golden era at the end of the 1980s. Regulation in the oil industry changed several times since 1974, mainly responding to the discoveries made. Although agreed contract terms have been honored for oil fields allocated in the past, regulation instability has affected long term the relationships with private investors, since new conditions were imposed for future contracts. Once too onerous conditions, too low prices and international competition drove investors away from the country, regulation was softened. Recently, the Colombian government has improved contractual terms and made tributary and royalty conditions more attractive to private investors. The important discoveries made in the last two decades led Colombia to an expenditure spiral, paired with a huge fiscal deficit and a high public debt, drastically changing a seven decade long record of fiscal stability. The cycle of cheap-expensive oil has exhibited a full swing, and although exploration contracts and investment have increased, no important discoveries have been made, revealing a complicated geology that might pose a challenge to the country's hydrocarbons' self-sufficiency.

Key words: oil, government policy and regulation, deficit, debt.

JEL Classification: H62, M48, Q38, Q32.

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EL PETRÓLEO EN COLOMBIA: HISTORIA, REGULACIÓN E IMPACTO MACROECONÓMICO

Resumen

La historia petrolera de Colombia empezó en 1918, y alcanzó su era dorada el final de los años ochenta. La regulación de la industria petrolera cambió en varias ocasiones desde 1974, principalmente en respuesta a los nuevos descubrimientos. Aunque los términos de los contratos firmados han sido honrados por las autoridades para campos petroleros asignados a compañías privadas, la inestabilidad regulatoria ha afectado la relación de largo plazo con los inversionistas privados, dado que nuevas condiciones fueron desarrolladas para los nuevos campos. Una vez las condiciones demasiado onerosas, los precios bajos y la competencia internacional ahuyentaron a los inversionistas, la regulación fue suavizada. Recientemente el gobierno ha mejorado los términos contractuales, hecho más atractivas las condiciones tributarias y de regalías para inversionistas privados. Los importantes descubrimientos hechos en las últimas dos décadas llevaron a Colombia a un espiral de gasto público, acompañado de altos déficit y deuda pública, cambiando drásticamente un récord de siete décadas de estabilidad fiscal. El ciclo de petróleo barato-carro ha completado una ondulación completa, y aunque los contratos de exploración e inversión se han incrementado, no se han hecho importantes descubrimientos, lo cual revela una geología complicada que puede presentar desafíos para la auto-suficiencia energética del país.

Palabras clave: petróleo, política gubernamental, regulación, déficit, deuda.

Clasificación JEL: H62, M48, Q38, Q32

1. The evolution of oil industry in Colombia

Oil history in Colombia is tightly linked to the shifts in the different factors that regulate this activity around the world. Variations in the oil price, set forth by both geopolitical factors and imbalances between supply and demand, determine the levels of investment and, hence, affect the amount of exploration activity. The era of cheap and easy oil is coming to an end. Since 2003 oil prices soared from \$30 to \$150 per barrel. Oil price reached a peak in 2008, and dropped again to US\$40 level early in 2009. Additionally, big discoveries are less frequent. High oil prices and increasing demand are a natural stimulus for the search for hydrocarbon resources. Current low price scenario will impact near term future work. The existing perception regarding hydrocarbon potential in different countries, as well as political stability, are important considerations for investors deciding to participate in this risky business. The effect of these factors has also been crucial in Colombia. In addition Colombia had a solid reputation as a country that honored the contracts, of being respectful of the agreements, and of having a sustainable fiscal record.

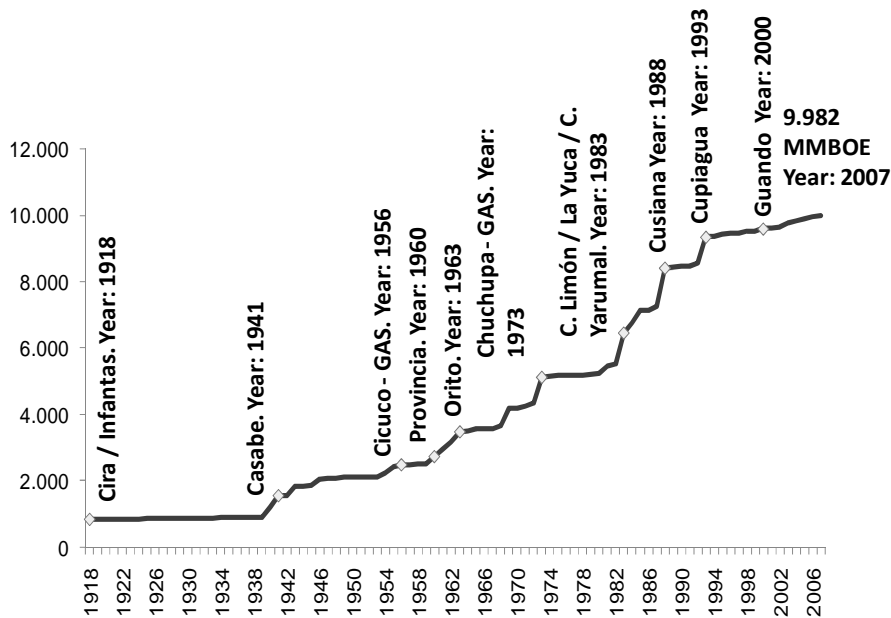
The oil industry in Colombia has its origin in 1905 with the signature of two well know concessions called “Barco” and “De Mares”, and subsequently consolidated with the discovery and further development of the giant “La Cira – Infantas” field in 1918. These episodes mark the beginning of 90 years of oil history, marked by a continuous exploration effort. The analysis of this activity in Colombia allows identifying three main periods:

1918 – 1969: Period of market forces and demand, where technological innovation and capital resources played an important role as engines of exploratory activity, in a country that offered plenty of opportunities. In Colombia the property of all subsurface resources belongs to the State. The incipient oil potential insinuated at this first stage, and favorable contractual conditions, attracted foreign investment and important international companies, such as Exxon, Shell, Texas, Chevron, Colpet, Phillips and Mobil, among others. During this period several fields of (over 200 millions barrels of oil each - MMBO) were found, for an accumulated total of 4,182 MMBO (see Figure 1). Towards the end of this period the state owned company, Ecopetrol was founded (1951), as a result of the reversion of La Cira - Infantas concession, operated by an Exxon affiliate(Tropical Oil Company).

1970 – 1994: this was a period marked by nationalism and deregulation, when a new Association Contracts was designed (1974) and the state oil company, Ecopetrol, was appointed as the administrator. The Association Contracts permitted to apply for larger exploration areas than the previous concession scheme and the contractual terms were initially attractive for the private investors. However, after the initial exploration success the contracts

terms were progressively modified to increase the state-take under several consecutive contractual schemes, leading to an almost complete loss of competitiveness for the contract. Despite the unfavorable contract changes important discoveries were made early during this period. This period was related to a number of important reserve discoveries (over 500 MMBO per field), and intensive exploratory activity. The discovery of giant fields such as Chuchupa (1973), Caño Limón (1983), Cusiana (1988) and Cupiagua (1993), placed Colombia in the spotlight for the most important oil multinationals, despite the unfavorable contractual terms. Thereby a significant increase in exploratory activity took place. Contract changes did not applied to contracts previously signed, only applied to new contracts. During this period 5,169 MMBO of reserves were discovered, and fresh capital and technology became key contributions of foreign investors.

Figure 1. Total accumulated reserves found in Colombia



Source: Ecopetrol, Agencia Nacional de Hidrocarburos and author's calculations

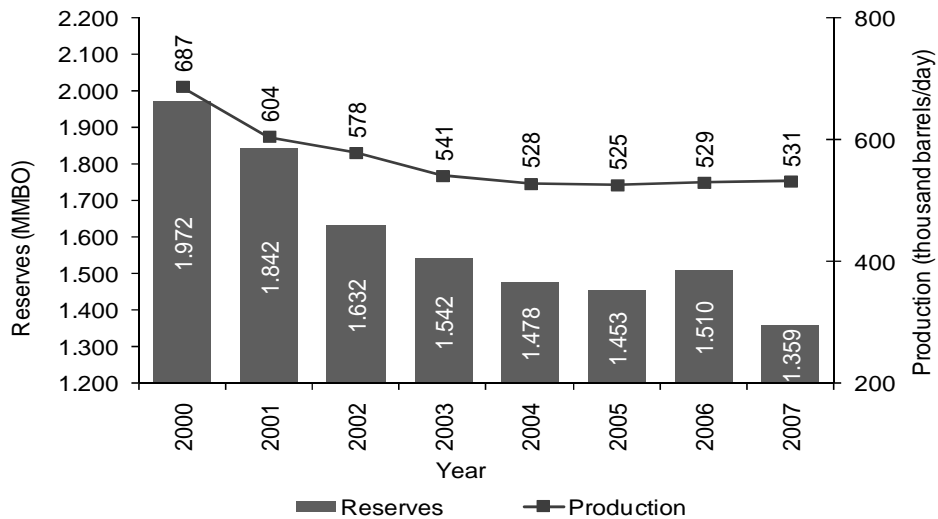
1995 – 2008: this period witnessed modifications of oil regulation and a recovery of exploration. The hydrocarbons sector was restructured and the National Hydrocarbons Agency was created (2003). New contracting mechanisms were developed and the State-take reduced, creating favorable conditions to increase investment. Small companies and independent investors played a crucial role in exploratory activity in the country, particularly in the later years, as a result of high oil prices. Along these years 631 MMBO were discovered, mainly in small fields and particularly in the eastern plains basin (Los Llanos). The number and size of discoveries got

smaller since 1993, with yearly discoveries lower than 100 and even to 50 MMBO, recently. The most important discovery in this period was the Guando field (2000), discovered by Petrobrás, with reserves close to 100 MMBO.

Capital for exploration investment and technology ceased to be an exclusive asset of large companies. Service companies started to provide technology and participate in exploratory and development projects, also becoming operators. Reserves discovered in Colombia along these 90 years reach 9,982 MMBO, and remaining reserves amount to 1,359 MMBO at year end 2007. The country has been permanently concerned with increasing the resource base and maintaining output level, so as to keep the character of oil exporting country.

Oil reserves and production over the past 8 years are illustrated in Figure 2. Over the past four years the average annual production levels have been maintained, efficiently overcoming the natural decline of the fields, through aggressive programs to optimize mature fields production, mainly by Ecopetrol and its partners. However, during this period yearly reserve replacement has been insufficient for maintaining the levels present at the beginning of the decade. This, in conjunction with the deficit created over the previous years, generates a worrying imbalance. Discovered reserves in 2007 amounted to 44 MMBO, compared to an annual average of 320 MMBO in the eighties, and 109 MMBO in the nineties.

Figure 2. Crude Oil Production and Reserves, 2002 - 2007



Source: Ecopetrol, Agencia Nacional de Hidrocarburos (ANH), and authors' calculations.

The most significant reserves addition along the past decade resulted from the revision performed in mature fields, which allowed to incorporate new volumes of reserves, particularly

due to an increase in the recovery factor. In 2000, the level of reserves in Colombia was 1,972 MMBO, while in 2007 this figure was 1,359 MMBO, implying a 31% reduction. Similarly, average daily production has been reduced from 687 thousand in 2000 to 531 thousand barrels/day in 2007, having remained fairly constant over the past three years.

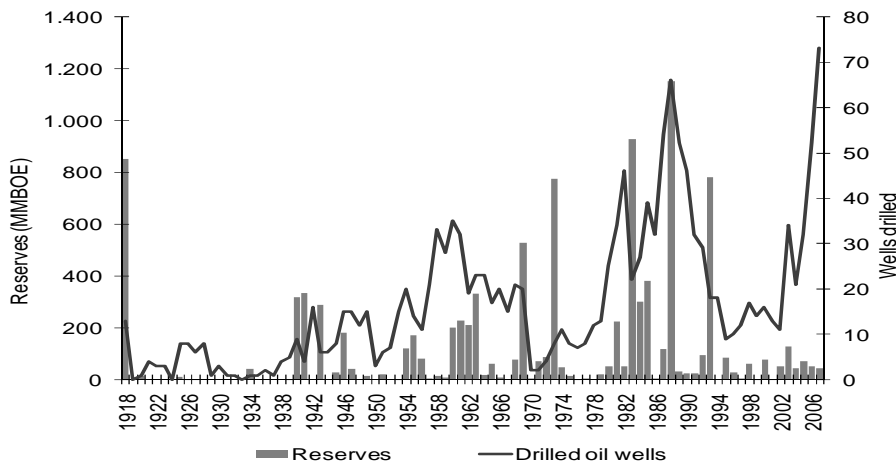
The Government's efforts, in particular at the ANH, are reflected in a substantial increase in the exploratory activity in the country, particularly in terms of the number of drilled exploratory wells and new E&P contracts. Unfortunately the results of such activity have underperformed expectations in terms of oil discoveries, and represent an alert sign for the future of Colombia's oil industry. Revising recent history, it can be seen that in 2007 the number of exploratory (A-3) wells drilled amounted to 72, while the amount of new discoveries were less than 50 MMBO.

Considering a longer planning horizon, and evaluating the results of exploratory efforts between 1918 and 2007, using as indicators the number of exploratory wells (A-3) drilled per year and the discovered reserves, the following observations can be made:

- 1) Discovered reserves in the early exploration phase (1918 -1969) do not exhibit a direct relationship with the number of drilled exploration wells. During this period found reserves reached 20 MMBO per exploratory well drilled (see Figure 3). Discovered reserves in these new exploratory areas were not the result of intensive exploratory drilling program. They were the combination of a good technical work and a more predictable geology.
- 2) In the intermediate exploratory period (1970-1994), once prospective exploratory trains were established, a clearer relationship is observed between level of exploration and results. The level of reserves per exploratory well varied between 6 and 10 MMBO.
- 3) In the later, more advanced state of exploration (1995-2008), in particular between 2001 and 2007, the exploratory effort has been large while discovered reserves remaining low. In this case the reserves discover per exploratory well reached only 0.6 MMBO. The substantial reduction of this relationship may be indicative of low potential, basin's maturity, as well as a lower economic success rate (**Pe**).

The adverse results of the exploration effort observed along the past decade are an indication of the low remaining potential of the basins where exploration has been concentrated? This is possible, but it must be remembered that the giant fields discovered, particularly in the Middle Magdalena and Eastern Cordillera foothills and Llanos basin, may be an indication of abundant hydrocarbons generation and a large hydrocarbon potential. Notice that the rich source rocks in Colombia have a common history with the source rocks which generate Venezuela's giant oil reserves.

Figure 3. Drilling activity and oil discoveries, 1918 - 2007



Source: Agencia Nacional de Hidrocarburos

2. Vicissitudes of oil contracts' regulation

The evolution of contracts in Colombia

Since 1917, when the first multinational company entered the country, the fiscal conditions given to private investors in the oil sector have changed significantly and, especially during the 1980s and 90s, they changed frequently. During the last decade, unlike in Bolivia, Ecuador and Venezuela, conditions for private investment firms improved. According to Manzano and Monaldi (2008), Medley Global Advisors (2006), Campodónico (2004) and the World Bank (2005) this was a result of poor exploration results after 2000. As Figures 3, 8 and 9 show, since 2002 drilling activity and investment in the Colombian oil sector have soared, however, the same is not true for oil wells drilled which all have been insignificant in terms of new reserves. This encouraged Colombian policy makers to improve fiscal conditions for private participants in order to attract more investment into the sector. The economic boom lived between 2004 and 2008, and the soaring oil prices also boosted FDI into the sector.

According to Reyes (2007), the first multinational company that entered the country was Tropical Oil Co. in 1917 to the De Mares Concession. Many significant discoveries were made in the Magdalena River region during the first part of the 20th century. Most of the contracts were concessions to private multinational companies, with reversal clauses that favored the

Colombian Government; this made Colombian contracts different from those around the world at the time, because in most cases, contracts favored the private investors more than the government. In the 1930s the exploration shifted towards the border with Venezuela, in the Catatumbo basin, a region known as 'Concesión Barco', quite productive up to the 1960s.

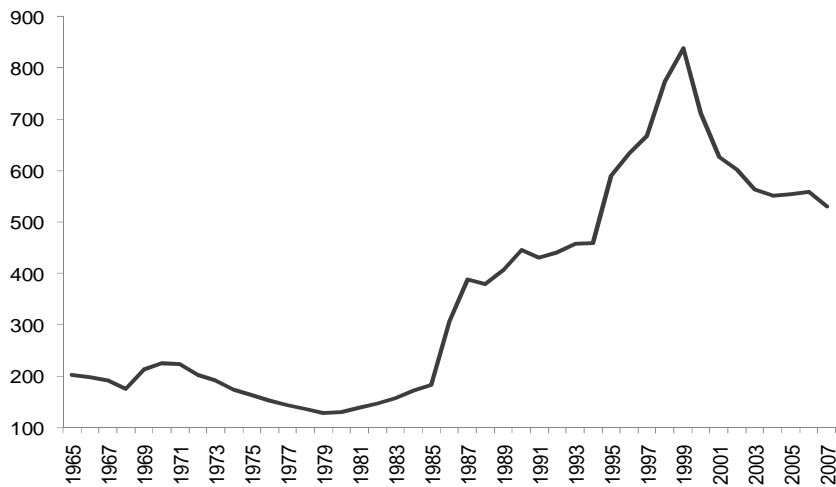
During the 1960s an important discovery was made in the south of the country, near the border with Ecuador, shifting Colombia into an oil exporting country since 1969. However, in 1973 the situation changed and Colombia became once again a net importer. According to Barrios (2003), the oil crisis and the increasing international prices encouraged the government to strengthen the existing Association Contract, which had been created by Law 20 of 1969. The 2310 and 743 decrees of 1974 and 1975 respectively, established that, excluding the existing contracts, Ecopetrol was the only company allowed to explore and exploit oil wells in Colombia. Ecopetrol could carry out the activities on its own or through association contracts.

Figure 4 shows that before the big oil fields, Caño Limón, Cusiana and Cupiagua were discovered in the late 1980s and early 1990s, Colombia's oil production reached its peak in 1970 when 226,000 barrels were produced per day. In 1980, the production had fallen to 131,000 barrels per day. Barrios (2003) attributes the drop in production to the decrease in the exploration activity generated by the association contract terms of 1974, which restricted significantly multinational companies' participation.

During the 1970s and 1980s exploration was based mainly at the eastern side of the country, in the Llanos Orientales. In 1982-83 Ecopetrol made important discoveries in the province of Meta; but the situation changed radically in 1984 when Occidental Petroleum found oil in Caño Limón (near the frontier with Venezuela, with about 1000 million barrels). Thanks to this discovery, Colombia's proved reserves doubled. Cusiana (1.17 billion of oil equivalent barrels, OEB²) was discovered in 1988, and Cupiagua in 1993 (near Cusiana, with 880 million OEB). These have been the major oil discoveries made in Colombia. The development of these oil fields increased Colombian oil reserves to a record level of 3.2 billion barrels in 1998. In 2000, Guandó was discovered by Braspetro, adding a further 100 million barrels to the country's reserves. Since then, oil reserves have declined to an estimated current level of 1,359 million barrels. Colombia reached its production peak in 1999 (838,000 barrels per day). In 2007, 531,000 barrels were produced each day. Exports have also declined from a peak of 515 kbd then, to nearly 176 kbd now. The surge in international prices has compensated these trends, stabilizing Ecopetrol's and the Colombian government's revenues. Oil is now nearly 21% of total exports and 4.3% of GDP.

² The Cusiana and Copiagua fields contain an important amount of gas that has to be converted to its equivalent in oil barrels.

Figure 4. oil production in Colombia, 1965-2007 (thousand barrels per day)



Source: British Petroleum

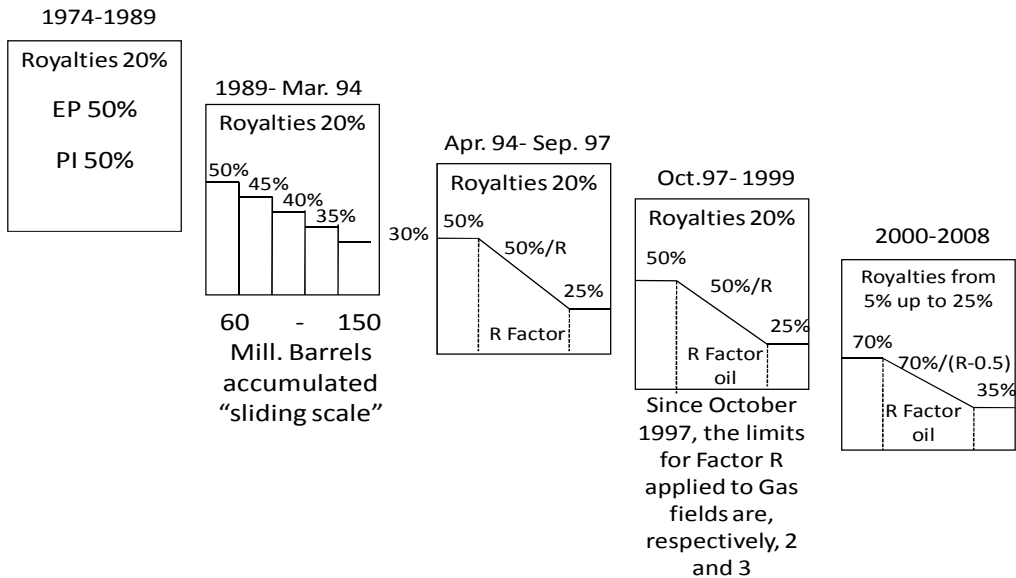
The association contract, period 1974 – 2007

The association contract in Colombia worked as a joint venture between Ecopetrol and the foreign company. The company assumed 100% of the exploration risk and costs and Ecopetrol shared past and future costs, once the field was declared commercial. Colombia's fiscal terms in the oil sector have changed several times, changing the rules and participation rate of the association contract. The subsequent association contracts can be divided into four separate types, and are described in Figure 5 and Table 1. In 2004, there were some changes in the contract that will be discussed later on, however, the main characteristics of type D contracts remain, and therefore are not separated in Figure 5 and Table 1.

Type A contract: 50-50 (1970-1989)

This contract was created in 1969, but came into practice in 1974. The foreign partner was in charge of the exploration period and had to pay the totality of the investment and assumed all the risks. The exploration stage lasted 6 years and was followed by 22 years for exploitation. After a commercial discovery was made, the foreign partner paid 20% in royalties from the hydrocarbons produced. From that moment on, both Ecopetrol and the multinational company had 50% participation over the field's production and shared, in equal parts, the investments made. Ecopetrol didn't participate in the production share until 50% (in current prices) of the exploration costs were covered.

Figure 5. Thirty years regulating oil production- distribution in Colombia



EP: Ecopetrol's participation. PI: Private investor participation (bottom portion of every picture), after taking out royalties.
Source: Observatorio Colombiano de Energía

If the partner made a discovery without Ecopetrol's participation, once the 20% royalties were paid, the private company could take the totality of the production of that well until 200% of the perforation costs were covered. Afterwards, Ecopetrol had the option to participate.

According to Barrios (2003), after the giant oil field was discovered in Cusiana, Ecopetrol realized that the existing association contract did not distribute the production according to the size of the field. This is why, in 1990, the government introduced the "Sliding scale association contract", in which the State owned company participation increased as production grew. This is known as the Type B contract.

This is an example of Vernon's "obsolescing bargain". As Manzano and Monaldi (2008) argue, the existence of geological risks in the exploration phases creates incentives for governments to offer attractive conditions in order to attract investment. However, when exploration is highly successful, as was the case with Caño Limón and Cusiana, there are ex-post incentives for the government to renegotiate the contracts signed. Therefore, once the Colombian oil reserves had doubled, the government changed the fiscal terms in order to capture exploration results contingencies.

Table 1. Evolution of the association contract in Colombia

	Type A	Type B		Type C		Type D	
Period	1970-1989	1990-1994		1994-1999		2000-2008	
Royalties	20%	20%		20%		Daily production < 5 kbpd 5-125 kbpd 125-400 kbpd 400-600 kbpd > 600 kbpd	Benefits 5% increasing in straight line up to 20% increasing in straight line up to 25%
Duration	28 years	28 years		28 years		30 years	
Exploration obligation	Negotiated	Negotiated		Negotiated		Negotiated	
Ring fencing	No	No		No		No	
Joint Venture	50% ECO-50% partner	Accumulated Production 0-60 Mb 60-90 Mb 90-120 MB 120-150 Mb > 150 Mb	Partner's Participation 50% 45% 40% 35% 30%	R-Factor 0-1 1-2 > 2	Partner's Participation 50% 50% 25%	R- Factor 0-1.5 1.5-2.5 > 2.5	Partner's Participation 70% 70%/(R-0.5) 35%
Exploration costs refund	50% current prices	50% current prices		50% constant prices		30% constant prices	
Development costs refund	50%	According to the production share		According to the production share		According to the production share	
R factor application	N/A	N/A		Per contract		Per field	

Source: Barrios (2003) and the National Hydrocarbons Association (ANH)

Type B contract: sliding scale distribution (1990-1994)

Type B contracts worked similarly to type A contracts in terms of duration and exploration obligations. Once the 20% royalties were paid, production was distributed in the same way as before (50%-50%). However, when production surpassed 60 million barrels, the state's company participation increased. Table 2 shows the participation rates according to the field's production. This contract included new clauses which aimed at transferring technological knowledge to Ecopetrol and improving the environmental control. In 1994 a new contract was

introduced. In this contract, Ecopetrol's participation rate increased not as a function of production, but as a function of the profitability of the project.

Table 2. Output distribution according to oil production (%)

Million barrels	Ecopetrol's participation	Associate's participation
0-60	50	50
60-90	55	45
90-120	60	40
120-150	65	35
> 150	70	30

Source: Ecopetrol

Type C1 contract: R factor (1994-1997)

According to Barrios (2003), type C contracts were born with the intention of taking into account the profitability of the projects. It not only included the total production, but also prices and costs. The author says that the so called "R factor" was introduced as a way to generate a fairer distribution of the profits between Ecopetrol and the foreign company. Therefore, once again, the participation rate increased when the production surpassed 60 million barrels; however, the rate depended on the company's revenues and costs, according to the R factor. The R factor is defined as follows:

$$R = \frac{AR}{ID + GO + A - B} = \frac{\text{Accumulated revenues of the associate in each oil field}}{\text{Accumulated costs}}$$

Where:

AR: Associate's accumulated revenues (volume x price)

ID: Accumulated investment

GO: Accumulated operational costs

A: Direct exploration costs financed entirely by the associate

B: Accumulated costs' refund

Table 3. Production distribution rate according to the R factor (%)

R factor	Ecopetrol's participation	Associate's participation
< 1.0	50	50
1.0-2.0	100-50/R	50/R
> 2.0	75	25

Source: Barrios (2003)

Under this type of contract, the costs refund had to be paid in constant prices, taking into account the international inflation rate. Since 1995, refunds included dry wells' costs and seismic works. As Figure 5 shows, in October 1997 a change was made in the R factor for gas production.

Type C2 contract: Gas R Factor (Oct. 1997- 1999)

Before 1997, the R factor was the same for both liquid and gas hydrocarbons discoveries. In October 1997, a change was introduced in the contract, in case gas was found. There were two main variations: first, the duration of the contract increased. A four year retention period was introduced after the six year exploration period ended and, the exploitation period was extended up to thirty years; therefore, the contract could last 40 years. On the other hand, a different distribution scheme was established. In this case, the R factor worked as shown in Table 4. However, according to Barrios (2003), Colombian fiscal terms for multinational oil companies were still not competitive enough, and thus, the association contract was once again modified in 1999.

Table 4. Gas production distribution according to the R factor (%)

R factor	Ecopetrol's participation	Associate's participation
< 2.0	50	50
2.0-3.0	100-50/(R-1)	50/(R-1)
> 3.0	75	25

Source: Barrios (2003)

Type D contract: R factor 30%-70% (1999-2008)

The main change made in 1999 was the decrease in Ecopetrol's take; it was lowered from 50% to 30%. In that way, the R factor applied also changed, accelerating the private investor's cost recovery. When production was less than 60 million oil barrels, the associate's take (after royalties) would be 70%. Table 5 shows the production distribution after the 60 million barrels limit is surpassed.

Table 5. Production distribution according to the R factor (%)

R factor	Ecopetrol's participation	Associate's participation
< 1.5	30	70
1.5-2.5	$100-70/(R-0.5)$	$70/(R-0.5)$
> 2.5	65	35

Source: Barrios (2003)

As Figure 5 and Table 1 show, type D contracts also changed the way royalties were paid. The private investor no longer had to pay a constant 20% of royalties, but instead these depend on production. If less than 5 thousand barrels of oil are produced daily, the associate has to pay 5%. Royalties increase in a straight line up to 125 thousand barrels, reaching 20%. Between 125 thousand daily barrels and 400 thousand, royalties remain constant at 20%. From 400 thousand to 600 thousand daily barrels, royalties increase up to the upper limit, 25%. In 2004, the contract was modified and royalties started from 8%. Figure 6 shows the way current royalties are paid.

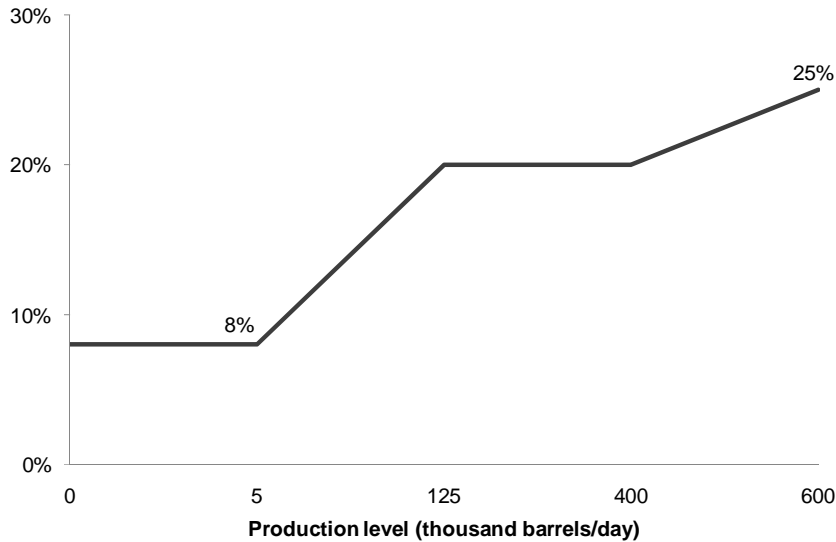
New Contract

In 2003, the government separated the regulatory and the entrepreneurial responsibilities of Ecopetrol. The former were assigned to the Agencia Nacional de Hidrocarburos (ANH), whose board is composed of the ministers of mining, finance and planning, with two more members appointed by the president. This agency is also responsible for administering the oil resources of the nation. In February 2004, the ANH announced a new type of contract in which the participation of Ecopetrol will not be mandatory in the open areas. Previously, the private investor was responsible for the whole exploration assigned areas, and Ecopetrol joined only in successful ones. Besides, Ecopetrol also pursued its own areas with modest success. Additionally, according to the World Bank (2005), in 2003 Law 1760 was approved.

Furthermore, under the new contract, one hundred percent of the oil can be extracted by the investor, modifying the 1999-2003 scheme. Royalties and taxes will depend on the development of the successful fields. Although these measures seem to fulfill international requests, potential investors are still unsure about the guarantee that they will be able to keep the fields until depletion, or that new conditions (taxes and government participation) would not be imposed

above those agreed upon. Indeed, the unstable regulation of the nineties is a revealing and troubling signal that this could happen.

Figure 6. Royalties paid according to daily oil production, 2008



Source: ANH

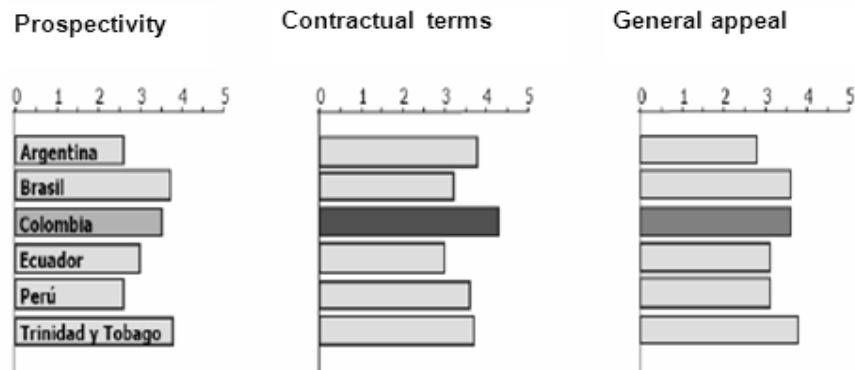
This new arrangement, called “modern concession contract”, will specify a timetable for exploration and exploitation for the private investors in every field, and will be monitored by the ANH. The agency can terminate the concession if this “best efforts” commitment is not fulfilled by the company. Still, even if potential investors are attracted, the security factor will gravitate around any exploration and production. The government is doing its best in this front also, aiming to consolidate the firms already in the country, and to attract new ones. What about Ecopetrol? It will compete for prospects with other companies, apparently on equal standing. This led, in 2007, to the public capitalization of Ecopetrol.

In July 2007, the ANH introduced the *Colombian rounds* system. The Agency decides on a specific area and sells the right to explore and exploit it through an auction process. According to the ANH, the private investor is obliged to execute the Minimum Exploratory Work offered during the bidding process and has to develop the terms of the contract assuming all the costs and risks. The company owns the production rights net of royalties, which are paid according to the terms specified in type D contracts (Figure 5). In the bidding process, companies offer the ANH a participation of the production, and a high price participation, which is due if international prices exceed a pre-established level. Notice that this new scheme increases again the state take, via a bidding process.

The effects of changes in the fiscal terms

Figure 7 shows that in 2005, according to Arthur D. Little, Colombia became the third country in Latin America with the most appealing contractual terms, following Argentina and Brazil. Figure 8 shows the increase in the number of contracts signed since 2003. In 2007, the government's target was to sign 30 contracts and there were actually over 50. Although the boost in contracts could be attributed to the modifications made on type D contract in 2004, it also coincides with economic boom, rising oil prices and better security conditions. However, the rise in contracts signed in 1999 could show the better terms given to private investors in 1999. Between type A, B and C contracts; there is no clear difference in the number of contracts signed.

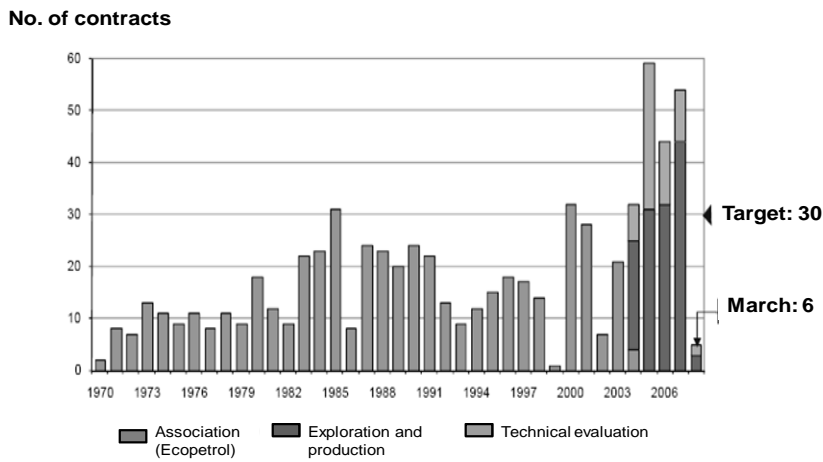
Figure 7. Private investor's perception on Colombian oil sector, 2005



Source: Agencia Nacional de Hidrocarburos

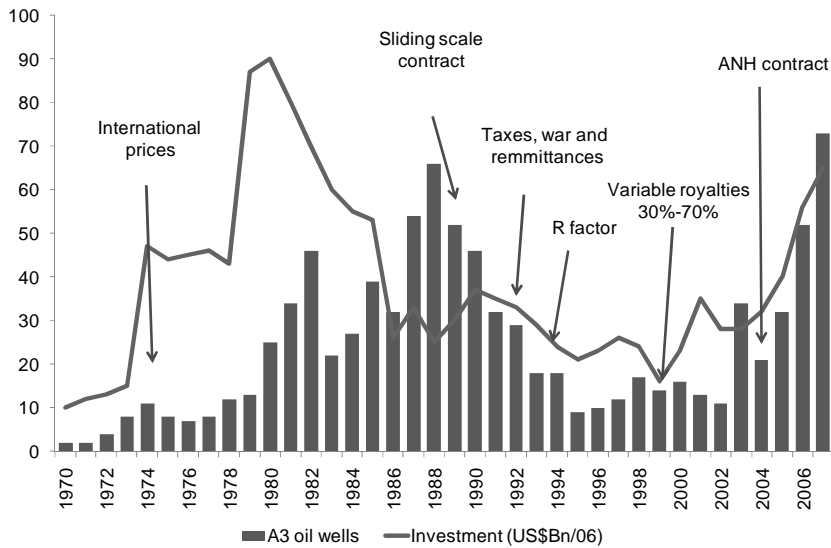
Figure 9 shows the number of oil wells drilled and the investments made in the oil sector in Colombia. It also shows the changes in the contractual terms since the seventies. The rise in investment in the 1970s coincided with rising oil prices and the latest surge began when better conditions were given to private investors as Ecopetrol's share was lowered from 50% to 30% and royalties became variable. Nonetheless, as Figure 10 shows, the rise in investment since 1999 can also be explained by soaring oil prices.

Figure 8. Number of exploration and exploitation contracts signed, 1970-2008 (march)



Source: Agencia Nacional de Hidrocarburos

Figure 9. Investment (US\$bn/06) in Colombian oil sector and oil wells drilled, 1970-2007



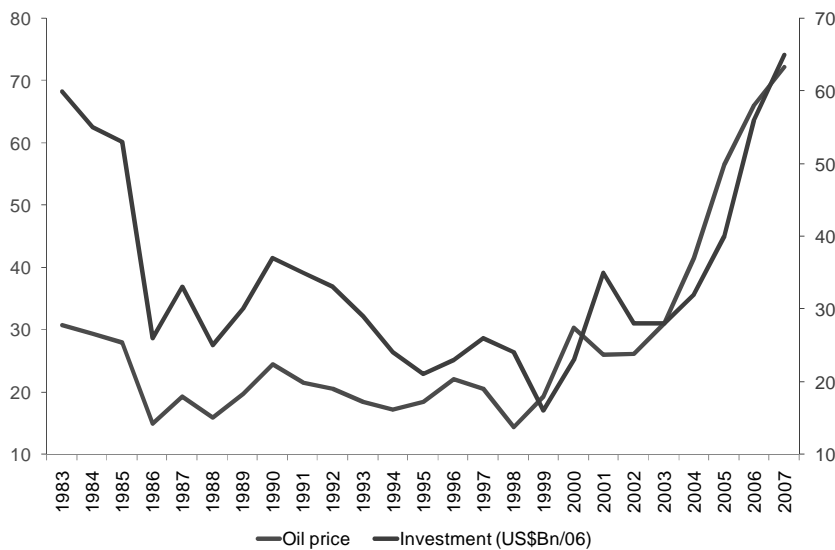
Source: Colombian Oil Association

According to Manzano and Monaldi (2008), Colombia, as Brazil and Peru, "have strengthened the credibility of their regulatory framework and moved generally in the direction of promoting

private participation.” (Manzano and Monaldi, 2008, p. 21). This, along with soaring international prices, led to an increase in FDI to the oil sector. In January 2000 there were US\$ 61.4 millions of FDI flows, in November 2008, there were US\$ 373.9 million.

Nonetheless, despite the attractive conditions for foreign investors and the consequential rise in investment, there haven't been significant new discoveries, and therefore Colombia's position as a net exporter is menaced. However, in comparison to its neighbors, especially Venezuela, Ecuador and Bolivia, Colombia is significantly more attractive for foreign investors.

Figure 10. Average oil Price (US\$/barrel) and investment in the oil sector (US\$bn/06)



Source: Colombian Oil Association and Bloomberg

Table 6 shows the results of a simple equation in which we estimate the relationship between investment in the oil sector, the type of contract used, international oil prices and the homicide rate, for capturing violence and the conflict. The dependent variable is investment in the oil sector in billions of US dollars. The independent variables are dummies for the different type of contracts, the homicide rate per 100.000 habitants and the international oil price is US dollars per barrel.

The international price has a significant and positive effect on the investments made. For every US\$ 10 rise, the investments in the Colombian oil sector rise in average US\$ 7.1 billion. As expected, the homicide rate has a negative impact on investment, but seems not to be statistically significant. We included this variable in order to capture the violence situation and its deterrence effect on investment decisions. The contractual modifications of the nineties

appeared to have had substantial negative effects on investment. Surprisingly, the changes of the first decade of the new century also exhibited a negative coefficient.

Table 6. Estimation results, dependent variable: investment in the oil sector, 1974-2007

Independent variable	Coefficient	t-statistic
Oil price (average WTI)	0.71**	5.96
Homicide rate per 100.000 people	-0.63	-1.4
1989-1993	0.41	0.1
1994-1996	-10.89**	-2.81
1997-1999	-14.05**	-2.73
2000-2008	-9.69*	-1.9
R-squared	0.83	
Number of observations	23	

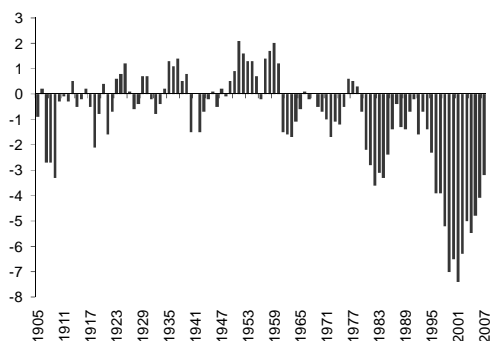
Source: Author's calculations; (*) significant at 95% confidence interval; (**) significant at 99% confidence interval.

In sum, Colombian contractual terms changed in the 1970s and 1990s according to the discoveries made. When the big oil fields, Caño Limón and Cusiana were discovered, the government increased the state-take according to the size of the fields by introducing the sliding scale contract. In 1994, the contract was redesigned in order to take into account the profitability of the projects. Over the last 15 years, there haven't been any significant discoveries; therefore, the Colombian government has made an important effort to strengthen the conditions for private investors. This, along with rising oil prices, has had a positive effect on the level of investment flowing into the sector.

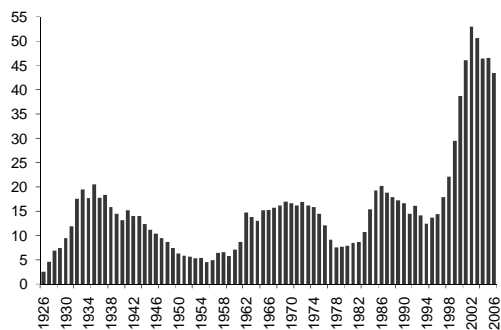
3. Macroeconomic and institutional consequences of a short lived oil boom

One of the most pressing questions about Colombia's economic performance is: what happened in the economy during the nineties? How did Colombian economy shift from a decent economic performance, and even prosperity up to 1995, to the worst economic crisis in its history, in 1999? In fact, recent governments still confront the consequences of events from the previous decade. The most notorious of these consequences, not solved yet, is the stubborn public deficit and the accumulated debt. Why has this become a chronic problem with no permanent solution at sight? How does a country that managed to contain its fiscal deficit oscillating between -3% and 2% of GDP for ninety years, and its public debt fluctuating between 5% and 20% of GDP in the same period, lost control of these two key variables in a span of a decade? (Figure 11)

Figure 11. Central Government's deficit 1904-2007 (% of GDP)



Central Government's total debt (% of GDP)



Source: Junguito and Rincon 2004 and Ministry of Finance

In fact, Colombia's austere management of public finances and its capacity to quickly correct mistakes had made it stand out among Latin American countries during the previous two decades. This is why the events after 1995 are so notorious. To point out the difficulty to interpret Colombia's recent past, it is useful to start out by enumerating some of the most outstanding phenomena which could be related to the fiscal reversal of fortune illustrated in Figure 11.

- Substantial oil discoveries between 1983 and 1994 (ca. 3 billion barrels in new reserves)
- New Constitution enacted, created the constitutional court and enhanced justices' role on granting rights to citizens, with fiscal impact; Central Bank independence; deepening of decentralization in health and education sectors, granting sub-national governments a share on nation's tax revenues
- Emergence of the public pension liability, hitherto hidden in the balance sheet of several decentralized social security institutions, which first became explicit during the nineties
- Cocaine export boom, with effects on the economy, society and institutions
- Internal conflict with guerrillas and paramilitaries intensified, due to their financing with kidnappings, drug trafficking and local corruption
- Economic openness in a globalization environment
- Bubble and bust of mortgage debt and housing prices.
- Health and education reform demanded large fresh resources, many of which used to increase teacher's salaries and for excessive labor contracts and privileges in public hospitals

Although it is difficult to prioritize the list of factors presented, we will maintain that the positive oil shock, represented in the substantial increase of reserves, was the single most influential event of the past decade, partially causing the fiscal misfortunes documented. This implies that the oil boom wasn't managed in the most appropriate way. Such handling can hardly be exclusively ascribed to a specific group of policy makers, such as mines ministers, Ecopetrol's CEOs or the central government economic team. Although some responsibility can be attributed to them, the orientation given to the new resources was derived from political decisions made by the society at large.

In fact, Figure 11 raises the question: why would a society that for ninety years had revealed a preference for stability and for moderate fluctuations in its fiscal balances and public debt, decide to change drastically its choice? This happened at the beginning of the 90s and was reinforced along the decade.

Many observers have pointed out the 1991 Constitution as a single cause behind the shift in fiscal stance. The reason alleged is the decentralized education and health outlays mandated by it. We believe that the constitution was the vehicle, the "how" of the process. But what must be explained is the "why". The question could be asked in the following way: why would a society who had watched carefully that the legal commitments of the public budget did not exceed systematically the tax resources, contributions and state-owned companies' surpluses, decide to assign to the national government budget an expenditure burden superior to its long term resources? What can justify this odd behavior, precisely in the country that had stood up in Latin America for its fiscal neutrality? Did the Colombian ruling class suddenly become irresponsible and created a constitution and legislation too generous along the 90s? These questions have not been raised, at least to our knowledge.

It must be taken into account that the consumption madness not only infected the central government, departments and municipalities, but also Colombian firms and households. The proof lies in the associated crisis in the business sector due to the acquired debts, in dollars and pesos, along the decade (Echeverry et al. 2003), and the mortgage crisis that troubled the Colombian households and destroyed the UPAC system.

The euphoric consumption behavior invaded governments, firms and households. Once again, what phenomenon induced traditionally moderate governments, firms and households to shift excessively their expenditure patterns?

It has been argued that the drug trafficking inflows or that the incidence of the guerrillas and the armed conflict can explain the events of the 90s. Naturally, part of the explanation lies on these facts, but it is hard to believe that Colombian households and firms decided to spend systematically above their incomes as kidnappings, guerrilla attacks and drug trafficking increased. On the contrary, these events would normally alert a society. In the Colombian

case, these events took place at the same time as the society let down their guard while it weakened institutionally and economically.

The principal cause, in our opinion, is the massive inflows from oil resources derived from the discoveries made in the 80s and at the beginning of the 90s. To these, revenues from drug trafficking and a brief international capital boom can be added.

Why, can the excessive expenditure in the 90s be attributed to a greater extent to oil than to capital inflows and drug trafficking income? The reason is that the shift towards an aggressive expenditure state policy can only be attributed to the first one. In fact, from the three events mentioned, oil had the biggest impact on public revenue. Capital inflows increased government revenue through privatizations, which were relatively small and illegal dollars' inflows normally don't pay taxes.

Nevertheless, capital inflows and drug trafficking dollars are partly responsible for the real peso appreciation of the 90s. There is no doubt that the strong peso played a key role in the expenditure boom of the private sector. This was the case for households and firms. To complete the picture, the real appreciation received an additional impulse from the deteriorating public finances and the government financing needs.

Summing up, the most significant shocks were the relaxation of the state budget constrain derived from oil revenues and the real peso appreciation. The transmission channels were: 1) the commitments acquired in the justice department and transfers to regions laid on the new constitution; 2) generosity towards teachers who perceived several raises between 1995 and 1998; 3) increase in government spending through the funds known as *Fondos de Cofinanciación*; 4) substantial increase in regional governments' expenditures derived from the central government's transfers and access to the financial markets; 5) transmission channels in the private sector were the increase in incomes resulting from the economic boom in the first half of the decade, the real peso appreciation, which increased household's purchasing power and a greater access to credit (mortgage and consumption).

The consequences were high state indebtedness, at all governmental levels and the private sector indebtedness, in households and firms. This high degree of financial leverage made the society vulnerable to the shocks that came later on.

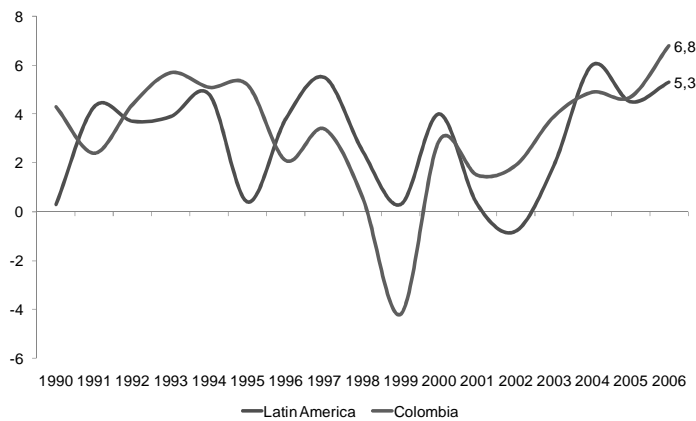
The negative shocks that afflicted the Colombian economy at the end of the 90s came both from the internal and external front. In the first case, the political crisis led by the judgment of the President by the Parliament and the worsening of the violence situation in the hands of the FARC and the paramilitaries.

In the external front there were considerable shocks, represented by devaluation and increased spreads of several emerging economies. It began with Mexico in 1994 and Russia, Brazil, Indonesia, Malaysia, Thailand, Korea, Ecuador and Argentina followed soon after. This country-

crisis led to a recessive cycle in Latin America, which reached its bottom in 1999, Colombian economy was subject to it (See Figure 12).

Another part of the analysis deserves attention: the Central Bank has been accused of focusing too much on inflation, leaving behind their responsibility on smoothing economic and labor market cycles. In fact, the constitution gave the Bank a specific role and the bank interpreted it in a more severe way. A 1999 Constitutional Court sentence illustrated this when the monetary authority was reminded that it should pay attention to labor fluctuations as well. There's no doubt and, has been documented, that long term, low and stable inflation is desirable. However, the over-emphasis made on controlling it had negative, short term effects. It also implied a loss of resources for the national government. Finally, it almost meant the disappearance of a shock absorber in the economic activity, role that the Central Bank had played for several decades. In our opinion, this last consequence has been the result of an excessive interpretation from the board members on what the Central Bank's target should be. The importance given to reducing inflation, rather than the short term smoothing of the economic business cycle, has been almost entirely a decision made by the board members, and not so much a constitutional mandate.

Figure 12. GDP cycle of Colombia and Latin America in the nineties



Source: DANE and ECLAC

In order to evaluate the relative importance of different phenomenon, economists use an analytical exercise which considers “contra-factual” scenarios. This basically consists of answering questions such as: what would have happened if...? Naturally, it's a hypothetical exercise and depends on the analyst's point of view. But, taking into account the previous paragraphs, one could wonder what could have happened if the oil wells hadn't been found? We believe that fluctuations in the 90s wouldn't have been avoided, but their magnitude could have been smaller.

In first place, real peso appreciation would have been much smaller and thus, household and firm's expenditure boom would have been moderate. On the government side, there's no doubt that the constitution wouldn't have been so generous, as well as the executive's laws and decisions along the decade. The country's access to external credit would have been limited, making it less vulnerable.

However, the economic liberalization would have still increased the transmission of external shocks to the Colombian economy and the independence of the Central Bank would have taken away its role of shock absorber and financial agent for the government and therefore, economic fluctuations would have increased anyway. The pension problem would have appeared anyhow, but the constitutional court's sentences on the "fourteenth wage" (*mesada cartoce*) and on the *pensión gracia* for the teachers would have probably been less generous if they had faced a famished state.

Summing up, we would not have lived in quite a different country from the one we are used to, but we could have spared the expenditure madness, bubble, implosion, recession, poverty that Colombia has experienced since 1997.

How should Colombia handle an eventual new oil boom? We believe that the only way is to pass a law, before any important discoveries are made. This is the only way a pillage policy can be avoided once a bounty treasure is at sight. The country's fiscal situation demands a serious definition of priorities in case a discovery is made. At the same time, the exchange rate effects, which had clear consequences during the previous decade, must be taken into account. Many countries have succumbed to the Dutch disease. Finally, the opposite scenario must also be contemplated promptly.

4. The outlook for oil and its fiscal impact

Oil prospects in oil-exporting countries have gained great relevance, with oil prices at this writing reaching \$125 per barrel. Even conservative forecasts point to an average annual price of \$95 p/b for 2008. Alas, Colombia's oil output, and reserves, have fallen steadily for the past decade. Total production dropped from 687,000 b/d in 2000, to 531,000 b/d in 2007, while reserves fell from 1.9 billion to 1.4 billion barrels. But the country has managed to slow the decline in both output and reserves, and in 2007, production actually rose from its 2006 level of 529,000 b/d, while reserves rose by 57.3 million barrels.

The scarcity, or moderate scenario, entails a reserve rise of about 2.3 billion barrels. It would require discovery of 1 billion barrels; another 1.2 billion barrels would be drawn from better recovery from existing wells (Figure 13). Any potential increase in production relies on the

results of recent and future exploration, and a number of enhanced oil recovery (special technology) projects, as well as the Llanos Heavy Crude Project. The Rubiales project also plans to raise output, from 22,000 b/d in 2007 to 100,000 b/d by 2010, subject to the authorization of an ambitious upgrading project.

The government aims to raise reserves by 250 million barrels per year, to a target of 4 billion barrels by 2020. That's twice as much as Colombia uses, so the country could resume substantial exports. Such a dramatic rate of reserve increase is quite ambitious, given that, over the past decade, reserves rose only 40 million barrels per year on average.

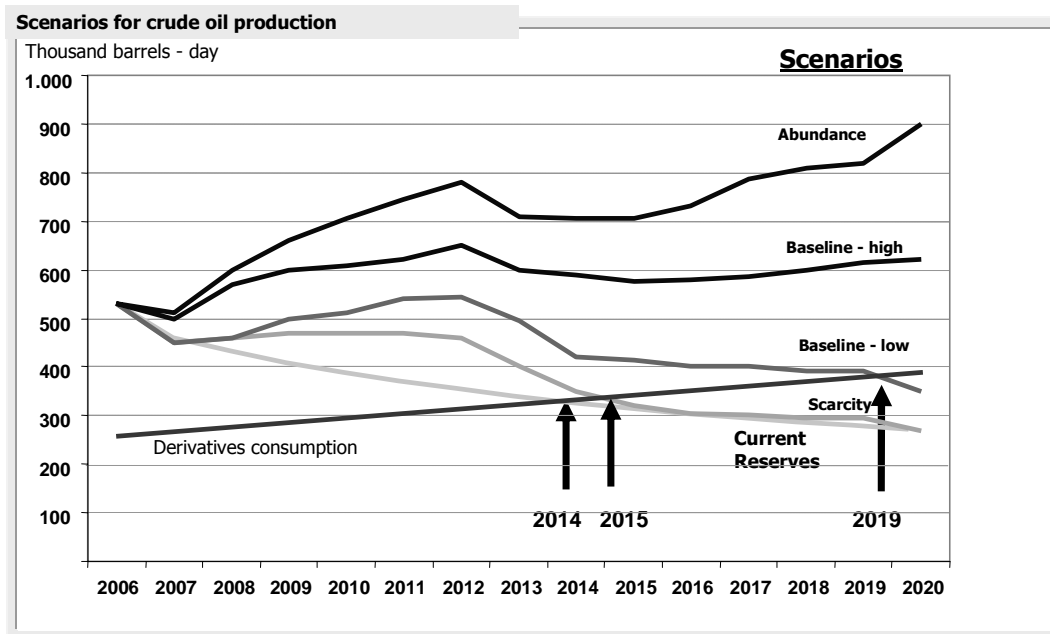
Given current proven reserves, oil self sufficiency should last until 2014, according to a study by the consulting firm Arthur D. Little (Figure 13). Ecopetrol's self sufficiency, though, is likely to end by 2009, according to 2007 forecasts. This implies that, starting in 2010, Ecopetrol would have to purchase oil from its associates in order to refine it. Yet, even under pessimistic exploration forecasts, total reserves should rise to extend Colombia's self sufficiency until 2015, and until 2019 under a moderate (scarcity) scenario.

The National Hydrocarbons Agency (ANH) calculates that investment of \$2 billion per year would be required to raise reserves to four billion barrels. This level of investment should be feasible at the current pace of FDI into the sector. FDI into the oil sector soared to \$3.5 billion in 2007, from less than \$2 billion in 2006. And, some say, it could reach \$5 billion this year.

This level of investment implies signing of 30 contracts and 60 new exploration (A-3) wells drilled per year, plus at least 10 discoveries of 20 million barrels each per year. ANH aims to sign 120 exploration and technical evaluation contracts by 2010. So far, 68 have been signed – but the number of contracts doesn't really correlate with exploration results. The ANH aims for 160 exploration wells drilled between 2006 and 2010; 95 have been drilled so far. The number of drilled wells increased from approximately 35 in 2006 to almost 75 in 2007. But only 40% of the wells drilled in 2007 yielded oil, but didn't add any significant impact on the oil resource base.

Five new contracts have been signed this year, three for exploration and production, and two for technical evaluation. Another 23 exploratory wells have been drilled, but only 10% were successful. This proves the sector has been very dynamic so far this year, receiving abundant capital. But we have yet to see the results from these investments, in terms of increased reserves.

Figure 13. Crude supply vs. local demand under various reserves scenarios

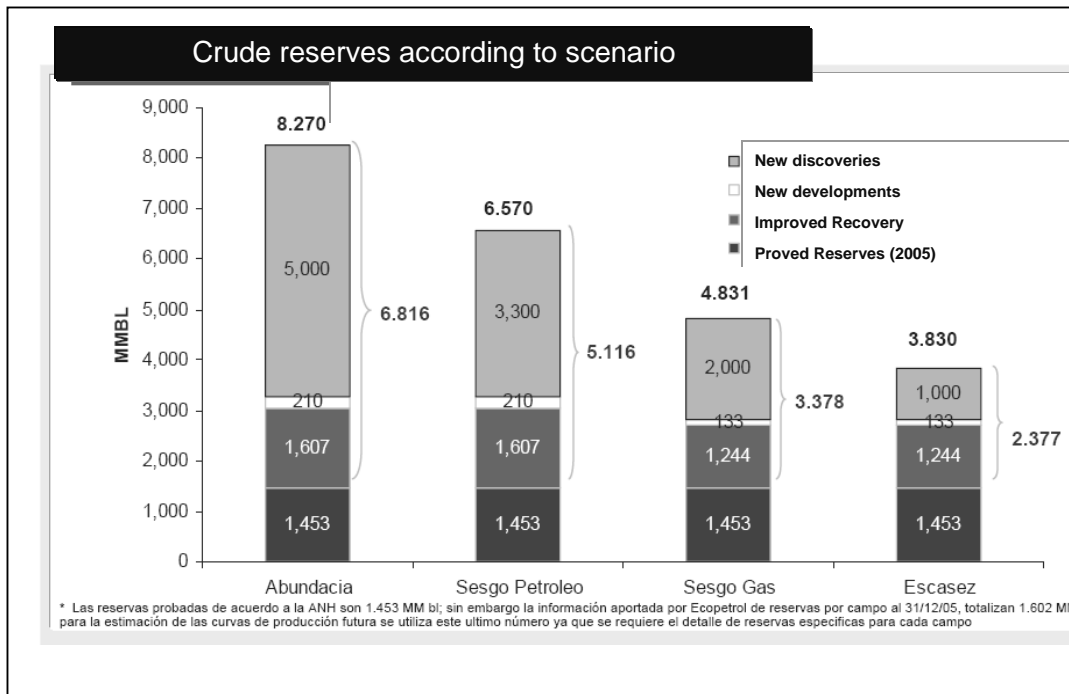


Source: Agencia Nacional de Hidrocarburos

Ecopetrol should play an important role in the oil sector’s development. In 2007 Ecopetrol helped drill 33 wells, 12 directly and the rest via association contracts. The success rate for these wells was 36%. Additionally, the company contributed 29.6 million barrels of new reserves. Of 531,000 b/d of production last year, Ecopetrol produced 399,000 b/d, raising its output by 14,000 b/d. Furthermore, Ecopetrol’s investment will swell substantially this year. That was one of the company’s main motives for going public: it wanted to be freed from the burden of participating in national fiscal accounts, so it could be internationally competitive. To that end, in 2008 Ecopetrol intends to invest \$3.7 billion.

The oil sector has had a substantial fiscal impact in Colombia, in three ways. First and foremost, until 2007 Ecopetrol was a state company, and its fiscal results contributed to the non financial public sector balance. Since the company went public in 2007 and “10% plus one share” is in the hands of its new shareholders Ecopetrol’s fiscal result no longer contributes to the Consolidated Public Sector’s balance. However, it continues to pay dividends to the central government, its main shareholder. These represent an important share of the capital resources that the government receives each year. Driven by climbing oil prices, contributions are major: COP 3.3 trillion in 2007, or 0.9% of GDP, from 0.6% of GDP in 2006. This figure is expected to rise by another 0.2% of GDP this year.

Figure 14. Scenarios for Crude Reserves (million barrels)



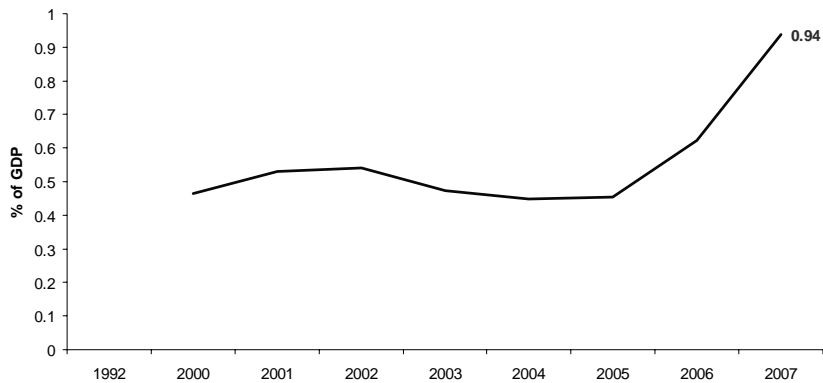
Source: Agencia Nacional de Hidrocarburos

Other channels through which resources from the oil sector affect the public sector balance include tax revenue, royalties and contributions to the oil stabilization fund FAEP. In 2006, tax revenue from the oil sector came to nearly 1% of GDP, or just over 6% of total tax revenue.

Higher oil prices should also be reflected in higher royalties to the regions. But these hardly ever translate into higher fiscal balances for regional governments, as the funds are usually spent right away.

Fuel subsidies also affect fiscal results. The government continues to subsidize fuel prices. Until last year, Ecopetrol paid this subsidy directly, but this quasi-fiscal responsibility was removed, to free the company from such a close association with national fiscal accounts. The central government pays the subsidy now, though it is financed by an Ecopetrol transfer. The cost of the subsidy is not really an expense for Ecopetrol; it simply represents the funds it didn't earn because fuel prices are not raised concurrently with oil price increases.

Figure 15. Ecopetrol's dividends paid to the Central Government (% of GDP)



Source: CONFIS and authors' calculations

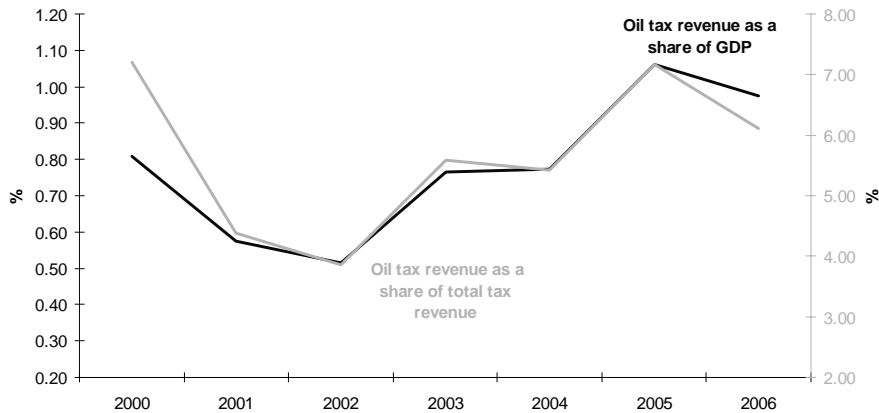
Fuel subsidies should come to COP 2.7 trillion this year, according to government estimates. This calculation assumed an average annual oil price of \$ 90 p/b, and an exchange rate of 1,989 pesos per dollar. At the end of 2008 the price of oil fell sharply to less than \$ 40 p/b, and the exchange rate depreciated substantially, surpassing 2,500 COP per USD.

The government initially intended to eliminate the fuel subsidy by the end of 2008. But the rapid oil price rise would imply monthly fuel price hikes of some COP 200 per gallon. That comes to a 3% monthly increase in the price of fuel, an idea unlikely to find any political support. So the government decided to keep the subsidy until December 2009. Until then, the government, and in turn Ecopetrol, expect to continue carrying the burden of soaring oil prices. For the man in the street, though, due to taxes linked to gasoline and diesel, domestic prices already are at, or even above international ones.

So the oil sector, despite shrinking substantially in recent years, is still crucial to the Colombian economy, both in terms of impact on GDP growth and for fiscal results. Oil exports soared 15.6% in 2007, to \$7.3 billion, while export volume was up just 0.3%. Oil exports still represent more than half of non traditional exports, and just under a quarter of total exports.

High oil prices should increase the appeal of investing in the oil sector to increase production, at least in the short term. But changes in the long term scenario for oil production haven't yet happened.

Figure 16. Oil Tax Revenue as a Share of GDP, and total Tax Revenue



Source: CONFIS and authors' calculations

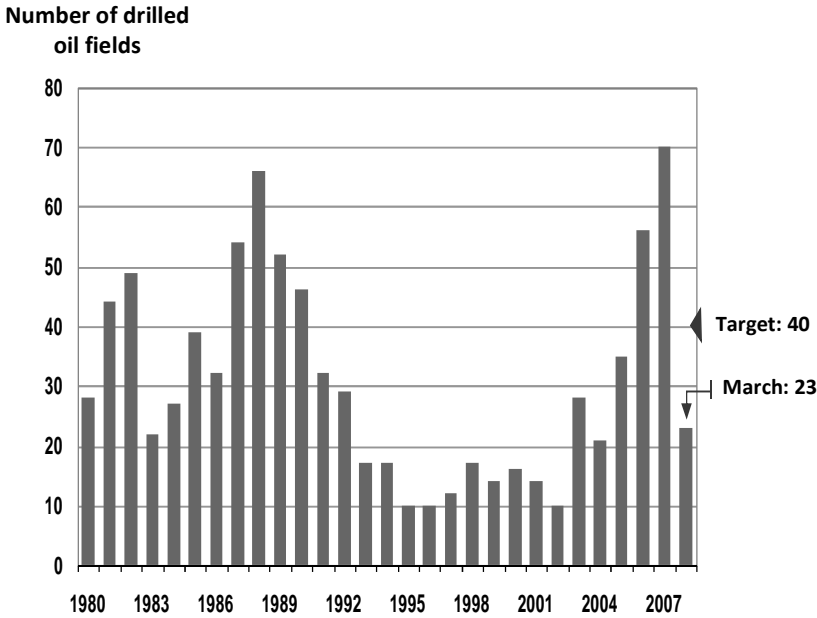
Let us now look at the brightest scenario. Figure 3 shows the peaks in exploration since 1918, and relates it to the new reserves found. The figure is quite revealing in the sense that dramatic increases in exploration led to substantial findings. That was the case at the beginning of the 1940s, the end of 1950s, and the beginning and end of the 1980s. Figure 17 shows that currently Colombia is exhibiting one of those exploration peaks; hence, should future resemble the past, the country should be at the verge of a huge discovery.

If that were the case, the lessons from the nineties should be learned. Macroeconomically, the huge fiscal mess at the end of the nineties owes much to the mirages of "Saudi Colombia" created at the beginning of that decade. Huge oil discoveries, that added in less than a decade 3 billion barrels to total reserves, led to over-expending, over-borrowing, loosening of budget constraints for public and private sectors, overvaluation, housing and mortgage credit bubbles, etc. Maintaining a cold head in the midst of considerable oil discoveries is something in which Colombia cannot lecture.

Colombia's alleged potential reserves are a debatable issue, and figures vary widely according to pessimistic and optimistic perspectives. In 2002 Ecopetrol presented a scenario in which potential reserves (to be discovered) in Colombian basins was estimated in 47 BBOE. Additionally, a recent study by Arthur D. Little for the ANH estimated a "scarcity" scenario of additional reserves in 2,4 BBO for the next 20 years, and a "probable" scenario of 5,1 BBO, subject to a determined level of investment and exploration activity. In turn, a study performed by Halliburton for the ANH suggested that there are more than 10 BBO in the underground of the Llanos basin, of which 20% could be recovered.

Although none of these figures of the undiscovered potential can be taken with certainty, all of them, reached by different methodologies, show a constructive view of the expected oil potential in Colombia. Such potential justifies investors' interest, and continued exploration in the Colombian basins. Basins such as the Piedemonte Llanero, or the Caribbean off shore are insufficiently explored and present attractive indicators. Mature sedimentary basins still present a series of opportunities which require the creativity of the exploration professionals. Furthermore, the potential of heavy crude in the Llanos Orientales represents an opportunity, which invites optimism.

Figure 17. Recent drilling activity in Colombia



Source: Ecopetrol and authors' calculations.

In addition to Colombia's oil reserve potential, the country offers favorable conditions for private investment, both national and foreign. This should provide a basis for the increase in exploratory activity in its different phases, and create the conditions for the country to maintain its condition as an oil exporting nation.

5. Conclusions

Colombia has a history of regulatory changes that makes potential investors still unsure about the guarantee that they will be able to keep the fields until depletion, or that new conditions (taxes and government participation) would not be imposed above those agreed upon. Indeed, the unstable regulation of the nineties is a revealing and troubling signal that this could happen. Nonetheless, in recent years, and given the lack of success in the addition of new oil reserves, the Colombian government has made an important effort to strengthen fiscal conditions to attract new investors. Additionally, international oil prices have played a special role in attracting investors; periods when investments rose coincided with soaring international prices.

We attribute to the short lived oil boom an important share of the disastrous macroeconomic performance of the end of the nineties. The channels of transmission were basically the relaxation of the intertemporal budget constraints of government, firms and households.

How should Colombia handle an eventual new oil boom? We believe that the only way is to pass a law, before any important discoveries are made, defining the use of increased state resources. This is the only way a pillage policy can be avoided once a bounty treasure is at sight. The country's fiscal situation demands a serious definition of priorities in case a discovery is made. At the same time, the exchange rate effects, which had clear consequences during the previous decade, must be taken into account. Many countries have succumbed to the Dutch disease. Finally, the opposite scenario must also be contemplated promptly.

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