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The Practice of the Auction Theory: The Colombian Case*

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Abstract

In the world the use of auctions has shown two important trends: 1. their use has been extended to a greater number of countries and sectors, 2. the set of objects auctioned has increased exponentially. Colombia is not an exception. The number of auctions and items in the country is huge, the sums of money very large and in some cases the mistakes made are tremendous. Given that, it is strange that there is no existing article explaining the most important auctions used in the country. The present paper describes the principal auctions held in Colombia over the past 20 years. Each auction is described in detail characterizing not only the allocation process, but also some results and conclusions. The work shows how the use of simple economic theory can allow us to understand the mistakes present in some auctions (Third Channel Auction) or to learn from auctions that have proven to be successful over time (electricity sector). This review is sufficiently broad, to cover cattle auctions through to financial ones; sufficiently geographically decentralized, to include agents from both, forested areas and big cities; and sufficiently transversal, to cover the public and the private sectors.

Keywords: Auctions, Privatization, Optimality, Efficiency.

JEL Classification: D44, L94, L95, L96, L98 ,G28

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1 Introduction

Auctions can be used as a selling mechanism when some products or assets do not have a standard price, or when a seller is uncertain about the value considered the maximum amount that participants are willing to pay for the objects being sold. When the bidders know the exact value of the object for themselves (*but not the valuation that other bidders have*), this is called private valuation. But when there is only an estimation of these values, and these are affected by information available to other bidders, they are known as interdependent values.

There are several factors used to evaluate the performance of auctions in different formats. Auctions are evaluated in two different aspects depending on the context. One is from the auctioneer's perspective, where the auction is expected to get the highest revenue possible (auction optimality). This could mean that the sale price is the highest. The other is the social perspective whereby it is expected that the auction will be as efficient as possible (i.e. the auction winner is the competitor who values the object the most, therefore, the result will provide greater benefit to society as a whole).

Efficiency is usually required by government agencies, sometimes sacrificing income; since they prefer efficiently allocated objects that improve social welfare and benefit society as a whole rather than assigning them to improve individual utility. Meanwhile, auctioneers who are only concerned with earning as much money as possible seek optimality. This is the case for charity auctions, art auctions, etc. Yet, these two are not the only targets to be considered as criteria for the design or conduction of an auction, as there are other activities like: preventing collusion among participants, stopping participant's predatory behavior and avoiding entry deterrence; to mention only a few examples.

Every day, the world is relying more and more on auction design. For example, the USA, Finland or even the Turkish government (see Chari & Weber (1992), Keloharju, Nyborg & Rydqvist (2005) and Hortacsu & McAdams (2010)) use auction mechanisms to allocate their securities among a wide variety of countries.

Colombia is not an exception, and auctions have become widely used; however, reviewing Colombian auctions of over the past 20 years is a very complex task. The complication is down to the fact that there are some mechanisms in Colombian daily life which resemble auctions; hence a very careful selection has been made as it would be impossible to include them all. One example is the tenders. They can be seen as auctions because the process beneath the mechanism works quite similarly. Tenders, are public contests, where participants use offers to compete against each other, similar to a first price auction. One important characteristic is that every participant makes her or his best offer and judges choose among the bidders, based on criteria of what they consider the best offer. Of course, many differences between tenders and auctions

can be pointed out and political issues such as lobbying or corruption could be argued. The important point is that tenders can be treated as auctions, and in Colombia thousands of them have been held by the government in their public recruitments. Nevertheless, as impossible as it is to include all the tenders that have been held, this survey includes a couple of them only to point out their existence and their similarity to auctions.

This study analyses the most relevant auctions held in the country over the last two decades, with their respective results and conclusions regarding the criteria previously mentioned. In the following chapters we study three specific industries of the Colombian economy: electricity and gas; communications; and the financial industry. Finally, in the last chapter of this survey, auctions held in other sectors are reviewed.

The scope of this paper takes into account auctions ran by the public and the private sector in each of these industries. Moreover, the idea of this survey is to encourage some reflection about the important aspects of auction design and the goals of each auction in terms of optimality and efficiency. A brief but complete description of each auction mentioned in this document can be found in Appendix 1, as well as a summary table regarding all the topics treated in this article. However, the purpose of this document is not only to summarize facts, but to expose the successes and errors of Colombian auctions based on what literature has to say about desirable properties in auctions. In Colombia, some problems concerning auction results may be due to the fact that in many cases only one bidder participates. This implies that competitiveness can not be achieved and this leads to loop holes such as market imperfections. Moreover, sometimes it is difficult to make a clear analysis or evaluation of the optimality and efficiency of these auctions.

Finally, this paper intends for the reader to critically question the key aspects of auction design in the Colombian context, and, to consider the importance of auctions, as powerful and useful tools in solving problems due to information asymmetries. With this in mind, and very close attention to key details, successful auctions, like those of the Colombian treasury bills, will be more common; while embarrassing mistakes, present in several auctions undertaken by the Colombian government, will hopefully become part of Colombian auction history.

2 The Electricity and Gas Industry

In this research, the electricity and gas industry is understood as all the institutions which produce, carry, distribute or commercialize electrical energy, gas or petroleum and its derivatives, among others that have been involved in an auction as bidders or as auctioneers. Other cases may be seen when assets concerning electricity, gas or petroleum are being auctioned, or when the production of this energy is auctioned as well.

2.1 Energy Spot Market Auction

2.1.1 General

Since July 20th 1995 the energy market system administrator and operator XM¹ manages the spot market, created in order to implement a competitive market scheme. In this market there is a Multiunit (*Sealed-bid*) Uniform auction running on a daily basis. To participate in these auctions, firms must have the title name of E.S.P (*empresa de servicios publicos*), public utility company. This is a day-ahead market, in which the generating agents make their unique price offer or bid, at 8:00 am for the next 24 hours with the expected hourly generation availability. This price bid is expected to reflect the variable costs for the firms plus a generation risk component.

The same day of the auction the market operator publishes, for all agents, their price bids, discriminated by generating agent and technological source as well as the hourly energy that each one has to supply at a determined uniform hourly price (*spot price*).

The market mechanism allocates the energy among generators in order of merit, from the minimum to the maximum variable cost, in which the demand doesn't participate at all. The spot price is the bid of the generating agent which was the marginal firm, the one which fulfilled the total demand with its offer. The daily load curve can be divided into three different time intervals: 7:00-9:00, 9:00-19:00 and 19:00-21:00. The middle one is the base load and the others are the peak load. It is expected that the price rises during the peak hours because as there is more demand the marginal plants tend to be the plants with higher costs (i.e. *thermal plants*) which charge higher prices.

If an agent has a real generation which is bigger than what is established in the ideal dispatch, it generates more than was planned, a price equal to the minimum is paid between its price bid and an exogenous limit price. This is called a positive reconciliation and it depends on the generating technological source established by the market regulator CREG². A negative reconciliation can also happen if the agent generates less than it was planned, and it has to pay the average between the agent's bid (*price*) and the spot price, which is fixed, and doesn't depend on the technological source.

Due to the volatility of the spot market, generators establish bilateral contracts with big consumers or with intermediaries. Also, through Firm Energy Obligations (*FEO*), firms that have been adjudicated in an FEO auction³ receive a fixed income. The total income³ received by the firms can be seen as a portfolio of

¹Further information can be obtained <http://www.xm.com.co/english/Pages/default.aspx>

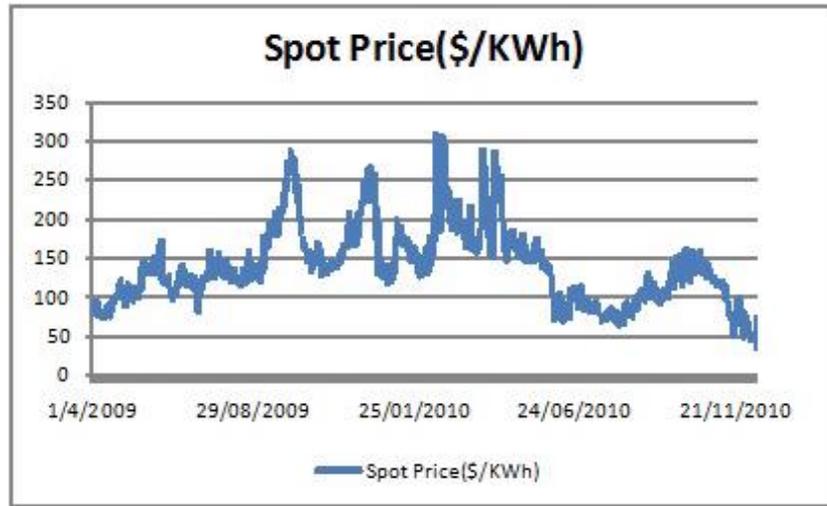
²The CREG is a gas and energy regulatory commission. Further information can be found at the following website http://www.creg.gov.co/html/i_portals/index_ingles.php

³See Colombia's Firm Energy Obligations (FEO) Auction.

Bilateral Contracts, FEO, and Spot Market.

2.1.2 Results

The Most important firms (*firms with more capacity participation in the market*) which participate in this auction every day are: EMGESA, EPM, CHEC, GECELCA, ISAGEN, EPSA, AES CHIVOR, GENSA, TERMOCANDELARIA, TERMOFLORES, TERMOCALI, MERIELECTRICA, TERMOTASAJERO, URRRA AND PROELECTRICA.



Source: XM.

Calculations: Authors

The daily or monthly price results can be found on XM homepage.

2.1.3 Conclusions

The Spot Market auction is a daily mechanism, in which bidders participate and further their knowledge in how to "play". Thus bidders are able to collude with others so that their benefits, within the price settings, rise. However, this kind of behavior is hard to prove in a multiunit auction held every day of the year.

In this market there are few agents who have a high percentage of the installed capacity (6 participants with 81% of total capacity). Therefore, as these participants bid in this auction through their plants, they somehow contribute to an implicit predatory behavior resulting in entry deterrence of the auction. New entrants or new electric generation projects of different agents have few incentives to compete in this market, because constructing new generating plants requires high capital investment as well as competition with companies that have huge capacity in a market with oligopolic characteristics.

Because of this, the efficiency⁴ of the auction is questioned; moreover, the efficiency is important because we are dealing with a public service and the price setting reflects on the prices consumers have to pay.⁵

2.2 Auction of ECOPETROL's refinery REFICAR

2.2.1 General

In August 2006, the Colombian Government and the board of ECOPETROL S.A⁶, the country's major oil company, ran an auction looking for a strategic investment partner to execute the expansion and modernization project of the refinery in Cartagena, northern Colombia, awarding 51% of share participation in Reficar. The winner of this auction had to execute the engineering, procurement and construction. Moreover, in partnership with ECOPETROL, it had to convert the old Mamonal crude processing in to the most modern in Latin America.

This project was expected to produce 70 thousand to 140 thousand barrels of diesel fuel and gasoline a day from 2011 on, as well as improve the quality of liquid fuels. One of the main concerns of this project was to generate at least 5000 jobs in the poor areas that surround Cartagena and contribute to the improvement of the industrial development in the Caribbean region.

The sale mechanism was that of an ascending auction (*English*) with successive rounds, in which the reserve price was not revealed.

At the auction prequalification, four companies were allowed to participate: Petrobras from Brasil, Glencore International AG from Switzerland, BP Corp. from North America and Marubeni Corp. from Japan. The two latter companies didn't present any offer to participate in the auction, and so, the only participants were Glencore International AG and Petrobras.

2.2.2 Results

The auction lasted two rounds. In the final round Petrobras bid \$US 595 million, but Glencore International AG bid \$US 630.7 million and won the auction. Despite bidding that amount, it had to pay \$US 656 million, which was the amount valued for 51% of the project. Finally, the reserve price was announced in \$US 625 million.

For such an important investment project, the adjudication price was very close to the reserve price. Thus, the reserve price should have been set higher; because, hypothetically, in this type of auction when

⁴More information in Espinosa, Miguel A. (2009). In Spanish.

⁵More information in Espinosa, Miguel A. and Riascos, A. (2010).

⁶More information in <http://www.ecopetrol.com.co/english/>

the reserve price is higher, the revenue rises.

2.2.3 Conclusions

The refinery auction held by REFICAR is a distinguished design among all auction formats and it allows for the adjudication price to increase more and more surpassing the reserve price. On the other hand, having successive rounds implies that bidders learn how to form cartels in the auctions, this affects the auctioneer's profit. The auction design would lead us to think that the main goal was the auctioneer's revenue, but, in fact, the results show the opposite as the auctioneer didn't earn as much as expected.

In this auction, there were only two potential bidders participating, with only one bid surpassing the reserve price (the adjudication bid); this shows a problem of optimality in this auction, because none of the participants had the incentive to pay more than what the auctioneer expected or the reserve price was not well set. Literature has shown that a high initial price not well established could result in shoddy auctions.

The auction winner didn't have any experience in refineries, it would have been important for the auction to have any technical or experience requirements for the participants, because default risk could have been avoided. In fact, this happened with the auction winner, Glencore, which wanted to postpone the work or to default it, arguing that there were liquidity and credit problems due to the 2008 international crisis. Some government agents considered the firm's inexperience as the reason for the default.⁷

2.3 Ecogas State-Owned Gas Company Auction

2.3.1 General

On December 5th 2006, the national government ran an auction to sell the capital rights and contracts of Empresa Colombiana de Gas (*Ecogas*). Until that date it was the most important Colombian gas transportation company with a pipeline network stretching around 3,700 kilometers.

The first stage of the privatization process was held on the 29th of September of 2006. In which by law the national government had to offer State-owned properties to the pensions and employees funds, unions, cooperatives and other social organizations.

For this stage, the only qualified institution was a pension fund, which offered COP \$1.96 Billion, which was below the 10% expected by the government. The bid was rejected.

The next step for selling Ecogas was an auction. This was a first price sealed bid auction with successive rounds, with a reserve price not revealed until the end of the auction. The auction ended when the highest

⁷More information can be found on <http://www.portafolio.com.co/archivo/documento/CMS-4767265> (In Spanish)

bid exceeded the second highest bid by 5% and surpassed the reserve price.

The prequalified companies for the auction were: Empresa de Energía de Bogotá (*EEB*), Prisma Energy International-Promigas, Promotora de Desarrollo de América Latina S.A. de C.V. from Mexico, Interconexión Eléctrica S.A. (*ISA*), Embridge from Canada, and Corporación Financiera Internacional from World Bank.

Only the first two companies actually took part in the auction: Empresa de Energía de Bogotá (*EEB*) and Prisma Energy International-Promigas, because the other companies did not present the technical offers required to participate.

2.3.2 Results

The auction only had one round, with Prisma Energy International-Promigas offering around COP \$2.885 billion, and with *EEB* offering COP \$3.25 billion. There was a secret reserve price revealed later of COP \$2.2 billion. Ending the auction with *EEB* as the winner surpassing the second bid by around 12.65%, as well as exceeding the reserve price, as stated in the rules of the auction.

2.3.3 Conclusions

The auction resulted in a competitive adjudication price, approximately 47% higher than the reserve price, with a high revenue for the auctioneer. Although there were only 2 participants, some other important companies passed the prequalification period with the intention of participating in the auction, so there were plenty of opportunities for new entrants.

In this auctions held by the national government, efficiency was an essential concern. The results don't necessarily illustrate that the winner of the auction valued the object the most (holding rights of such an important gas transportation company). The fact that the gap between the adjudication bid and the second highest was 12%, could show evidence of the winner's curse.

2.4 Auction of Three Power Companies

2.4.1 General

On February 26th 2008, the national government ran a sealed-bid first price auction for shares of three electric power companies, these were the Cundinamarca (*EEC*), Santander (*ESSA*) and Norte de Santander (*CENS*) power companies. The main purpose of the auction was to raise money for the national government budget (*optimality*). The auction was first planned to sell five power companies with expected revenues of

at least COP \$1 billion, but the Boyacá (*EBSA*) and Meta (*EMSA*) power companies were not taken into consideration in the final auction. After the auction, the three companies remained public because they were bought by a suitable public operator (*previously selected between the two showed below*) in partnership with respective departmental governments. The auction was simple, the partnerships, independently of each department, presented sealed-bids that had to surpass the reserve price previously established by the national government and not published for the total shares owned by the national government (*not necessarily 100%*).

The operators selected by the departmental governments were: EPM (*Empresas Publicas de Medellín*) by Santander and Norte de Santander departments, and EEB (*Empresa de Energía de Bogotá*) for Cundinamarca departments. The operators had to acquire a minimum of 50% plus one share.

The government actually auctioned the following: 79% shares of Norte de Santander Power Company (*CENS*), 82% shares of Santander Power Company (*ESSA*) and 88% shares of Cundinamarca Power Company (*EEC*).

2.4.2 Results

EPM acquired around 77% of Norte de Santander’s Power Company (*CENS*) shares for COP \$180,000 million, which had a reserve price of COP \$165,130 million. The departmental government of Norte Santander kept 8% of the shares they owned, and 12.5% went to Coffee Committee.

EPM acquired 74% of Santander’s Power Company (*ESSA*) shares for COP \$373,000 million, which had a reserve price of COP \$365,769 million; the departmental government of Santander kept 22% of the shares and the municipality of Bucaramanga kept 2.76% of their shares.

EEB in partnership with the departmental government acquired 88.1% of Cundinamarca’s Power Company (*CENS*) shares for COP \$211,681 million, which had a reserve price of COP \$120,220 million.

The total revenue for the national government from selling the three Power Companies was around COP \$764,000 million.

The results shown above, are summarized in the following table:

Table 1: Auction Results for the Three Power Companies

Power Company	Shares Sold	Reserve price (COP \$Million)	Winner	Acquisition Price (COP \$Million)
CENS	77%	165,130	EPM	180,000
ESSA	74%	365,769	EPM	373,000
CENSA	88.10%	120,220	EEB	211,681
Revenue			COP \$764,681 Million	

Source and calculations: Business News Americas.

The results show that the CENS auction was won by EEB with a bid that exceeded the reserve price by almost COP \$90,000 million. The national government raised more than was expected with this auction, but Cundinamarca's departmental government and EEB may have saved a lot of money.

2.4.3 Conclusions

The Auction sale of the three Power Companies had only one potential bidder per company which became the winner of each one; this shows that there were no incentives for new entrants to participate. This was a problem, due to the lack of competition, in terms of the main objective which was to raise the government's revenue. So perhaps if the auctioneer designed a more competitive auction the revenue would have been even bigger.

Although the aim was for the power companies, to remain public, these auctions could have had more than one participant per auction, so a more competitive auction would have been held with bigger revenue for the national government.

The lack of competitiveness may have been a problem of entry deterrence and implicit predatory behavior since the departmental governments picked these huge public companies, restricting other participants from taking part in the auction against these potential bidders. Another reason may also have been the restrictions within the auction design.

The results show that in the CENS Auction, despite the fact that the national government raised a lot of money, EEB and the department of Cundinamarca overestimated the value of the company and they ended up paying more for it than what it was worth. This is known, in auction literature, as the winner's curse.

Well known in theoretical field, is the fact that first price sealed bid auctions are not efficient and also that the reserve price could raise higher revenues, but the most important idea is that in an auction there has to be competition in order to develop strategic behaviors. Total lack of competition, as in this case, can generate the worst results in terms of revenue because each "bidder" attached to each power company has a bargaining power in the sense that nobody else is competing for that market and also political pressure on the government make a suitable environment for low revenues.

The problem here is not about the auction design they chose, the actual problem is that the dynamic of the "auction" doesn't show auction characteristics at all. However, this entry problem could be an issue related to political statements, such as the idea that territorial entities were the appropriate candidates

to participate. On closer analysis, entities nearer the power companies would have lower transaction and administrative costs, and also they are more likely to choose suitable operators in the area that by nature have lower costs in the market. For example, EEB, one of the suitable operators, was an operator in the Cundinamarca area, where ECC the power company was located. This implies a direct relationship with local governmental entities. Therefore, these entities are more suitable candidates to be elected as auction participants, leading to a decrease in other potential candidates.

The main idea lies in the political context in which this “auction” was run.

2.5 Colombia’s Firm Energy Obligations (FEO) Auction

2.5.1 General

Taking into account that a large proportion of the electricity in Colombia is produced by hydro generation (*approximately 67%*), hydrological phenomena and constant climate change may give rise to shortages causing great volatility in prices spot market (*power exchange*), leading to a greater risk for both existing and new generators seeking to invest in such projects.

The mechanism implemented by Comisión de Regulación de Energía y Gas (*CREG*) and administrated by XM Compañía de Expertos en Mercados S.A ESP was an auction of Firm Energy Obligations (*FEO*) needed to cover the energy demand. This mechanism was needed to ensure the system’s reliability by providing incentives for investments in new resources to assure enough firm energy –the ability to provide energy during dry period– to fulfill the future demand in times of scarcity at efficient prices reducing investors risk as well as cost to consumers. Under this scheme, the generators which were assigned with FEO have a fixed energy payment when the spot market price surpassed, for at least one hour a day, the scarcity price.

The auction was held on May 6th 2008 with FEO starting from December 1st 2012 until November 30th 2013. First there was a prequalification period, where existing generators and new investors sent information required to participate in the FEO allocation. This auction has a uniform price formation and is held whenever needed depending on energy demand forecasts and is held 4 years in advance of the commitment period.

XM runs a descending clock auction⁸; like a descending multiunit uniform auction with multiple rounds, in which the price was the highest winning bid. This auction was opened with a starting (*reserve*) price of 2 times CONE (*Cost of new entry*), initially set administratively by the CREG. The first round was sealed at a closing price set by the auctioneer. New plants submitted their bids during the auction while existing

⁸More information in Cramton, P. and Stoft, S. (2007) and Harbord, D. and Pagnozzi, M. (2008).

plants submitted their bid previous to the auction, with the possibility of temporary withdraws at certain prices, like a sealed-bid auction for the existing plants. Between the starting and closing price of the round, the bidders (*new plants*) presented quantities to supply at certain prices consistent with an upward sloping supply. These bids were not published; it was a sealed-bid format. Then the administrator constructed an added supply and announced an excess of supply. With this, it calculated a new closing price for the second round. Then the bidders again answered this with an upward sloping supply. The process continued until the supply and demand were balanced.

2.5.2 Results

There were 78 projects presented at first of which only 10 projects were actual participants of the auction, they were property of 8 bidders with new plants. There was a total of 18 participant bidders, including bidders with new and existing plants. The starting price ($2*CONE$) was 26.09 US\$/MWh and the closing price for the first round was 22 US\$/MWh. The auction lasted 6 rounds, with a closing price of 13.998 US\$/MWh.

The Scheme of the rounds is shown below:

Table 2: FEO Auction Rounds

Round	Starting P. (US\$/MWh)	Closing P.(US\$/MWh)	Supply E. (GWh/year)
1	26.09	22	8355
2	22	20	7851
3	20	18	4537
4	18	16	3467
5	16	14	907
6	14	12	-1765
Auction Closing Price			13.998 US\$/MWh

Source: XM.

This table shows each round of the auction, with its respective starting and closing price, and the supply excess announced by the auctioneer at the end of each round.

Firm Energy was allocated to 47 existing plants and to 3 new plants, belonging to different bidders, of which one is owned by a new market participant (*GRUPO POLIOBRAS S.A*). These new plants and allocations were assigned as follows:

Table 3: FEO Auction Winners

Firm	Plant	FEO (GWh/year)	Technology	Installed Capacity (MW)
Isagen S.A E.S.P	Amoya	214	Hydroelectric	78
Grupo Poliobras S.A	Termocol	1,678	Natural gas/ Diesel (Fuel oil)	201
Gecelca S.A E.S.P	Gecelca 3	1,117	Coal	150

Source: XM.

This table shows the winners of the auctions, specifying the firm that owns each plant, or electric generation unit, with the firm energy allocated the technology and the production capacity installed.

The total assignment including existing generating plants was 65,869 GWh/year, of which only 3009 GWh/year (4.56%) were allocated to new plants.

The auction closing price (13.998 US\$/MWh) was higher than the CONE (13.045 US\$/MWh), which was the target or optimum price expected.

Of the 10 new plants belonging to the 8 bidders, only 1 was a Hydro technology plant, while the others were Coal, CC-GAS, Fuel Oil and Gas technology plants.

2.5.3 Conclusions

This FEO auction mechanism has a robust design with rules that mitigate the exercise of market power and allow new entrants with different technological sources to take part. However, it provides incentives for collusion, since a generator (*bidder*) can have several plants and bid for each one independently bidding in a way that it takes the biggest revenue possible. Also, if this generator faces becoming the marginal plant with different capacity plants participating, it can withdraw plants in a way that it fixes a convenient price with the highest capacity being allocated.

Despite the aim of improving the system's reliability, a Hydro technology plant was adjudicated. The goal of ensuring the reliability was not completely achieved because more Hydro capacity was added to the market, somehow affecting the efficiency of the auction, due to the fact that the plants with less nature-social costs are thermal plants. Anyhow, the resulting price was higher than the expected efficient price, showing that new entrants tend to bid more than their valuation⁹, or that CONE was somehow just an expected price.

The information revealed by the auctioneer did not necessarily influence the bidding behavior of the new plants, as it is supposed to work theoretically with multiple round auctions. This can be explained because

⁹More information in Forero,G. and Espinosa, M. (2011).

variations in the excess of supply were not clear in terms of what kind of bidder retired from the auction, a new or an existing plant, this distinction could have been relevant for bidders.

In energy markets, where auctions are held daily, the uniform auction design is particularly vulnerable to collusion (*tacit or explicit one*), because every bidder must submit a curve according to their position in the market (*either demand or supply*). For example, in the case that bidders have to bid a demand curve for every price level, one form of collusion is when each bidder bids higher prices for small quantities (*see Klemperer, 2003*) and a deviation from this collusion results in a higher cost for everybody. In the same way, when every bidder is bidding a supply curve, they could bid lower prices for small quantities hoping that the added supply curve has a high upwarding slope. Therefore, this mechanism (*especially in an energy market*) needs a high entry to avoid any type of agreement.

In the end, revenue wasn't a problem; this mechanism actually worked, some improvements could be made, or a more efficient mechanism can be implemented (i.e. *Vickrey design*). Some important data is that only 3 new plants were adjudicated with FEO (out of 10), against 47 existing plants; of these new plants adjudicated, one was Hydro technology, another Gas/Fuel Oil and the last was Coal as shown in Table 3.

2.6 Auction for the Available Production of Firm Gas

2.6.1 General

On December 17th of 2009, ECOPETROL S.A ran an auction for the available production of firm gas to offer in Casanare (A state in the Colombian east) fields of plant LTO-II in Cusiana's Oil well. The product offered was a uniform offer of firm gas of 32.821 MBTUD (*PDOF*) from the 1st of August of 2010 until the 5th of June of 2015 to supply plant LTO-II in Cusiana.

An auction took place due to the regulations that state that if the purchase request exceeds the PDOF, the sale has to be undertaken by auction. Which was exactly what happened between 2010 and 2015.

The participants who took part in this auction satisfied certain legal requirements declared previously by the auctioneer and they had to pay a guarantee of seriousness of US \$1.219.920, corresponding to the 10% of the minimum quantity available for buying.

The mechanism used, was that of an ascending multiunit open electronic auction (*English Auction*)¹⁰ with successive rounds, in which the price was uniform for all the winners. The whole auction process and some of the rules are described below.

¹⁰Further information can be consulted in REGLAMENTO DE LA SUBASTA CON LAS MODIFICACIONES DEL ADENDO No. 1, 2, 3 y 4. Diciembre 2009 Bogotá, Colombia. (www.ecopetrol.com.co) (In Spanish)

There was a starting price for the first round of 3.40 US\$/MBTU. The auction ruled that the minimum purchase offer was to be 2,000 MBTU and the maximum, 32,821 MBTUD (*PDOF*). The auction was electronic so the bidders submitted their bids via internet with an electronic tool supplied by ECOPETROL S.A.

According to the rules, the maximum variation of the price between rounds is the 5% and the minimum variation would be the previous round's elasticity. At the beginning of each round the auctioneer published the starting price, the smallest and largest offer as well as the demand excess from the previous round. During the auction the participant could only bid one offer per round, and as the price increased the bidder could only maintain or reduce the amount offered. If the bidder did not send an offer in a determined round the rules stated that this would be considered a retirement offer. If any of the rules were unfulfilled by the bidders, they were disqualified from the auction.

When the sum of valid offers made by the bidders was less or equal than PDOF then that was named the last or adjudication round and the residual supply was calculated. This final round had 2 stages. Stage 1: The auctioneer assigned the quantity of valid offers made in the previous round. Stage 2: The participants made a price bid for the total excess of supply, in which the price bid had to be at least the same as the closing price from the previous round. After a bid was sent, the participant could see all the price bids made by the contenders in a descending ranking and it could send more price bids until the remaining time expired, with the condition that it had to raise its own bid by 0.01 \$US/MBTU. The winner of the excess of supply was the one with the highest price bid. If there happened to be a tie in the highest bid price, then, the one who first made the bid had won.

The price of adjudication was uniform. It depended of the initial price of Stage 1 of the final round, the highest price bid for the excess of supply (*Stage 2*). The quantity allocated in Stage 1 and the quantity allocated in Stage 2 (*excess of supply*).

Eighteen companies qualified to participate in the auction. Some of these were: EMPRESAS PÚBLICAS DE MEDELLIN E.S.P. (*EPM*), ISAGEN S.A. E.S.P., GAS NATURAL S.A. E.S.P. and PETROBRAS COLOMBIA LIMITED.

2.6.2 Results

The results of the auction were: A price of 6.14 US\$/MBTU, for August 2010 and modified by an index. The quantities allocated with the respective company were:

Table 4: Auction for the Available Production of Firm Gas

Company	Quantity (GBTUD)
Isagen S.A E.S.P	19
Mansarovar Energy Colombia LTDA	6.8
Gas Natural S.A E.S.P	4
Petrobas Colombia Limited	3
Total	32.8

Source: Aguilar, P., Roda, P. & Sánchez, G. (2010). Consideraciones regulatorias, precios de bolsa y subasta de gas. Informe 46-2010. Superintendencia de Servicio Publicos.

The results of this auction showed that the adjudication price was high compared to the gas regulation price. However, the quantity auctioned (32.821 GBTUD) is very low compared to the quantities demanded on the market, reaching more than 350 GBTUD; with only 9.37% of the market needs auctioned.

2.6.3 Conclusions

This auction held by ECOPETROL S.A had a format in which it is common for the bidders to collude because of bid signaling due to the open format, or to employ predatory behavior because strong bidders can make public their will to overbid every attempt made by other bidders to win the object and not allowing new entrants to participate. However, the fact that this was an electronic auction, gave this format sealed bid characteristics, allowing more participants to take part in the auction, having no entry deterrence at all (*Klemperer, 2003*).

The results highlight the efficiency of the auction, given that the resulting price¹¹ resulting from it was high compared to the normal regulation price. This was important because, on the whole, participants revealed their costs and their true willingness to pay for providing the firm gas. However, if another kind of auction is held, participants would learn from experience, and possibly collude or tend towards lowering the price. This is why the format should be changed to a uniform sealed bid electronic auction with successive rounds, so that there would be no accesible information as in the open format; which allows the bidders to collude.

¹¹More information in CONSIDERACIONES REGULATORIAS, PRECIOS DE BOLSA Y SUBASTA DE GAS. Informe No 46 -2010. Superintendencia de Servicios Públicos. (In Spanish)

3 The Communications Industry

In this document, when we refer to the communication industry we mean all the institutions that participate in different media services, such as radio, television, telephones or cell-phones and that have been involved in an auction as bidders or as auctioneers. Other cases may include the auction of companies that have licenses for radio electric spectrum, radio frequencies or TV frequencies or when these kinds of licenses are auctioned as well.

3.1 Personal Communication Services (PCS) Auction

3.1.1 General

Between late 2002 and early 2003, the Colombian Ministry of Communications (*Ministerio de Comunicaciones*)¹² held an auction (*multiunit but could also be sold as one package*) to adjudicate licenses for providing Personal Communication Services (PCS)¹³. These services allow voice, data and mobile or fixed image transmission with a license of 30 MHz provided within the frequency bands 1.895MHz-1.910MHz and 1.975MHz-1.990MHz of the radio electric spectrum, in each of the three different regions in which the country was divided (*Eastern, Western and North*). There was the possibility of adjudicating more than one region for a single bidder (i.e. the bid could be for each region or for a package of regions).

With the introduction of new mobile services operators in Colombia, it was expected that the market conditions would be modified, eliminating the duopoly of Comcel and Celumovil, which had really high rates, thus generating competition which benefits the consumers with favorable rates, high quality service and improving the coverage area. The winner of the auction (*new operator*) was expected to have conditions to compete against the existing operators.

There were some important aspects or purposes stated: i) transfer the majority of oligopolistic rent calculated by the stakeholders to the state, ii) create competition among the stakeholders, iii) transfer the last portions of oligopolistic rent derived from the synergies of the operators to the state, iv) implant a simple mechanism that achieves these objectives, v) provide an objective and transparent mechanism in light of potential stakeholders, so as to provide an atmosphere of confidence about how they will adjudicate the concession.

A three stage auction was designed to achieve these purposes. The first stage was an accreditation stage, in which the potential applicants submitted a sealed envelope containing documents proving their suitability

¹²More information at <http://archivo.mintic.gov.co/mincom/faces/index.jsp?id=3392>

¹³More information in Documento CONPES 3118, 3202. Departamento Nacional de Planeación. (In Spanish)

to participate in the process and hence to be adjudicated with the PCS system. Some of the requirements included conditions regarding legal, technical, financial and experience aspects.

The second stage involved a sealed bid, similar to a discriminatory multiunit auction to make a selection of the best bids but no adjudication, in which there is a second envelope with an initial bid; it could be an individual bid per region or a joint bid for the three regions. This stage was only open to those who passed the first. This initial bid had to be at least 80% of a minimum value stated by the government. The bidders would then be allowed to raise their bid to the minimum value, only once, and thus be able to participate in the next stage. If only one bidder was taking part, the auction would be declared unsuccessful and be terminated with no adjudication; unless the bidder's initial bid was at least 90% of the minimum value.

The third stage was a simultaneous ascending auction with successive rounds (*Multiunit English auction*). Each of the bidders could improve their bids competing with the other participants. At the end of each round there would be a temporal winner with the highest bid per round. Between rounds each bidder had to improve their bid by at least 0.5%. The final winner of the auction was whoever had made the highest bid at the end of the final round.

3.1.2 Results

Only one company, Colombia Movil (*OLA*) participated in the auction, and was adjudicated with the license for the three regions. This entity was formed through a consortium made up by two of the country's largest telephone companies: ETB and EPM. The adjudication price was US \$56 million.

3.1.3 Conclusions

It is not possible to confirm that all the objectives stated at the beginning of the auction were accomplished, basically because there was only one participant in the auction.

This may have not be a problem of auction design, but rather, due to the bad economic conditions of the telecommunications sector and of the country at the time the auction was held. The auction result was poor and had an entry deterrence problem, with a low adjudication price and lack of competition against the auction winner.

In a PCS auction, it is normal for efficiency to become a relevant matter, especially in Colombia's Mobile Telecommunications sector at a time where the only two companies were charging high prices. Thus, it was important for the firm that valued the most and won the auction, to render this a more competitive market with lower prices for consumers. However, the lack of entry makes it difficult to evaluate the efficiency of the

auction, because any other participant may have valued the object more than the sole participant (winner).

3.2 TELECOM-COLTEL Auction

3.2.1 General

On April 7th 2006, the national government ran an auction for 50% plus one share of the public Telecommunications Company Colombia Telecomunicaciones S.A ESP (*Coltel/Telecom*)¹⁴ turning this company into a public services firm of private nature, with the purpose of having an oligopoly of the public government with an international investor, instead of a public monopoly. The mechanism used for the sale of Coltel/Telecom was a multiple round English auction. The company valuation was held by the investment bank CITI-GROUP Global Markets Inc, at COP \$533,577 million (*US \$233 Million*), established as the reserve price for the auction.

At first, five companies showed an interest in participating in the auction, these were: Telefónica (*Spain*), CANTV (*Venezuela*), Phone 1 (*Sweden*), TELMEX (*Mexico*) and from Colombia: Empresa de Telecomunicaciones de Bogotá (*ETB*), Empresas Públicas de Medellín (*EPM*) and Cablecentro in partnership with a European company.

But due to the terms of reference, unfavorable for private or public national companies, ETB, EPM and Cablecentro were implicitly retired from the auction.

There were only two participants who accomplished the technical and economic requirements and that didn't receive any objection by the regulator (*Superintendencia de Industria y Comercio*). These two participants were Telefónica from Spain and CANTV from Venezuela.

3.2.2 Results

This auction lasted 5 rounds. Telefónica of Spain won with a final bid of COP \$853,577 million (US \$369 million) surpassing CANTV's final bid of COP \$813,577 million (US \$351 million). Although there were only two participants, this was a competitive auction because there were more bidders who wanted to participate but could not due to technical requirements. The mechanism of multiple rounds helped to raise the competitiveness and the final price. With only one round, the adjudication price could have been lower.

This auction ended with an adjudication price exceeding the reserve price by approximately, COP \$320,000 million (60%), which reflected that it fulfilled the expectation of the auctioneer.

¹⁴More information in Matias, Sergio R. (2006) and Matias, Sergio R. (2007). (In Spanish)

3.2.3 Conclusions

In the auction theoretical field, the mechanism used to sell Telecom is well known as one that tends to raise prices due to multiple rounds (*Klemperer, 2001*). In spite of there being only two participants, it seemed like a competitive auction in which there were multiple potential bidders tending to participate. However, as the main potential bidders were two of the most important telecommunication companies, this gave way to certain predatory behavior, because of their reputation. In addition, the auction format was very robust and there was not any observable failure in it to affirm that bidders had incentives to collude.

Efficiency was an important concern in the goals of the auction because what the winner of the auction had to value most was providing public services, such as telecommunications, in partnership with the national government forming some kind of duopoly in the market. The result showed this, not only because the adjudication price exceeded the reserve price by far, but also because two well known potential bidders lasted five rounds until only one remained showing that they really wanted the prize.

3.3 Colombia Movil S.A (OLA) Auction

3.3.1 General

On August 31st 2006, the boards of Empresa de Telecomunicaciones de Bogotá (*ETB*)¹⁵, Empresas Públicas de Medellín (*EPM*), UNE Telecomunicaciones and Colombia Movil S.A ran an auction for 50% plus one share of the Mobile Telecommunications Company Colombia Movil S.A (*OLA*) looking for a strategic partner to operate and embrace more market share of the mobile telecommunication in Colombia as well as defining the commercial and technological strategies.

The valuation of the company was made by an important investment bank Corficolombiana S.A, and this value was only released the day of the auction as a reserve price, the value estimated was COP \$1,146,000 million.

The sale mechanism proposed was a first price multiround auction. The day of the auction the Bogota *Chamber of Commerce*¹⁶ announced that the validation of an offer was subject to the bid, which had to be at least 85% of the reserve price.

In this process, 13 Mobile Telecommunications companies with experience in emerging markets were invited to participate.

¹⁵Further information about the company can be find at www.etb.com.co. (In Spanish)

¹⁶It is a private organization concerning the formality of economic activity and business development. More information at <http://ingles.ccb.org.co/portal/default.aspx>

At first six mobile operators were interested in the process: Digicel Ltd (*Digicel*), Entel PCS Telecomunicaciones S.A. (*ENTEL*), Millicom International Cellular (*MIC*), América Móvil (*Comcel*), Cable & Wireless and Telefónica Móviles.

The first phase of the process ended on May 5th with the selection of three potential investors: Digicel Ltd (*Digicel*), Entel PCS Telecomunicaciones S.A. (*ENTEL*) and Millicom International Cellular (*MIC*). But ENTEL did not finally participate.

At 3:00 pm the term expired for Digicel and MIC to introduce their sealed-bid into the urn, but 5 seconds before the MIC introduced its bid. Digicel did not even try to introduce its bid because the company did not pay the \$30,000 million pesos policy committed to make a bid in this auction. The reserve price was released immediately.

3.3.2 Results

The MIC folder, the sole participant, contained a bid of COP \$1,135,000 million, COP \$11,000 million less than the reserve price. It was announced that the offer had to be raised. Later, MIC offered COP \$1,147,000 million, only COP \$1000 more than the reserve price. Closing the deal and winning the auction.

This auction involved no competitiveness, since there was only one participant that paid only a little more than the reserve price.

Although the auctioneer raised COP \$30,000 million from the entry policy, the idea was for there to be more than one participant, so they could achieve a high adjudication price which exceeded the reserve price by much more than it did, and even more than the entry policies.

3.3.3 Conclusions

Although this mechanism, in which Colombia Movil S.A was adjudicated, is one that tends to raise the prices due to the multiple rounds, it did not even accomplish competitiveness. Despite this, there were plenty of bidders interested in participating in the auction, the selection of potential bidders may have contributed to entry deterrence.

The presence of only one bidder in the auction may be considered a lack of interest and incentives of new entrants leading to an inefficient allocation of the company. The auction design, and specifically the entrance requirements, may have contributed to the bad outcome. This inefficiency is a major issue in this type of auction of a telecommunication company as a participant in the country's Mobile Telecommunications oligopoly. Moreover, the fact that the adjudication price was almost the same as the reserve price shows

how inefficient and non optimal this auction was, due to the poor revenue raised.

3.4 Third Private TV Channel Auction

3.4.1 General

In 1997, the first two private TV channels were adjudicated and in 1998 they started broadcasting. Some studies show that both national private channels have 67% of the total ratings in the country and 90% of the advertisement investment in Colombian TV¹⁷. Colombia is one of the few countries where open TV is losing audiences to pay-per-view television (PPV TV). It may be the case that people's TV demand is not satisfied. This is why the CNTV¹⁸ (*Comisión Nacional de Television/ National Commission Television*) held an auction on July 27th 2010, in order to adjudicate a new private TV channel in Colombia. Some other reasons were to increase the competition, maximize revenue and improve the quality of the service. A lot of interest was shown among national and international investors, which is why the CNTV considered adjudicating two licenses. Finally, however, only one was adjudicated. Neither the two existing private channels agreed with the CNTV decision because that implied a more competitive market, with less revenue for them.

The auction had a reserve price of COP \$103,409 million, which was known by the bidders. The auction format was similar to a sealed-bid first price auction with successive rounds. In which only the participants that were enabled in a previous requirement procedure were able to participate. The first envelope delivered determined which bidders continued to participate, and the lowest bids were excluded from the next round, leaving only the two highest participant bids. In the next round the bids made had to be greater than the highest of the first round, and if one bid exceeds the other by 30% then the license was adjudicated. If not, there would be another round in which the auctioneer would decide the winner depending on the third bid made by the participants. The winning bid was added to the reserve price, and that was the final price paid by the winner. If there were only one participant, the reserve price and then the adjudication price, would be 10% higher.

3.4.2 Results

Some of the companies interested in participating in the auction were: Canal 3 (*Grupo Planeta*), Inversiones Rendiles (*Grupo Cisneros*) and Grupo Prisa among others.

¹⁷More information on LICITACIÓN PÚBLICA No.002 de 2.010. (In Spanish).

¹⁸More information in spanish available at http://www.cntv.org.co/cntv_bop/

At the end of the requirement process the only participant left was “Grupo Planeta” and it was not adjudicated with the license for the third Colombian private TV channel. This happened because some requirements (such as the fact that legally at least 2 bidders were required to participate)¹⁹ with “Procuraduria General de Colombia” weren’t accomplished. If it had been adjudicated, the adjudication price would have been, the reserve price (COP \$103,409 million) plus 10% (COP \$10,340.9 million).

3.4.3 Conclusions

The aims couldn’t be clearly evaluated in this auction because it was not held. This may have been a problem of auction design. This failure was also due to a possible collusion in which the other two participants withdrew their propositions before making any economic bid, or it may have been down to possible predatory behavior because of Grupo Planeta’s reputation in owning the major newspaper in Colombia “El Tiempo”²⁰ and other companies.

There were major political and legal concerns about the adjudication of this license which may have affected the interests of everyone involved, this is why this auction design and this adjudication is considered a big failure.

Another big failure in this auction, was that a long time passed between its announcement and its realization. Thus the bidders could have prepared themselves for the auction and could had coordinated their bids to collude. Also, the auctioneer revealed more information than necessary; for example, in making the reserve price public. Therefore, the problem lied in auction design.

4 The Financial Industry

In this study, the financial sector is understood as all the financial institutions, such as banks, the treasury ministry, government financial organizations, the stock market and corporate financial institutions among others that have been involved in an auction as bidders or as auctioneers. Other cases may include banks that are being auctioned or financial instruments such as the government securities (*bonds*) that are the objects being auctioned.

Nevertheless, it is important to remember, that as much as this research is a historical survey of Colombian auctions, every day more and more auctions are being held in Colombia’s financial sector.

¹⁹More information at http://www.larepublica.com.co/archivos/TECNOLOGIA/2010-06-23/procuraduria-da-via-libre-al-tercer-canal_103448.ph (In Spanish)

²⁰More information about the newspaper can be consulted at <http://www.eltiempo.com/>. (In Spanish)

4.1 Granahorrar State-owned Bank Auction

4.1.1 General

On October 31st 2005, the national government held an auction to sell 97.78% of the capital of the state-owned bank Granahorrar²¹; a bank with more than 20 years of experience in the mortgage field in Colombia. At the time, the country had favorable macroeconomic expectations due to the strong recovery of its financial system. The purpose of this auction was the privatization of the bank.

The mechanism used was a sealed-bid first price auction in the first round. The remaining bidders had the chance to participate in a second stage, but with an English design. There was a reserve price fixed by the “Fondo de Garantías de Instituciones Financieras” (*FOGAFIN*), which is in charge of supervising and providing liquidity to financial institutions among other functions²². In the first round the bidders had to place their sealed-bid in an urn, as well as the documentation for the Superintendencia Bancaria²³ (*institution in charge of financial regulation in Colombia*) in another urn, and information about the legal representative who was making the deal in a third urn. Only the two highest bids in the first round passed to the second round, and the others did not have any other chance to bid. The next round started with the highest bid from the previous round. The rule was that any participant must bid at least more than 2% of the previous highest bid, to continue participating or to win the auction. The rounds lasted until the second last bidder retired; this means that the second last bidder wasn’t willing to bid more than 2% more than its previous bid.

The reserve price fixed by FOGAFIN was COP \$430,000 million. There were 5 bidders (*banks*) allowed to participate in the auction, these were: Santander bank, BBVA-Colombia, Bank of Bogota, Colpatria and Davivienda (*also banks*).

4.1.2 Results

The day of the auction no representative agent from the Santander bank appeared, despite they paid the right to take part and they were considered a potential bidder. The first round started and the four remaining participants (*BBVA, Bogota Bank, Colpatria and Davivienda*) placed their sealed bids as well as the other documents in the three urns.

All the bids were reviewed privately by the delegate and were: Colpatria with COP \$623,333 million,

²¹This bank merged with the BBVA bank in 2006 as a result of the auction. For further information about this topic visit the following website in Spanish, <http://www.bbva.com.co/?http://www.bbva.com.co/salapren/notasprensa/r35nota003.htm>.

²²For further information see the following website <https://www.fogafin.gov.co/Web/Formularios/Public/Home/frmHome.aspx>.

²³More information in Spanish, about the institution functions can be check at <http://www.superfinanciera.gov.co/>.

Bogota bank with COP \$704,000 million, BBVA with COP \$813,000 million and finally Davivienda with COP \$857,112 million. With all the bids being higher than the reserve price and as result only BBVA and Davivienda passed to the second round, this was a policy of the government that only allowed the two highest bidders on the second stage.

In the second round the base price was COP \$857,112 million, the highest bid of the first round. BBVA placed a sealed-bid of COP \$930,000 million. Then it continued with Davivienda making a bid of COP \$950,000 million. Later on BBVA made a final bid which Davivienda could not surpass, COP \$970,000 million. With BBVA as the winner of the auction acquiring Granahorrar for more than 2.23 times the value²⁴ and becoming the second strongest bank in the country after Bancolombia.

4.1.3 Conclusions

The results show that the mechanism held by the national government was a competitive auction, with two potential bidders, Davivienda and BBVA and other two weaker bidders. Plus it did not show any symptoms of entry deterrence or predatory behavior, neither theoretically because it is a seal-bid auction or empirically as showed in the auction process.

The adjudication price was high compared to the reserve price, which makes this a successful and optimal auction, since the goal for the national government was to raise the highest quantity of money and to adjudicate Granahorrar to an experienced bank in the mortgage field as BBVA.

The results seem to provide an intuition about the efficiency of the auction, since the entity who won the auction was a bank with such experience and resemblance in the international arena. In fact, the BBVA bought some banks in other countries gaining experience and learning how profitable this bussiness was internationally. Nevertheless, it is difficult to go beyond that intuition.

4.2 Operations of Open Market for Transitory Expansion (OMA: Repo)

4.2.1 General

The operations undertaken by the Banco de la República, Central Bank of Colombia and monetary authority²⁵, to expand or contract the monetary supply in the economy are known as the OMA. Usually, they undertake the REPO operations for a transitory expansion when they need to increase the monetary supply.

²⁴Data can be consulted at the following article in Spanish or in English (but with fewer data), <http://historico.elpais.com.co/historico/nov012005/ECO/A601N1.html>, http://www.bnamericas.com/news/banking/BBVA_wins_Granahorrar_auction_with_US*424mn_bid.

²⁵For further information see the following website http://www.banrep.gov.co/index_eng.html

The mechanism used for the loan is a multi-unit auction that works like a sealed bid auction (*similar to a uniform auction*), and it uses an electronic system for placing the bids.

In the first place, the Central Bank (*when money supply expands*) decides the expansion quota and the maturity term of the REPO (*there can be short and long terms for maturity*), or the term in which the agent has to repurchase the financial title that he lends as collateral. Next, the financial agents (*bidders*) place their bids in an electronic system called ENS²⁶, which is regulated by the bank, bidding the amount of money that they would like to borrow and also the effective interest rate that they are willing to pay. All the bidders face uncertainty about the bids that other financial agents make.

Meanwhile, the bank receives all the bids and organizes them from the highest to the lowest effective interest rate, where demand equals the supply (*quota for expansion*) the winners price is set, that is the lowest rate bid by the winners (*where demand and supply are in equilibrium*).

Also, bidders have to give to the bank some kind of financial title as collateral (*with the same value of the loan*), and when the maturity term ends, the bidders who won have to repurchase the title at a fixed price (*taking into account the interest rate*).

These operations are undertaken almost daily and the terms vary depending on the transitory expansion that the bank requires, the most common is the one day REPO. The process is exactly the opposite when the bank is contracting the money supply but the financial operation is called reverse REPO.

4.2.2 Results

The Central Bank runs this type of auction on a monthly basis. For the purpose of this survey, we are going to analyze only one of these auctions.

On May 3rd 2010, the bank held a one day maturity term REPO auction, where 39 bids were made by all the intermediaries mentioned in the table below. The price that each had to pay was an effective interest rate of 3%. The results were as follows:

Table 5: Open Market Operations for Transitory Expansion

²⁶Further information about this electronic system can be consulted in the following website http://www.banrep.gov.co/payment_system/ps_sen.htm.

Offers Presented				Offers Approved	
		Effective Rate (%)			
Term (days)	Nominal Value (COP\$)	Min.	Max.	Nominal Value (COP\$)	Effective Cut Rate (%)
1	2,239,707,000,000.00	3.000	4.000	2,239,707,000,000.00	3.000
Total	2,239,707,000,000.00			2,239,707,000,000.00	
Intermediaries		Number of Bids		Amount bid (loan COP\$)	
Commercial banks		28		2,174,000,000,000.00	
Business financial companies		2		10,000,000,000.00	
Trust companies		3		14,200,000,000.00	
Stock brokerage		6		1,172,000,000,000.00	

Source and calculations: Banco de la República de Colombia.

As illustrated in the chart above, the total amount auctioned was a nominal value (the monetary sum paid at the maturity of a financial instrument) of COP \$2,239,707,000,000. The bids or bid points rewarding a rate-quantity pair, show that the minimum rate bid was 3%, the maximum was 4% and the effective cut rate was 3% (*loan interest rate for all investors*).

In this case nobody was left out and everyone received a part of the expansion quota. This kind of mechanism (uniform auction) clearly shows the advantages that a bidding process could bring to the central bank. For example, it is easy to think how bidders, worried about losing this auction, could try to increase their chances by bidding a higher effective rate even if they lose profit.

In this case, all bids were between 3% and 4% and all the expansion quota was lent to the bidders²⁷.

4.2.3 Conclusions

Uniform auctions can be a very useful tool in monetary policy. Therefore, this type of auctions had the advantage that they could raise loan rates substantially. This happens because, the uncertainty that bidders are facing, ends up changing their behavior towards aggressive bidding (*this doesn't mean that it is more profitable than other multiunit auctions, it depends, there is no general ranking*).

All the bidders face liquidity issues and this dynamic is the central incentive for this type of auction to work, the financial cost that they face when they bid for a REPO is the opportunity cost that they face for

²⁷All the results were taken from http://www.banrep.gov.co/informes-economicos/ine_sub_repmay.htm, more auction results can found there, but the entire content is in Spanish.

immediate liquidity, therefore allocating these loans by auction is very profitable. Is it always the best way to allocate the REPO? The answer is that it depends, as always, on Economics. The uniform auction has the advantage that it promotes participating and avoids entry deterrence and predation (*also collusion, see Klemperer, 2003*), this means that weaker bidders have a chance to win with a lower interest rate, but on the other hand this could end in lower profit (*lower rates*) for the bank. Also, this auction is inefficient in that bidders want to make a profit and they would not bid their entire valuations. Although, these revenue problems can affect the central bank basically, because collusion could lead to even lower rates for loans, affecting their interest incomes.

4.3 Class B TES Bonds in Colombian Pesos

4.3.1 General

The TES are Colombian national treasury bonds that are sold by an auction mechanism in the primary market²⁸. This is one of the most popular ways to finance the government's fiscal deficit. There are 3 types of TES: bonds in USD, bonds in COP and bonds in RVU²⁹.

The way the auction works is similar to the Uniform auction. At first, the Ministerio de Hacienda y Crédito Publico (*treasury ministry of the government*³⁰), according to their deficit, sets a quota that is the maximum amount of money that will be borrowed (*nominal value*). Then the central bank, who organizes the auction, uses its electronic system (*ENS*) for collecting the bids, where every bidder only knows its own bid.

The bids consist of effective interest rates and amounts of money that the bidders have available (*for investment*) at that moment. The rates are organized from lowest to highest and the equilibrium price is set where the deficit quota matches the supply. The highest rate of the winners is the rate paid to all the winners. However, bidders could bid a very high rate to get more profit, but if the government doesn't agree with the bids they can end the auction and keep the TES. There is also a minimum money offer that could be bid to get a TES.

These auctions are held 3 or 4 times a month and the number of bidders participating is fixed by the government during the entire year. The selection of bidders is undertaken by the treasury ministry each year through a program called Market Creators and the selection is based on their performance in the primary

²⁸Auction regulations can be found in Spanish at http://www.banrep.gov.co/reglamentacion/rg_subastas.htm#tes.

²⁹The Real Value Unit is a unit of account that shows the acquisition power of de Colombian pesos and is based on the IPC Colombian index (consumer price index). For further information and history, check http://www.banrep.gov.co/statistics/sta_cppu.htm.

³⁰Their official website is <http://www.minhacienda.gov.co/MinHacienda/MinistryFinance>.

market (i.e. where and asset is sold for the first time) and secondary market (i.e. market where assets are resold). Their function is to provide liquidity in the secondary market and also to study the local government debt and provide the best financial conditions in the capital market. In 2010, 14 financial institutions were members of this program, 10 of them as market creators and 4 as candidates to market creators. These are listed below:

Table 6: Market Creators Program in 2010

<i>Market Creators</i>	<i>Candidates to Market Creators</i>
Davivienda Bank	Correval
Bancolombia	The Royal Bank of Scotland
GNB Sudameris Bank	Banco Agrario de Colombia
Corporación Financiera Colombiana	
BBVA - Colombia	
Interbolsa	
Santander Bank	
JP Morgan Corporación Financiera S.A	
Bogotá Bank	
Citibank	

Source: Ministerio de Hacienda y Crédito Público.

4.3.2 Results

These auctions are run constantly all year long and they have been held for a long time. This survey is only going to show one of the many share auctions held by the treasury ministry. On April 28, 2010, the government auctioned TES securities for a fixed quota and the results were as follows:

Table 7: Class B TES Bonds Auction Results

			Effective Rate (%)			
Term (days)	Maturity	Nominal Value (COP\$)	Min.	Max.	Cut Rate (%)	Price
4	17-04-2013	153,623,900,000.00	6.500	7.300	6.974	97.641
7	15-06-2016	146,441,000,000.00	7.700	8.500	8.067	102.43
16	24-07-2024	84,119,600,000.00	8.400	9.000	9.000	118.878
Intermediaries			Nominal Value by Intermediary (COP\$)			
Commercial banks			807,500,000,000.00			
Financial coportarions			77,000,000,000.00			
Stock brokerage			287,500,000,000.00			
Total			41,507,000,000.00			

Note: Maturity is based on the following date's format (DD-MM-YY) and the bond price is in basis points.

Source and calculations: Banco de la República de Colombia.

The table above summarizes all the auction characteristics, for instance the first column (*Term*) show the years left until the bond's expiration. The second column shows the maturity of the bond, this is the day when the bond expires and the last coupon is paid to the owner. The next column is the nominal value per bond type, this is the value paid to the bond owner in the maturity. The last 4 columns refer to the interest rate (*return rate that investors expect to gain*), its minimum and its maximum, the cut rate (*is the rate where the market clears, all investors receive this return*) and the bond's price, shown in basic points (*measured use in the stock exchange market*). Finally, the columns below show the amount that each bidder bid in the auction.

The effective rates of equilibrium for the TES with maturity terms of 4, 7 and 16 years were 6,974%, 8,067% and 8,590%, respectively³¹. The highest nominal value approved was COP \$153,623,900,000 with its corresponding effective cut rate 6,974%. We can see a relation between the nominal value and the effective rate, in this case the higher the nominal value approved, the lower the effective rate turns out. This can also be linked to the term of maturity.

³¹All the results were taken from http://www.banrep.gov.co/informes-economicos/ine_sub_tesb.htm, more auction results can found there, but the entire content is in Spanish.

4.3.3 Conclusions

The whole idea and results that the uniform auction can bring are the same as in the case of the REPO auction. On the other hand, there is little difference in the behavior that bidders could have in this scenario. Imagine the following dilemma in choosing a mechanism, the government makes the decision, due to the higher gap between international bank rates (e.g. *IMF*) and local market rates offered by investors, that the best way to finance their deficit is through treasury bonds. They would like to choose a mechanism which leads to less collusion, no predation, no entry deterrence criteria and of course for lower interest rates. Two viable candidates are Uniform auction and English multiunit auction. If the bank chooses the uniform auction it is clear that the bank is trading a more competitive mechanism (*English auction*) but more likely to fail in the problems named above (*Klemperer, 2002*), for a more robust mechanism (*in the sense mentioned above*) but intuitively less attractive. Therefore, in open scenarios, bidding could lead to lower rates and in sealed scenarios could lead to few lower bids. The incentive here is that with a collusion problem, the auction could turn out to be a fiasco and with higher financial costs than the one expected (*Klemperer, 2003*), so that's why a uniform auction could be a much less risky mechanism to use. If it chooses the ascending auction, its financial cost may tend to lower rates more than they could expect using other mechanisms.

What to do? Is this a general dilemma or does it depend on the government environment and market? Theoretically, this could be seen as a general dilemma, practically it depends on the context. As mentioned earlier, uniform auctions allow weaker bidders to have a chance of winning. This implies, that the “weak” bidders (i.e. *the ones interested in winning with higher rates*) will tend to participate trying to win a bond to trade it in the secondary market (*usually in financial markets*) and this will increase competitiveness in the bids leading to lower rates³². However, the market structure is an important factor to analyze the theoretical properties of uniform auctions and the consequences in topics such as efficiency and optimality³³.

4.4 FRECH Auction

4.4.1 General

The FRECH³⁴ is the fund for mortgage portfolio stabilization. Its function is to provide liquidity for commercial banks for them to lend money in mortgage loans. For instance, think of a person who asks for

³²See Villaneda, F. and Espinosa, Miguel A. (2011), Cardozo, P. (2010), Santamaria, N. and Beltran, H. (2002) and Santamaria, N. and Alvarado, J. (2005) for general details about bonds allocation.

³³See Villaneda, F. and Espinosa, Miguel A. (2011).

³⁴For further information see the following website in Spanish, <http://www.presidencia.gov.co/sne/2004/agosto/23/17232004.htm>.

a mortgage. The bank, needing liquidity to respond to the demand, with the help of a securitization of mortgages, issues mortgage titles taking the real estate as collateral. These mortgage titles have no liquidity in the resale market so they need to find a way to exchange them for a more liquid monetary aggregate. Therefore, the FRECH, that is part of the Banco de la República (*Colombia's Central Bank*), organizes weekly auctions, selling Colombian treasury bonds (*TES*) only in exchange for these mortgage titles.

However, the idea of this exchange is to enter the bank's REPO expanding operations and use the TES as collateral for gaining liquidity, or to resell them on the secondary market.

The auction mechanism is an electronic auction with the same characteristics as a Uniform auction. In first place, the FRECH sets a fix amount of TES for the auction and an exchange rate, for example 90 TES for one mortgage title. Then, the bidders that are usually 5 commercial banks or less set their bids that are represented in financial costs for purchasing the Bond. The banks that are willing to pay higher financial costs are the ones who win the auction.

As always, the FRECH organizes the bids from the highest financial cost to the lowest and when the amount of bonds equals the demand, of that moment, they set the equilibrium price as the lowest financial cost of the winners.

Note that this mechanism of getting a marketable financial asset is a way of acquiring the possibility of changing these bonds as collateral in the REPO operations. These Bonds also have a short term maturity, usually seven days. These auctions are held, on average, 4 times a month.

4.4.2 Results

As mentioned in the sections above (*TES and REPO auctions*), the Central bank has held this type of auction more than once but in this survey we will only concentrate on one.

This auction took place on April 23rd, 2010. Only 4 bidders participated and the financial cost that was set to be the price for all winners was 0.020. The results were as follows:

Table 8: FRECH Auction Results

Offers Presented				Offers Approved	
		Financial Cost (bids)			
Term (days)	NV (Million COP\$)	Min.	Max.	NV (Million COP\$)	Financial Cost (Cut)
7	400,000.00	0.020	0.050	400,000.00	0.020
Total	400,000.00			400,000.00	
Intermediaries		Number of Bids		CVP (Million COP\$)	
Commercial banks		4		400,000.00	

Note: NV means Nominal Value and CVP means Cost of Value Presented.

Source and calculations: Banco de la República de Colombia.

The table above shows the minimum and maximum financial costs in the auction. It also shows the Equilibrium financial cost (*where supply meets demand*), that is the cost charged to all the bidders, the bids presented by the commercial banks and the nominal value.

All bidders participating won the auction and the nominal value of the cost presented in the bids, was COP \$400,000 million. Although, the highest financial cost was 0.050, the price paid by all of the bidders was 0,020 (*the lowest bid*)³⁵. This is how uniform auctions work by changing bidders' behavior and pushing them to bid higher.

4.4.3 Conclusions

The FRECH doesn't hold auctions very often. The uniform auction design has the advantage that it is "fair" for all competitors and also for the reputation of the bank (*transparency*), in the sense that all bidders have to pay the lowest financial cost despite the fact that each of them (*winners*), had bid higher financial costs.

In theory, this mechanism has its own results and advantages due to the rules behind the design; if the seller (*bank*) decides to change the rules at the end, and charge every bidder for what they bid, the structure of the bidding behavior would change for the next auction that the FRECH undertakes. This may damage the behavior strategies for future auctions of this type, resulting in lower profits for the bank and less credibility. Finally, as Table 8 shows, there were only 4 bids placed and they could have been placed by less than 4 banks. This issue could show a lack of competitiveness resulting in a low equilibrium price (Financial cost). Intuitively, optimality could be affected by the lack of entry.

³⁵All the results were taken from http://www.banrep.gov.co/informes-economicos/ine_sub_frech.htm, more auction results can found there, but the entire content is in Spanish.

4.5 Call Option Auction

4.5.1 General

The intention of this auction is for Colombia's Central Bank to sell the option or right of buying USD from the bank under certain conditions. Nevertheless, this auction is rarely run by the bank, and it is not used unless the demand for US currency exceeds the supply.

This behavior can be considered as risk aversion behavior; because participating bidders are willing to pay a risk prime to guarantee that they can buy dollars when the Market exchange rate (TRM) is at a certain level that compromises his investment. For example, an importer who makes some financial projections for a deal using a certain exchange rate let's say COP \$1800 to 1 dollar, which results in some profit, is willing to pay a risk prime for exchange rate fluctuations. If the rate devaluates to COP \$1820, then the importer's profit increases. The problem is that at some point of devaluation the deal is not profitable, but at the current time it is, so the importer would be willing to buy dollars and one possibility is that commercial banks have no currency supply. This means that the importer is subject to market supply.

Here, is where this option of having the right to buy dollars from the central bank at a specific market exchange rate, works. This auction consists in a number of bidders who offer a prime bid by electronic media, where by they pay an amount per dollar for getting the call option, and the amount of dollars that they want to buy. Each bid is only known by whoever placed it, and the bank organizes the bids in a descending order. When the fixed amount of dollars equals the demand, at that point, they set the equilibrium price as the lowest prime bid placed by the winners. This auction is similar to a uniform auction.

The only condition to exercise the right is that in the term that the option is available, usually during the next 30 days after the auction, the Average Mobil ($MA(20)$) from the last 20 days, has to be below the current market exchange rate (TRM). If that happens, the option is enabled, if not it is disabled. This means, that the TRM series has to be growing for the option to be enabled, because the only way the $MA(20)$ is lower than the current TRM is when it is increasing.

4.5.2 Results

This survey will only show the result of the auction ran on February 12th 2009. In the auction 40 bidders gave their demand for dollars and their prime risk that could be seen as the price for each fixed amount of dollars, for instance, COP \$1000 for each USD \$100 being demanded. The results were as follows:

Table 9: Call Option Auction Results

Offers Presented				Offers Approved	
		Prime Value (bid)			
LDE	Nominal Value (USD)	Min.	Max.	Nominal Value (USD)	Prime Value Cut
12-03-2009	599,800,000.00	1,500.00	28,500.00	180,000,000.00	8,700.00
Total	599,800,000.00			180,000,000.00	
Intermediaries		Number of Bids		Cost of Value Presented (USD)	
Commercial banks		33		505,200,000.00	
Financial corporations		5		94,000,000.00	
Bussiness financial companies		2		600,000.00	
Total		40		599,800,000.00	

Note: LDE means Limit Date for Exercise and the date's format is (DD-MM-YY).

Source and calculations: Banco de la República de Colombia.

The columns shown in the table above may be interpreted the same way as in the TES auction. The only difference is that the bid is not in terms of return rates, it is in terms of Colombian pesos (*prime value*). Meanwhile, the first row in the date column refers to the maturity of the option.

Notice that in this case there is a high number of bidders participating and that could explain why the maximum prime bid is so high compared to the minimum bid, taking into account the risk aversion. The uncertainty of other bidders' behavior is an incentive for the other competitors to bid higher values than usual, when there are less bidders, they wouldn't have thought considered it. The result here was a prime cut of COP \$8,700 pesos for a dollar supply of \$180,000,000³⁶.

4.5.3 Conclusions

As the results show, the difference between the highest and the lowest bid is considerably large, this says something about the auction mechanism. First it should be taken into account that the prizes of the auction are homogeneous financial derivatives. The same definition of this financial instrument can lead us think that the participant bidders are somehow risk adverse bidders. Therefore, they are willing to pay a risk prime for avoiding less profit due to exchange rate issues.

³⁶All the results were taken from http://www.banrep.gov.co/informes-economicos/ine_sub_opci_inmer.htm, more auction results can found there, but the entire content is in Spanish.

Second, the bidders are not maximizing their expected payoff, in this case it is a utility function that represents risk aversion. Hence, the less utility that a lower bid represents (*lower probability to win*) for a bidder, it is lower than the utility a bidder loses with a lower payoff.

Finally, the two issues mentioned above and the fact that in this case the number of bidders is large enough, can explain part of the behavior that this uniform auction presents. Also, collusion issues and entry problems (*predation and entry deterrence*) are of no importance here because of the number of bidders participating.

As a main conclusion, the uniform auction for this scenario is quite a successful choice with high expected revenue.

4.6 Put Option Auction

4.6.1 General

Put Option Auctions are the opposite of Call Option Auctions. They give a person the right to sell US dollars to the Central Bank also under certain conditions. In this case, the condition is that if the option is available, let's say during the next 30 days after the auction, the Average Mobil (MA(20)) has to be above the market exchange rate (*TRM*) for the option to be enabled.

If an exporter who made a deal in US dollars is projecting his profits with a current exchange rate, and this rate starts to fluctuate aggressively, the exporter's profits could be reduced if he can't sell the dollars at the right time. This is why he would be willing to pay a prime risk where he establishes, that if the exchange rate reaches a certain level, he can use this Put Option and the Bank will have to buy his dollars at the market exchange rate of the day, given that the MA(20) condition enabled the option.

This auction is similar to a Uniform Auction. The way this auction works is the same as Call Option Auction. The bank receives bids through its electronic system SEBRA³⁷, where each bidder bids the prime risk that he will pay and the amount of dollars he wants to sell. Thus, the Central Bank organizes the primes in a descending order and where fixed bank demand for dollars equals the supply. The equilibrium prime that would be the lowest prime bid by the winners is set at that point.

4.6.2 Results

The central bank has used Put Option Auctions many times (*including the Call Option Auction*) to control exchange rate volatility. Here, this survey will only present one particular auction.

³⁷Further information in Spanish about the SEBRA electronic system can be consulted at http://www.banrep.gov.co/sistema-financiero/seb_sebra.htm.

On July 22nd, 2009, the Central Bank ran this auction where 44 bids were received and the cut prime was COP \$9100. The results showing the quota per dollar demand is shown in the following table:

Table 10: Put Option Auction Results

Offers Presented				Offers Approved	
		Prime Value (bid)			
LDE	Nominal Value (USD)	Min.	Max.	Nominal Value (USD)	Prime Value Cut
21-08-2009	819,100,000.00	2,000.00	15,850.00	180,000,000.00	9,100.00
Total	819,100,000.00			180,000,000.00	
Intermediaries		Number of Bids		Cost of Value Presented (USD)	
Commercial banks		37		743,800,000.00	
Financial corporations		5		74,000,000.00	
Bussiness financial companies		2		1,300,000.00	
Total		44		819,100,000.00	

Note: LDE means Limit Date for Exercise and the date's format is (DD-MM-YY).

Source and calculations: Banco de la República de Colombia.

The columns and rows in the chart can be interpreted the same way as in the Call Option Auction. These results show the same behavior as seen in the Call option auction; a common result in uniform auctions. The maximum is very different from the minimum bid because of risk aversion and the 44 bids presented.

Both the Put and Call Option Auctions, had the same nominal value approved (USD \$180,000,000) but the prime of cut was higher in the Put Option Auction³⁸.

4.6.3 Conclusions

The structure of this auction and the consequences that risk averse bidders (*the prize here is also a financial derivative*) bring to the mechanism design are pretty much the same as in the Call Option Auction.

An advantage that these results of the auction present compared to the ones in the Call Option Auction is that there are more bidders here. The idea of bidders colluding in clusters seems pretty difficult, because coordination is almost impossible. Also, the "weaker bidders" have more chances to win in a uniform auction,

³⁸All the results were taken from http://www.banrep.gov.co/informes-economicos/ine_sub_opci_inmer.htm, more auction results can found there, but the entire content is in Spanish.

because bids are private information so competitors don't know what others are bidding, and also bidders tend to shade their bids after the second unit (*Krishna, 2009*). This doesn't happen in the open format auction where bids are public.

4.7 FOGAFIN Bonds

4.7.1 General

FOGAFIN³⁹ is a fund that guarantees that financial institutions can back up people's savings deposits. One of its jobs is to invest large amounts of money to provide confidence to savers in safe deposit issues. In 1999, Colombia was suffering an economic crisis and many enterprises and banks were bankrupt. The problem was that neither FOGAFIN nor any other entity could backup the safe deposits of the financial institutions due to the crisis. Therefore, the idea was to capitalize all the public financial institutions that were in crisis through FOGAFIN, the strategy was to issue banking capitalization bonds as a way to refinance the financial institutions that were in danger of bankruptcy. The allocation of these bonds was with private offers. Later, in 2002 and 2003, FOGAFIN and the Central Bank of Colombia decided to run an auction with the idea that the bidders who win the auction could, later on, market those bonds in the secondary market. The bidders who participated were market creators, candidates to market creators of public deficit titles, the stock market and some other financial entities.

The procedure for the auction was the following: first, the central bank made public how many bonds in nominal value would be auctioned. Then, they established 2 rounds in which the market creators and candidates to market creators who won in the first round, could participate in a second round. Third, all bidders in the first round, had to submit 2 types of information in their bid; the first is the nominal value of the titles that they are going to demand plus, and second the effective rate that the bidder is willing to bid to get the bonds.

The mechanism used was the SEBRA electronic system, and every bidder could bid several times for different amounts within a period of time. Note that bidders only knew their own bid.

However, the way the objects are allocated depends on the amount of supply made by FOGAFIN and the effective rates. All the effective rates bid are organized in ascending order, and the price that is common for every winner (*rate of equilibrium*) is when supply equals demand.

The way the price of the bond is calculated is important because it determines the value of these on the market (*important for the secondary market*). The equation for the cost of the title is the following:

³⁹See the link in the Granahorrar State-owned Bank Auction section.

$$VC = P * VN$$

VC is the cost value of the title; VN is the nominal value of the title until the day of auction fulfillment, this includes interest already capitalized and P is the dirty price of the title, $P = \left[\sum_{i=1}^n \frac{coupon_i}{(1+R)^i} \right] + \frac{K}{(1+R)^n}$, with n = number of capitalization periods until maturity, R is the rate of equilibrium in the auction, $coupon$ is the interest payment made to the owner and K is the capital value at calculated maturity. This auction is similar to a Uniform auction and it was held 28 times between 2002 and 2003.

4.7.2 Results

From the 28 auctions that were run, this survey will analyze the one undertaken on May 20th, 2003. Results of the first round are presented in the following table:

Table 11: Fogafin Bonds Auction Results

Issue Date	Maturity (Years)	Nominal Value Approved (COP\$)	Cost Value Approved (COP\$)
11-08-1999	6	5,000,000,000.00	5,046,050,000.00
11-08-1999	8	3,000,000,000.00	3,036,030,000.00
28-09-2000	4	5,000,000,000.00	5,100,030,000.00
28-09-2000	6	3,000,000,000.00	5,042,510,000.00
Equilibrium Price	Adoption Rate (%)	Min. Rate (%)	Max. Rate (%)
100.921	9.46	9.46	10.26
101.210	10.02	10.02	10.60
102.006	9.31	9.31	9.70
101.416	9.81	9.46	10.26
Entities		Nominal Value (COP\$)	Participation (%)
Commercial Banks		42,000,000,000.00	100
Total		42,000,000,000.00	100

Note: the operation date was on May 20 of 2003 and the fulfillment date was on May 22 of 2003. Also the issue date format is (DD-MM-YY) and the equilibrium bond price is in basis points.

Source and calculations: Banco de la República de Colombia.

The table presented above shows 8 columns. The first two are about the maturity of the bond and the day the bond was issued (*each row is one bond with its corresponding maturity*). The next three columns corresponds to the total nominal value auction, the cost value (*see equation 1*) and the equilibrium price of the bond. The last 3 columns refer to the rate of return approved for each bond, and the range bid (*minimum and maximum*).

In this particular case, note that all the nominal value approved (*supply*) was issued to the bidder or bidders that bid an effective rate of 9,46 (*low boundary*) in the case of 6 years maturity term of the title (*upper one*). The same applies for the 4 year and 6 year term of the title case. Only the bottom 6 year term title case could reach an approval rate within the boundaries

The lowest equilibrium price was for the top 6 year case, with a price of COP \$100.921 and the highest was the 4 year case with COP \$102.006⁴⁰ .

4.7.3 Conclusions

The bids submitted in this auction seem to be less competitive. we can only determine that the boundaries in the effective rates are close enough and this issue could be attached to the number of bidders. In this particular case the uniform auction could be sensitive to collusion (*Klemperer, 2002*), because there is a huge incentive to submit lower rates because the dirty price of the bond would be higher and there would be a bigger chance that they could make a profit in the secondary market (*of course it depends of the secondary market situation*).

Is there any other more appropriate mechanism? In essence, all mechanisms depend on the context, but particularly when the number of bidders participating is very low, (less than four bidders, here the number is fixed (20)) , in general auctions are vulnerable to collusion problems and to lack of competitiveness in the bids. For example, Klemperer (2003), talks about the Netherland 3G auction fiasco were bidders attendance was very low, collusion rose and the revenue was one third of the expected income.

Here the problem is lack of competitiveness (*concerns about collusion also rise*) due to the size of participants, therefore, the result could represent a bigger financial cost for the Central Bank.

⁴⁰All the results were taken from http://www.banrep.gov.co/informes-economicos/ine_sub_foga.htm, more auction results can found there, but the entire content is in Spanish.

4.8 Popular Bank: Hammer Auctions

4.8.1 General

Every month of the year, the private bank called Banco Popular (*Popular bank*)⁴¹, runs different types of auctions according to the object they are selling. The objects for sale in the auctions are classified in 8 categories: furniture and fixtures, heavy machinery, electro domestics, real estate properties, vehicles, spare parts, pipes and scrap. However, most of the time the bank only acts as an auctioneer between buyers and sellers. The rest of the time is when they sell their own goods, such as real estate property or other kinds of assets.

There are 4 types of auction ran by the Popular bank and each one is run in a different frequency. Also, enabled bidders are those who fulfilled age requirements (*18 years*), don't work at the bank and are not currently facing legal issues; enabled buyers are public entities and individuals.

Wheel Auction

This type of auction is held on a monthly basis by the bank in different Colombian cities and also some municipalities. The main characteristic of this auction is that it works as a single unit English auction (*single units could also be packages of homogenous units*), but with fixed price increases. It also has an initial price that is set 6 days prior to the auction, and an entry cost that is a 20% deposit of the initial price.

Virtual Auction

The second type of auction run by the bank is called virtual auction and it works in the same way as the wheel auction with the difference that it is held via internet (*weakly*)⁴², this means that bidders do not have to be in the same place. A particular issue of this single unit auction is that it operates on a time limit; this means that a closing time is set for the auction and can only be changed if at the end, when there are less than 3 minutes left; a bidder overbids the last bid. If that happens, 5 minutes are added to the closing time.

Sealed-Bid Auction

The frequency of this auction depends on how assets are valued in the market and what the offers for those assets are like. This auction mechanism is the same as a first price auction, but with the same entry cost mentioned above and some legal entry requirements. It also has an initial price and bids must be sent to bank offices during the deadline period.

⁴¹For further information in Spanish about the private bank see the following website <https://www.bancopopular.com.co/>.

⁴²Virtual auctions are held on this website <http://www.elmartillo.com.co/> and also information in Spanish about wheel auctions is available on the website.

Sealed-bid Auction with Tie Rule

The last type of auction undertaken by the bank is the same as the sealed-bid auction (i.e. *first price auction*) mentioned above but with a specific tie rule. This means that if two or more sealed bids tie, the bank has to call the bidders involved and ask them for a new bid to determine the winner, in this case the process is repeated until one of the bidders wins.

4.8.2 Results

Many auctions are being run daily on the bank's website: The advantage of this is that government institutions such as the treasury of the state can use this public mechanism to make their recruitments. For example, on July 31st 2010, the treasury ministry used the wheel auction to sell recruitment contracts for alienation of fittings and fixtures. The value of the contract was for COP \$80.000 million.

The advantage for the government to use this mechanism is the transparency issue in their recruitments and also the guarantees that the Popular bank gives to all its users ⁴³.

Another example of the way these auctions are handled is the entry fee that is required to participate. For instance, on the 21st of January 2011, the official website for auctions, published an auction for a package of electric articles for a total amount of COP \$70 million. The entry fee (*20% deposit*) required to participated was of COP \$14 million. That fee could generate entry deterrence due to the higher cost.

Finally, this mechanism may present some pitfalls. For example, in October 2010, the public service enterprise in Colombia called *Empresa Distrital de Servicio Públicos* ⁴⁴ was liquidating all its assets, so it ran an auction, using the wheel mechanism, selling 60 vehicles.

The results showed that they only sold 7 vehicles in the auction for COP \$100 million and the reason they gave for this results was that many of the other vehicles had political issues because they had been turned into cleaning vehicles (*such as dump truck and garbage trunks*)⁴⁵.

4.8.3 Conclusions

The four auction mechanisms used by the bank are very helpful tools for sellers, as anything can be sold through auctions, providing there is a solution to the asymmetric information problem. The 4 auctions provide entry incentives because people can find the best type for them and avoid entry deterrence. Popular

⁴³For further information in Spanish about the recruitments check the following document http://www.contratos.gov.co/archivospuc1/2010/C/113001000/10-12-288608/C_PROCESO_10-12-288608_113001000_1503832.pdf

⁴⁴The enterprise no longer exists. Further information in Spanish about its history could be found on the following document <http://www.umng.edu.co/revcieco/2006/PDF%20de%20Corel/Lahistoria.pdf>.

⁴⁵All data was taken from <http://www.eltiempo.com/archivo/documento/MAM-247831>. The entire content is in Spanish.

Bank provides the auction format and the initial price valuation, it also collects initial deposit, final payments and if the auction mechanism has the wheel design; it provides official supervisors to check its development.

Nevertheless, the wheel auction design is exposed to collusion (*very common in English auctions*) problems. As a solution, the bank sends a supervisor to check the development of the auction who has the power to end the auction or dismiss bidders if necessary. Virtual auctions, on the other hand, could be a better tool for sellers because they are less exposed to collusion problems (*bidders are not in the same place*) and efficiency seems to be achieved in this mechanism in private valuations, because the English auction is equivalent to a second price auction which is efficient.

Moreover, entry deterrence and predation problems could happen more with the wheel design, so virtual auctions could be a better choice for important market assets. Also, reserve prices could be a good way to avoid collusion issues and raise higher revenues. However, reserve prices can also bring problems when they are misused. For example, Klemperer (2002), showed the reserve price fiasco in Turkey, where the government was auctioning two telecom licenses (*not at the same time*) and it decided to set the reserve price of the second license (*a whole new auction*) as the clearing price of the first auction. The result was that the winner in the first auction bid so high that nobody bought the second license (*the result was a monopoly in communications market*).

Finally, the biggest concern of these mechanisms is attracting bidders to participate; this could be a problem because of the 20% deposit entry fee and very high initial prices. Literature has shown that entry fees and high initial prices that are not well established could result in shoddy auctions.

4.9 Credit Auction: 2007 Case

4.9.1 General

Financial sectors all over the world have taken advantage of the auction properties and their desirable results. One of these cases is the credit market, in particular the credit default portfolio in the banking sector.

One of the biggest concerns for a financial institution is to collect its credit portfolio on time. A good management of this portfolio can be seen in the recovery/balance ratio, sometimes recovering the entire credit portfolio after a long time may be difficult for some institutions, the time invested and the management resources could have low recovery rates as a result. In this scenario auctioning the credit portfolio based on expected revenue is a useful profitable resource, the only issue is all the time needed to fulfill all the requirements for portfolio transference.

In 2007, the CISA institution⁴⁶ and Fogafin⁴⁷ ran an auction to sell a credit portfolio and some properties. They made one sole package with all the assets for a total amount of COP \$2.60 billion; this included a credit portfolio with 186000 loans with balance due by COP \$2.4 billion and 1 real estate property. They used a first price auction with an entry fee of 60 million Colombian pesos and a reserve price. Nevertheless, bidders entry wasn't an issue, 7 bidders participated (Deutsche bank, Lehman Brothers, Citi Group, Mckinsey & Co, Morgan Stanley, GE and AIG global investment).

4.9.2 Results

The results from the auction ran on June 15th 2007, are presented in the following table:

Table 12: Credit Auction Results

Bidders	7
Prize Value	COP \$2.60 billion
Winner	AIG Global Investment
Winner's Bid	COP \$595.595 million
Entry Fee	COP \$60 million

Source: Business News Americas.

The optimality issue was accomplished because Fogafin and CISA were expecting at most COP \$319.500 million. The winner, months later, after the auction announced publicly that buying credit portfolios is a profitable business⁴⁸. All the bidders exceeded the reserve price.

4.9.3 Conclusions

These types of auctions prove the usefulness of auction markets and auction theory. In this case, the lack of an official market where credit portfolios could be sold, showed that auctions are a good and profitable way of selling this assets. The first price auction, as the results show, is commonly known in literature as a mechanism for reducing collusion, also in some cases the uncertainty faced by bidders lead to higher revenues.

⁴⁶The letters stand for Central de inversiones, which is a financial institution in charge of credit portfolios and real estate management. For further information in Spanish visit the following website <https://www.centraldeinversiones.com.co/>.

⁴⁷See the Fogafin bonds section for more information about this institution.

⁴⁸Results data (Spanish version) were taken from http://www.bnamericas.com/news/banca/Capital_Recovery_Group_logra_cartera_de_Cisa_por_US*311mn.

Accordingly, Fogafin and CISA raised almost 200% of the value they expected, this means that the portfolio's value they thought was lower than the market's valuation. To conclude, this particular case shows how auctions are powerful tools when the available information (*portfolio's valuation*) is incomplete. Particularly, in this case it was the first time a credit portfolio was auctioned and the revenue objectives were a priority for the seller, because they needed the money to recover part of their internal default credit portfolio. Also, as Table 12 shows it was very attractive to auction these types of financial assets because many competitors participated.

4.10 Stock Market Auction

4.10.1 General

The Ministerio de Hacienda⁴⁹ and the Bolsa de Valores de Colombia (*BVC*)⁵⁰ in the past few years changed the stock bargaining model in Colombia. The problem was that the old model wasn't appropriate for foreign investment because people who wanted to invest had to learn all the Colombian stock market structure before investing. This was because it didn't work like global standard stock models so it was difficult to understand. For instance, the price formation wasn't clear, the market "froze" when prices were very high and stocks allocation among offers was confusing.

The new model was based on the European ring model and the bargaining process was restructured with auction mechanisms (*run daily*). However, the bargaining structure is formed by so-called wheels. There are 2 types of wheels, the first are the REPO operations (*they don't use auction mechanism*) and the second are the Cash transactions (*this survey will focus on this one*) and they are divided depending on the stock's liquidity.

First, in the cash transaction type, the bargaining process for liquid stocks is made up of three sessions. The first part is the opening setup where no one can trade stocks, but people can withdraw previous orders. The second part is called open market and it works like an auction. This means that people start making offers (bidding) and there is an algorithm called CALCE that sets the equilibrium price, based on where maximum quantity (*stocks*) is allocated⁵¹.

In this session a range price is set previously and no bids will be accepted outside the range, if the CALCE algorithm, when setting the equilibrium price, finds two possible equilibrium prices on the boundaries a

⁴⁹See TES auction section for further information about this institution.

⁵⁰The BVC is the stock Exchange from Colombia. For further information in Spanish visit the following website <http://www.bvc.com.co/>.

⁵¹All the stock market model and the CALCE algorithm can be review in Spanish at the following website <http://www.bvc.com.co/cursos/mostrarpagina.jsp?codpage=21>.

volatility auction starts and the bargaining process stops while the Volatility Auction (*usually they are 2 minutes and 30 seconds long*) is going on. The idea of this Volatility auction is to reset the boundaries and the reference price; this is possible due to bids because if one of the transactions that are being made exceeds the USD \$7000 the system automatically resets the boundaries on the volatility auction⁵². Finally, the third session is the auction closure where a closure price is set which then becomes the reference for the next day. The price is set in the same way as it is on the open market; that is CALCE algorithm.

Moreover, on the wheel type cash transaction, the bargaining structure for the non-liquid stocks is different. In this case, there are 2 sessions, an auction opening session and a closure session. In the first session, an opening price is set as well as a reference price for the range price (*same as in open market session*), bidding is allowed and equilibrium price is set with the CALCE algorithm. Stock allocation is only made at the end of the auction (*session*) and closure of the session is random. The final session, works in exactly the same way as the auction closure in the case of liquid stocks.

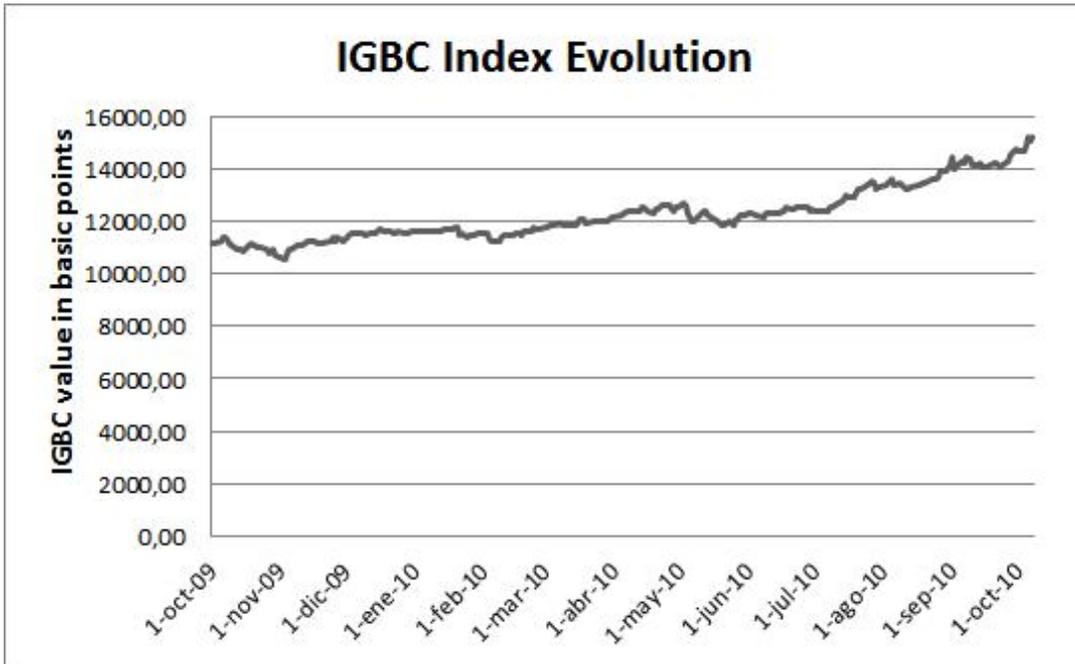
This type of stock market auctions are very rare mechanisms, but it can be said that the auctions undertaken on the open market sessions work in a similar way to a Uniform price auction. This is because the CALCE algorithm sets a common price for the stocks allocation; this means that bidders can pay the same price for different amounts of the same goods.

4.10.2 Results

Although the global crisis has affected the financial markets, in Colombia, the stock market indexes have been growing since 2009. The Colombian market has improved due to the new stock market model among other countries. The following charts show 3 financial indexes and the volatility of one of the biggest indexes in Colombia (*IGBC index*⁵³).

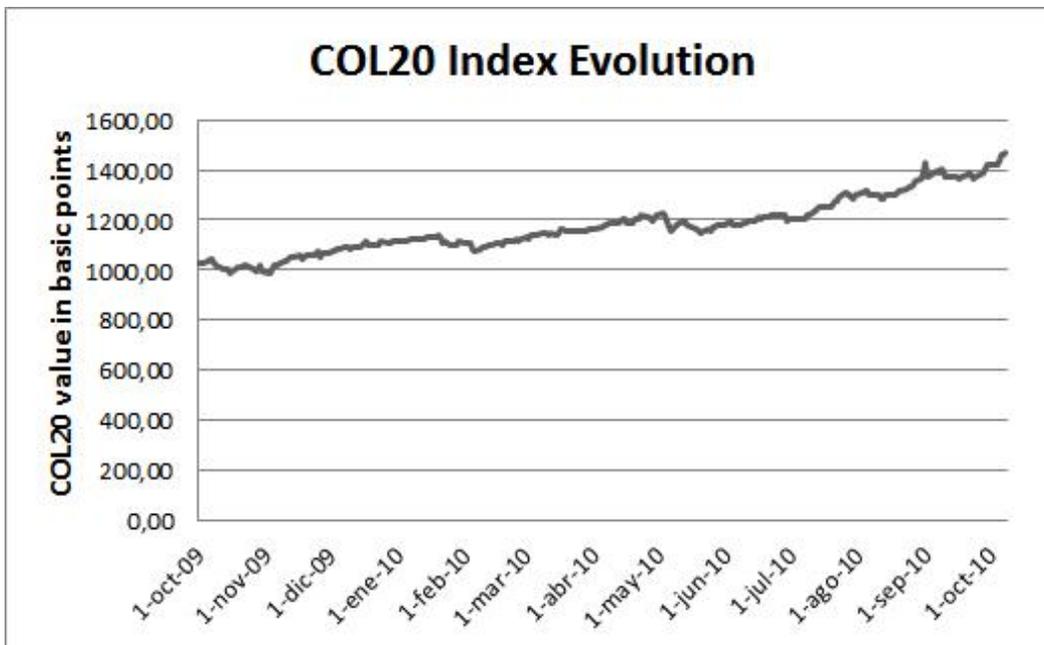
⁵²This rule is called Price marking.

⁵³More information in Spanish about the index data and its methodology can be consulted at <http://www.bvc.com.co/pps/tibco/portalbvc#>.



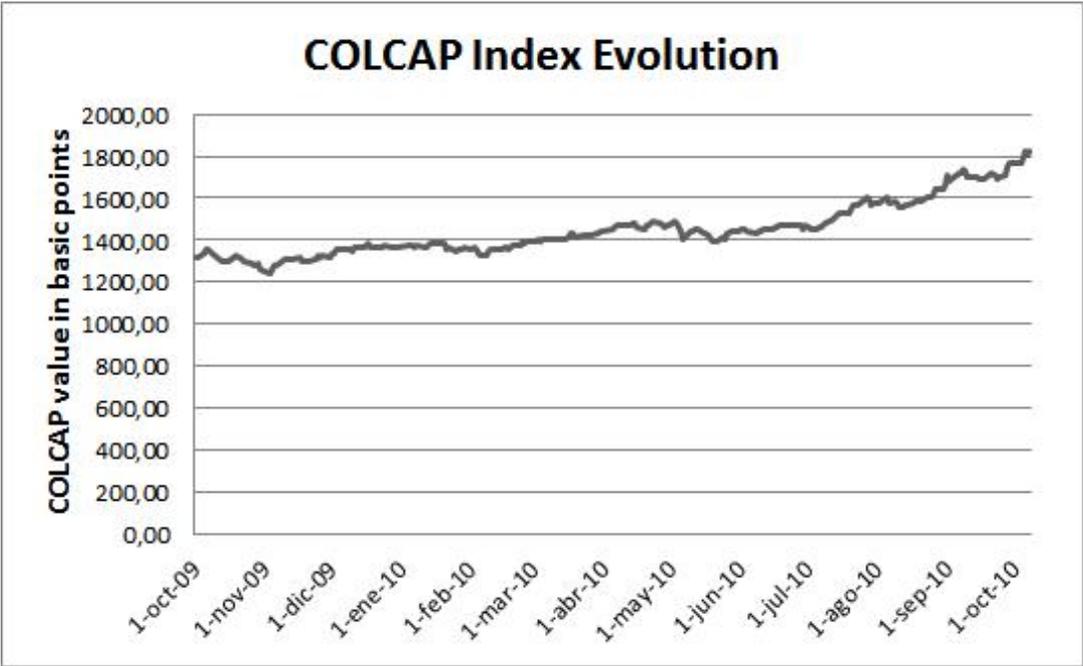
Source: Bolsa de Valores de Colombia

Calculations: Authors



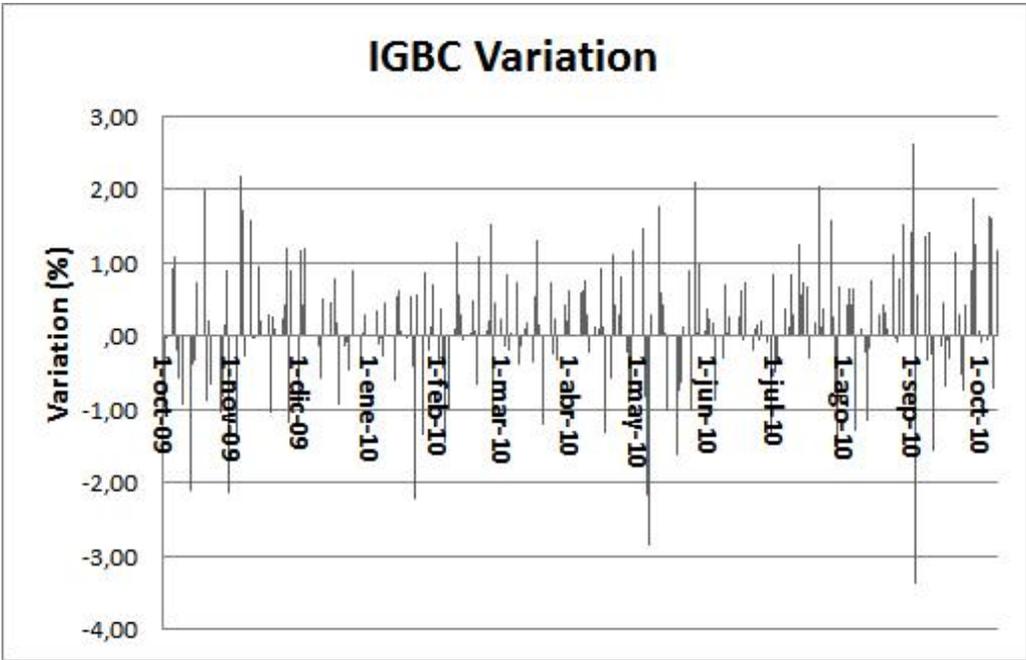
Source: Bolsa de Valores de Colombia

Calculations: Authors



Source: Bolsa de Valores de Colombia

Calculations: Authors



Source: Bolsa de Valores de Colombia

Calculations: Authors

As a result⁵⁴ the indexes grew from October 2009, to the end of last year and volatility has increased but this can happen because of the financial crisis which has affected the whole world.

Another way of seeing the auction results in the stock market model context is checking the transaction volumes and the index performances. In November 2010, the Colombian stock market reported that stock transactions had exceeded COP \$4.8 billion (*this result doesn't include the REPO operations only cash transactions*) one of the greatest values of the year. Finally, the IGBC index (*one of the most important in Colombia*) in the same period reported an increase of 8.1% for a total of 36,5% in the entire year, as reported by Bloomberg⁵⁵.

4.10.3 Conclusions

The biggest concern in this scenario is optimality concern because, the older model that the stock market used was in some way blocking foreign investment due to its complexity. With the new model, structured through complex auction designs and based on the European model, optimality issues were solved because it became easier for foreigners to invest in a stock market with the same structure as the standard ones.

As an example of the results this new auction stock market achieved, on the 22nd of November 2010 the capital markets of Chile, Peru and Colombia merged to achieve the first financial platform in Latin America⁵⁶.

Although, efficiency isn't the biggest concern of this design, it has some important features, for example the CALCE algorithm looks for the biggest welfare allocation. Meaning that the equilibrium price will be set where the biggest amount of operations are being handle of (*where demand and offer are the nearest to the equilibrium*).

Finally, the volatility auction is an excellent tool to regulate prices because it can reset the price range according to market needs. In contrast to the old mechanism where the market freezes and all the transactions stop. Also, the Volatility Auction is a way to regulate financial operations in the stock exchange, showing the many ways auction designs can be implemented for a wide variety of economic topics.

⁵⁴Results (Spanish version) were taken from <http://www.fiduagraria.gov.co:8090/archivos/Boletin%20mercado%2043.pdf>.

⁵⁵Ibid., p.3

⁵⁶For further information in Spanish about this topic check the following article <http://www.portafolio.com.co/archivo/documento/CMS-8315883>.

5 Others

Others, is understood as all the auctions for different services, assets, food, art or animals, which have no relation to the Financial, Electric and Gas, or Communication industries. This is done to show the diversity of auctions held in Colombia, how different objects can be adjudicated throughout auctions, and the savings that can be achieved with their implementation.

5.1 Computers for Education (Computadores para Educar “CPE”) Auction

5.1.1 General

Since the year 2000, the government implemented CPE⁵⁷ auctions yearly in order to donate computers to the low income population, generating savings and improving the computer supplier system. Another objective of CPE is reducing the digital gap and the lack of knowledge in some regions of Colombia with the intention of ensuring a better level of education and major access to technology. This document is focused on the auctions held in two different years (*2008 and 2009*). Each year different auctions were held for different computer parts. It should be pointed out, that despite the fact that these auctions include computer systems, they are included in this section and not in the Communications industry, because the goal of these auctions was to ensure a higher level of education for the poor and not to adjudicate any license concerning communications at all.

In 2008, the type of mechanism implemented for CPE was an inverse Dutch auction. Through auctions the government expects the procedure to be held in a public and transparently. In these types of auctions there is a reserve price (*in this case is also a starting price*), where the bidders place their bids, and the one with the lowest bid, wins.

This year the government held auctions for partial computers: 4 different auctions⁵⁸ with the idea of acquiring 3 items: PC, monitors and kits which contained keyboard, mouse, speakers and microphone. The first item was divided into two auctions (*two lots*); in the first, 10,872 dual core processors were auctioned and in the second, 8,128 single core processors, all with the respective mother board and RAM. In the third auction 16,500 monitors were auctioned and in the fourth approximately 23,500 computer kits.

CPE also held auctions for complete computers with the purpose of minimizing computer costs. The computers were divided into two different lots of 13,424 and 13,423, taking into account that the same bidder could not win both lots. This was more like a discriminatory multiunit auction (*2 units/ 2 lots*).

⁵⁷More information at www.computadoresparaeducar.gov.co (In Spanish)

⁵⁸More information in Sanz, Andres F. (2010) (In Spanish)

In 2009, the type of auctions held were Dutch auctions for only one lot, with the difference that the reduction of the bids had to have a difference of 0.5%. For more than one lot auctions were similar to Discriminatory open auctions, with the two lowest bids being adjudicated with a lot, paying a price equal to each one's bid. These auctions were for partial computers and had exactly the same 3 items. For the first item the single core processors were divided into 3 lots: the first two acquired in the same auction had 13,500 and the last one had 6,488 in a different auction in which the winners of the first auction could not participate. For the second item the kits were divided into 3 lots: all with 13,094 keyboards, 13,357 mouse, 14,762 speaker pairs, and 15,112 microphones. For the third item the monitors were divided into 3 lots of 12,051 each.

5.1.2 Results

a) 2008 Auctions

The first auction for partial computers had 7 participants, the budget or reserve price for the totality of processors was approximately COP \$3,178.5 million, the adjudication price was COP \$2,536.8 million, with savings of COP \$641.68 million (*20% of the budget*).

The second auction for partial computers had 7 participants, the budget or reserve price for the totality of processors was approximately COP \$1,805.3 million, the adjudication price was COP \$1,376.5 million, with savings of COP \$428.74 million (*23.7% of the budget*).

The third auction for partial computers had 6 participants, the budget or reserve price for the totality of monitors was approximately COP \$3,807.3 million, the adjudication price was COP \$2,681.8 million, with savings of COP \$1,125.5 million (*29.6% of the budget*).

The fourth auction for partial computers had 4 participants, the budget or reserve price for the totality of kits was approximately COP \$1,224.6 million, the adjudication price was COP \$1,139 million, with savings of COP \$85.6 million (*7% of the budget*).

These results are best shown in the following table:

Table 13: 2008 Auction Results

Auction #	# of Bidders	Budget (Million COP\$)	Adjudication Price (Million COP\$)	Saving (%)
1	7	3,178.50	2,536.80	20.2
2	7	1,805.30	1,376.50	23.8
3	6	3,807.30	2,681.80	29.6
4	4	1,224.60	1,139.00	7

Source: Sanz (2010). Tesis Universidad de los Andes: Análisis de los

Sistemas de subastas de "Computadores para educar".

The two auctions for complete computers had a total budget of COP \$25,531.5 million; the first auction had an adjudication price of COP \$12,388 million and the second COP \$12,381 million, for a total of COP \$24,769 million, with total savings of COP \$762.56 million (*3% of the budget*).

b) 2009 Auctions

The first auction for the first item (*two lots of processors*) had 8 participants; the budget or reserve price for the two lots was approximately COP \$13,211.2 million. The adjudication price for the first lot was COP \$5,595 million and COP \$5,600.67 million for the second lot, for a total of COP \$11,195.67 million; with savings of COP \$2,015.4 million (*15.25% of the total budget*).

The second auction for the first item had 6 participants, the budget or reserve price was approximately COP \$3,413.5 million, the adjudication price was COP \$3,000 million, with savings of COP \$413.5 million (*12.1% of the budget*).

The auction for the second item had only 4 participants for the 3 lots, the budget or reserve price for the three lots was approximately COP \$2,068 million, the adjudication price for the first lot was COP \$685.14 million, COP \$686 million for the second lot and COP \$686.4 million for the third lot; for a total of COP \$2,057.5 million, with total savings of COP \$10.51 million (*0.5% of the total budget*).

The auction for the third item had 9 participants for the 3 lots, the budget or reserve price for the three lots was approximately COP \$10,807.4 million, the adjudication price for the first lot was COP \$2,091.24 million, COP \$2,495 million for the second lot and COP \$2,499.44 million for the third lot; for a total of COP \$7,085.68 million, with total savings of COP \$3,721.73 million (*34.4% of the total budget*).

The results are summarized below:

Table 14: 2009 Auction Results

Auction #	# of Bidders	Budget (Million COP\$)	Adjudication Price (Million COP\$)	Saving (%)
1	8	13,211.20	11,196.67	15.2
2	4	2,068.00	2,057.50	0.5
3	9	10,807.40	7,085.68	34.4

Source: Sanz (2010) Tesis Universidad de los Andes: Análisis de los

Sistemas de subastas de "Computadores para educar".

5.1.3 Conclusions

Results of CPE auctions held on 2008 and 2009 show that one of the main objectives, generating savings, was fully achieved. Although acquiring computers by parts include some default risk which may affect the delivery of the computers and the failure of the CPE program.

In the 2008 auctions for processors, the winner of the first auction could participate in the second one, which increases the default risk, as well as the probability of collusion; for example the winner of the first auction colluding in order to let other to win the second auction, if the other contributed bidding in a way that the first had won the first auction.

This mistake was corrected for the auctions of complete computers in 2008, and in 2009 for partial computers, where a participant could only win one lot.

The savings for partial computers in 2008 were higher than with complete computers because some firms may have been specialized in certain parts of the computers, making the auction more competitive. This was fully corrected in 2009 where only partial computer auctions were held and as a result, there were more savings and less risk.

Holding similar auctions year after year increases the possibility that the participants learn and modify their strategic behavior tending to collude, to raise the adjudication prices. In these auctions entry deterrence is practiced, due to the fact that few firms can sell high quantity computers and these firms exercise predatory behavior because of the reputation, and because they had won or participated in previous CPE auctions, so the participants may always be the same.

5.2 Real-Estate Auction

5.2.1 General

Real-Estate auctions are run in Colombia for different purposes. Sometimes they are run when debtors can't pay their mortgages, and the banks, through real-estate agents, auction these properties. Also these kinds of auctions are made to ensure the sellers an easy, fast way to sell their property at a good price and immediate liquidity. This also benefits buyers who can usually take credits with different banks to buy the properties.

One of the most important Real-Estate Companies which runs these kinds of auctions is Corral Maldonado⁵⁹. This firm ran an auction on September 7th 2000 to sell 95 properties in Bogota, Chia, Girardot, Mosquera, Fusagasuga and Sopo. The price of the properties ranged between COP \$31.8 and COP \$480 million and the buyers could request credits with BBVA Bank. This auction is one of the many mechanisms

⁵⁹More information at <http://200.74.129.90/corralmaldonado/index.php> (In Spanish)

used by the firm between 2000 and 2010, with properties all over the country. The firm held their 148th auction on the 29th of August 2009.

These auctions are held online, and run like English Auctions in which bidders can only observe the highest bid made. To participate, the bidder must select the properties of interest (the bidder can check the property physically), and ask for credit if needed. The bidder then, has to make a deposit of around the 20% of the reserve price established for each property; which is less than the appraised value and would be returned if the property is not adjudicated. In these auctions, the bidders can participate manually by placing their bid anytime another raises the bid, or automatically in which the bidders place a maximum offer and the system bids for them.

5.2.2 Results

For the auction held on the 29th of August of 2009, Corral Maldonado reported sales of over COP \$1000 million. 33% of the properties sold corresponded to housing estates and the rest of it was distributed among locals, storage and rural properties. These properties had up to 68% off of their commercial value.

5.2.3 Conclusions

Although this electronic auction is an open auction, bidders don't know the other bidder's identities, they can only observe the highest bid, and so collusion would not be a problem like in other open auctions. Moreover, there is no entry deterrence because everyone who wants to participate can; however, a bidder can exercise predatory behavior if a potential bidder bids a really high price that doesn't allow other bidders to bid anymore, although this will be good for the revenue acquired for the seller and the auctioneer which is finally one of the principal objectives of these auctions.

These auctions are convenient for everyone involved; the sellers, because they have liquidity and they can sell their properties at good prices; the buyers, because they have the chance to buy certified properties at good prices below the commercial appraisal; and the intermediaries, because they have a rent per each property put on the market. In these auctions, the bidders know the commercial appraisal price; however, in the English format, bidders could have the winner's curse, as they could have paid more than they real value of the property acquired. This could be due to the fact that the only information they had was the highest bid made by another bidder and as the results show, the revenue raised compared to the real prices was high.

5.3 Procuraduría General Auction

5.3.1 General

On July 7th 2009, the Procuraduría General de la Nación⁶⁰, a state entity in charge of supervising public employees and representing individuals against the state, ran an auction to provide help desk services, technical support and full maintenance of physical assets and software systems belonging to it in Bogotá and around the country. This is one of the many tenders this institution holds, but we include it in this survey as it was advertised as an auction.

This contract was using an electronic descending auction, similar to a first price sealed-bid descending auction. This kind of auction is often held by this entity when it requires different services to avoid problems of hiring.

The budget available for this was COP \$1,000 million. To participate, the auction bidders had to fulfill all the legal and technical conditions stated in the contract specifications. They had to deliver 2 closed envelopes, one containing the information enabling requirements for accreditation, such as legal and financial capacity, technical capability and experience in this field. The other envelope had to contain an initial bid. The lowest of the economical bids made by the qualified participants was the starting bid for the auction.

After being accepted as participants, their bid made could not surpass the budget imposed by the auctioneer, or the starting bid contained in the second envelope opened only one hour previous to the start of the auction. Moreover, the bid had to be made for the totality of the service. None of the participants could identify the others and could only see the position of their bid with respect to the others, but not actual bids (i.e. *reserve price*).

The auction had a maximum duration of 30 minutes stipulated by the regulations. During this time any participant could make any number of bids, subject to the new bid being at least 0.5% lower than the previous bid. A rule stated that if the best bid was made during the last 5 minutes of the auction, an additional 5 minutes were added. And so on if there was a better bid. If the lowest bid (*best bid*) seemed artificial to the auctioneer, then he would ask for explanations, if not satisfied with the explanation, the bid would be rejected and the next best bid accepted.

5.3.2 Results

For the qualification of the auction there were 2 candidates SELCOMP INGENIERIA LTDA and COMPUTEL SYSTEM LTDA. But the second did not pass the technical and experience approval required by the

⁶⁰For further information visit the website in spanish <http://www.procuraduria.gov.co/>

auctioneer. The only participant in the auction was SELCOMP INGENIERIA LTDA. The economic bid envelope was opened and the bid was COP \$1000 million, exactly the budget available. As the bid fulfilled the rules, that was the final price, and SELCOMP INGENIERIA LTDA was the winner⁶¹.

5.3.3 Conclusions

The results show the lack of competitiveness in this type of auction due to high technical and experience requirements which makes it hard for new entrants to participate or to pass the prequalification process.

The adjudication price was exactly the budget available to provide the service of the help desk, technical support and full maintenance of physical assets and software systems of its possession in Bogotá and around the country; the initial economic bid should have been lower than the adjudication price, at least by some stated percentage, then not all the budget would have had to be spent for the auction to make sense. However, the auction did not have any incentives for the participants to place a lower initial economic bid, even if there was more than one participant.

However, the importance in this type of auction, is efficiency and for the winner to satisfy the technical requirements. In terms of efficiency one cannot tell what the winner of the auction was the one that valued the price the most. Literature in auction efficiency shows that many issues concerning asymmetric bidders (*when their valuations come from different distribution functions*) could avoid accomplishing efficiency in this type of auction (*Krishna, 2009*).

Although the goals of the technical requirements and the problem of contract hiring were solved, it would have been better if this entity had saved some budget by making the auction more revenue optimal, allowing more entrants the possibility to participate.

Bidders' entry is always an important concern (*Klemperer, 2002*). Incentives must be established to accomplish this goal. For instance, political requirements always promote entry deterrence because legal issues can be time consuming. One way to avoid this is to reduce or eliminate legal requirements for entry. Another important concern to attract bidders' entry, is the mechanism design, this is the most important one because literature on this topic has shown that entry deterrence can be a concern when the auction mechanism chosen promotes predatory behavior. For instance, an auction design where an industrial organization seems to be oligopolistic, requires a design that enables new participants to promote competitiveness instead of scaring them out due to the market power. These kinds of loopholes could be either promoted or corrected by auctions.

⁶¹ All data was taken from <http://www.contratos.gov.co/consultas/detalleProceso.do?numConstancia=09-9-65570>.

5.4 Electronic Auctions in the Colombian Public Sector

5.4.1 General

Electronic multiple unit auctions have been held in the Colombian public sector for some years. This kind of auction is based on technological platform and internet service named e-procurement, which makes it possible for acquisitions by the public sector to become more efficient⁶².

Electronic auctions have been held because they make the processes more transparent, because information is more accessible and there is an increase in the number of bidders. Another important factor is that savings are made due to the reduction of the transaction and administrative costs for both the auctioneer and the bidder.

The most common electronic auction held is the “reverse” auction, which is a descendent auction or Dutch auction, whereby in a competitive environment the true price of the goods or services is revealed. In this auction there is a price ceiling and the bidders start bidding until the lowest price is offered. More details on this can be found in appendix 1.

For these auctions, the public sector entities or auctioneer must establish what they want to acquire, and which bidders can participate. There is a time set for the extent of the auction, which is between twenty and forty minutes. There are various options for establishing the price ceiling, for example it can be set depending on historic price information, whatever price the auctioneer wants, or making a pre-bid by the bidders and select the lowest price.

Another rule for this type of auction is a distance or percentage stated by the auctioneer between each of the bids, and also a time distance between bids. Finally the auctioneer decides which information is public and which will remain private; for example, whether or not to publish which participant bids the best price and the price, or whether to only publish the position of each bidder.

5.4.2 Results

a) Ecopetrol Electronic Auctions

Ecopetrol held various auctions from 2002 to 2004 for procurement and hiring processes, with the purpose of achieving transparency, administrative efficiency and principally savings. Annually, Ecopetrol buys and hires to the value approximately COP \$3.5 billion.

Ecopetrol held descending auctions in 2002, 2003 and 2004. In 2002 the hiring budget was COP \$3,608 million; the adjudication was for COP \$2,944 million, COP \$664 millions below the budget, saving 18.4%.

⁶²More informaton in Prada, S. (2005). (In Spanish)

In 2003 the hiring and procurement budget was COP \$14,204 million; the adjudication was for COP \$11,004 million, COP \$3,200 million below the budget, saving 22.5%. In 2004 the hiring and procurement budget was COP \$84,000 million; the adjudication was for COP \$63,000 million, COP \$21,200 million below the budget, saving 25%. The total savings approached COP \$25,000 million.

The results are best summarized in the table below:

Table 15: Ecopetrol Electronic Auction Results

Auction year	Budget (Million COP\$)	Adjudication (Million COP\$)	Saving (Million COP\$)	Saving (%)
2002	3,608	2,944	644	18,4
2003	14,204	11,004	3,200	22,5
2004	84,000	63,000	21,000	25
Total Savings			COP \$24,864 Million	

Source: Prada, S. (2005). Como disminuir el gasto publico utilizando tecnología: Las subastas electrónicas.

Calculation: Prada, S. Departamento nacional de planeación.

In 2003, Ecopetrol also held an ascending auction to sell idle assets and excess of inventory, which had a reserve price of COP \$615 million; the adjudication price was COP \$991.9 million, COP \$376.9 million above the reserve price, gaining 61.3%⁶³.

Ecopetrol Auctions were considered successful due to the increasing yearly savings, and because the time elapsed for the acquisition was considerably reduced, approximately from seven weeks to 4 days.

b) Seguro Social EPS Electronic Auction

An *Entidad promotora de salud (EPS)*⁶⁴, an entity belonging to the Colombian social security (*ISS*)⁶⁵, held an auction in 2003 for the procurement of 406 different types of drugs, with the purpose of reducing costs due to the competition of the drug producing entities or transaction costs. The auction held was a descending auction with a dynamic formation of the supply curve, with the support of an expert company in charge of e-sourcing / e-business services.

The only available information to the bidders was the price variation determined by the position in the ranking of the auction. No information about other participants or their bids was disclosed. With this electronic auction there was no contact between ISS and the drug entities, giving transparency to the

⁶³ Ibid., p.22

⁶⁴ An EPS is a health service company, in charge of providing health insurance to the people. All the funds come from the government and are managed by these institutions.

⁶⁵ The ISS is a government institution in charge of public health and pension funds. Further information in Spanish can be found at <http://www.iss.gov.co/portal/index.jsp>.

acquisition process as well as reducing the length of the acquisition from approximately 3 or 4 months to 1 or 1.5 months.

The auction led to a range of 20% to 70% reduction of the drug prices. The budget initially stated for the acquisition was COP \$96,249 million but the assigned budget was COP \$91,715 million because 25% of the drugs were not offered. The saving obtained was of 6% plus the saving represented in the IPC index (Consumer's Price Index) and the increase in the purchase volume compared to previous years, resulting in a total saving of approximately 13%. The EPS of ISS also held an auction in 2004 for the acquisition of drugs, obtaining a saving of COP \$7,300 million⁶⁶.

The electronic auction as a drug acquisition mechanism used by the EPS of ISS was successful and very important for ISS; it represented huge savings in drugs and transaction costs, as well as transparency in the acquisition process and time reduction. The auction evolved and its performance can be undertaken online anywhere in the country, giving more element of competitiveness to the drug producing entities and more efficient prices for the ISS.

5.4.3 Conclusions

These Electronic auctions held either by ECOPETROL S.A and by Seguro Social S.A (*ISS*) allowed new entrants in the market to participate from anywhere in the country, conversely to what theory has stated about open auctions and collusion and entry deterrence issues. This contributed to the competitiveness and efficiency of the auction as well as budget savings by the entities.

The most significant issue in these kinds of auctions that are held to hire and acquire goods and services is money savings and transparency, which are fully accomplished as the results exhibit the big savings made by ECOPETROL S.A year after year in which the auction was held, as well as the savings made by Seguro Social S.A. Auctions are anonymous, the only thing that matters is the participants' bids, and the transparency issue in both auctions was solved.

5.5 Conexión Colombia Auction: Art for a Cause

5.5.1 General

Conexion Colombia Corporation⁶⁷ and Sokoloff & Associates LLC⁶⁸ ran an auction on September 20th, 2009. The purpose of the auction was to sell 65 paintings using an English ascending auction with initial

⁶⁶ Ibid., p.24

⁶⁷ The function of this organization is to collect and provide economic funds to a wide variety of foundations in Colombia, looking for the best impact social projects. Their official website in Spanish is <http://www.conexioncolombia.com/>.

⁶⁸ Sokoloff & Associates is an art advisory and public relations group. Their website is <http://www.sokoloffart.com/>.

price for each painting and also a reserve price unknown by the bidders. Each object was sold individually and each bidder had the opportunity to see the paintings with their commercial price before hand.

The auction began at 8:00pm with 350 bidders. The initial price was set by the “hammer” that was the figure of the auctioneer and each bidder had the opportunity to bid higher values according to the other competitors in the room. The auction also gave people who wanted to participate and couldn’t assist the opportunity, to bid. This was what the auctioneer called the absent offer. The procedure for this offer consisted in leaving an envelope with the maximum bid that the bidder was willing to offer for each painting he liked, and later in the auction the “hammer” with all the information of the absent offers, bid, in their name, knowing the minimum price he could offer for winning in the name of the absent person.

However, that was the only exception; all the remaining bidders had to be in the room, or have a person there to represent them. The auction was a standard auction; each painting was sold to the maximum bid. If the bid was above the reserve price, every bidder in the room had the opportunity to overbid this maximum offer.

Also, on September 29th 2010, they ran another art auction using the same mechanism and for the same purpose (*charity funds*). In this case 89 paintings were auctioned ⁶⁹.

5.5.2 Results

In the auction held in 2009, 23 of 65 paintings were sold above their commercial price and all of the paintings listed in the catalog were sold. The commercial average price was COP \$21.939.535 and the average selling price was COP \$19.934.884. Some paintings provided profit (*difference between the selling price and the commercial price*), but others didn’t. All the final bids were above the reserve price, although many prices were below the commercial price⁷⁰. A special case is the painting of Carlos Cruz-Diez called “Physichromie No. 2095” that gained a profit of nearly COP \$40 million. Perhaps this result could be achieved because of the mechanism chosen by the auctioneer⁷¹. The following table shows the ten most expensive paintings:

Table 16: Art Auction Results

⁶⁹For paintings catalog, auction details and contact information visit the following website in Spanish, <http://www.conexioncolombia.com/subasta.html/>.

⁷⁰The average profit may be negative in this case, but the only reason for that is that we excluded the Andy Warhol painting from the data because of inconsistencies.

⁷¹Data is not available for the public, it was only provided for this research by Conexion Colombia. Contact information is available in the link above. For the calculations Warhol’s painting was not taken into account because the data base provided seemed inconsistent between the commercial price and the selling price, so we excluded from the averages calculated.

Lot Number	Artist	Commercial Price (COP\$)	Sale Price (COP\$)
18	Cruz - Díez Carlos	165,000,000	127,000,000
36	Caballero Luis	55,000,000	41,000,000
27	Zapata Hugo	52,500,000	38,000,000
10	Muniz Vik	48,000,000	62,000,000
32	De szyszlo Fernando	42,000,000	42,000,000
24	Negret Edgar	40,000,000	28,000,000
20	Rojas Carlos	37,500,000	26,000,000
31	Grau Enrique	37,500,000	32,000,000
17	Rojas Miguel Ángel	31,500,000	37,500,000
35	Cárdenas Santiago	30,000,000	47,000,000

Source: Conexión Colombia.

5.5.3 Conclusions

This art auction was undertaken using a mechanism well known in the theoretical field as an auction design that allows prices to rise higher than other formats, under assumptions such as private values, symmetric bidders, increasing bid functions, risk neutrality and no budget constraint (*Klemperer, 2002*). It also provides incentives for collusion and entry deterrence. In this case, the number of bidders avoids this type of entry problem and at the same time promotes competition making it almost impossible, due to the number of competitors, to collude.

However, it is very important to notice that in this type of auction, efficiency is an important factor and this plays an important role when the auctioneer wants to sell the paintings to the bidder that value it the most. The results can be a very illuminating symptom of efficiency given the auction mechanism, most selling prices are similar to the commercial price and also by using theory, bidders will tend to bid all the way to their value if it's necessary. Finally, the auction was a success, according to two criteria. The first is that the revenue raised by the auctioneer accomplished their expectations, and the second criteria is that the art market was promoted because all the paintings (*including the ones from new artists*) were sold.

5.6 Cattle Auction

5.6.1 General

Cattle Auctions are very common on the Caribbean coast of Colombia, cities like Sincelejo and Monteria, and towns like Planeta Rica, Sahagún, San Pedro and Sampués are specific places where auctions are held. COGASUCRE is a cattle marketer in Sincelejo that provides cattle services⁷² and has held auctions for a long time (*about 15 years*). These cattle auctions are held every Wednesday. Another, important cattle marketer in charge of coordinating and regulating cattle auctions in the cities mentioned above is SUBASTAR S.A.⁷³. Many other small intermediaries work in this region.

In this auction the idea is to sell packages of cattle from every cattle rancher from the region using an ascending auction (*more commonly known as English auction*) with a pre-established initial price.

COGASUCRE and SUBASTAR S.A, work as intermediaries between cattle ranchers and possible buyers. The first step with this auction mechanism consists in giving a number to each package of cattle offered by the rancher to be weighed by the cattle marketer. Next, each bidder will be in the same place bidding according to its preferences of the packages. Although, the auction can be thought of as a multiunit auction it is a single object because each package is sold individually and there are no packages being offered simultaneously.

Another aspect of the auction is that the auctioneer or the owner decides the initial price and each bid is given for unit of weight, for example a bidder bids X amount of money for 1 kilogram. The total weight of the package of cattle and the strain is known before bidding.

Throughout the auction, every bidder has the chance to bid an amount of money and they can also over-bid another competitor, the final price is determined by the highest bid made. Despite the idea of an initial price set by the auctioneer, the advantage of this is in the case of COGASUCRE, is that if the package has no offers after announcing the initial price, then COGASUCRE pays to the cattle rancher the initial price for each kilogram of the weight of the package, knowing the intermediary's commission.

Also, the quality of the cattle is measured by standard rates of marketer organization and the packages are classified in two types: first class cattle and second class cattle. The classification depends on the strain and condition of the cattle.

The cattle auction is held every Wednesday of the month (*COGASUCRE*) and twice a month (*on average*) (SUBASTAR S.A).

⁷²The official Spanish website for further information is <http://www.cogasucres.com/>.

⁷³For further information visit the following website in Spanish, <http://www.subastar.com.co/index.htm>.

5.6.2 Results

Many auctions have been held in this region with some interesting results. In 2008, the Colombian journal of livestock science published an article about cattle auctions in Monteria and Sincelejo⁷⁴ showing the structure in these cities. This study will provide the important results presented in that journal's article.

Table 17: Cattle Auction

Cattle Statistics						
Year	Monteria			Sincelejo		
	Buyers	Total Cattle	Auctions Ran	Buyers	Total Cattle	Auctions Ran
2003	874	123,075	100	411	62,510	47
2004	999	147,796	100	472	82,247	57
2005	778	103,179	100	450	61,669	47
2006	508	80,004	105	578	84,560	62

Source and calculations: Castillo, O. (2008). Market structure of growing cattle auctions in Monteria and Sincelejo cities (Colombia).

Revista pecuaria de ciencias humanas.

The table above shows a summary of the auctions held over 4 years. In Monteria, the best year for selling cattle was 2004, it held the same amount of auctions as in 2003 and 2005. In Sincelejo, in 2006 the biggest quantity of cattle was sold in comparison to 2003, 2004 and 2005. The difference was that 62 auctions were held in that year and the years before only 47 and 57 auctions were held. Nevertheless, in the case of Monteria, the auctions held in 2004 attracted the biggest number of bidders in comparison to the other years. That was also the case in Sincelejo; the auctions held in 2006 had the largest entry of bidders.

The chart below shows some statistical results from cattle auctions in Monteria and Sincelejo. A more interesting result is presented in the following tables⁷⁵.

Table 18: Monteria Index

⁷⁴More information in Castillo, O. (2008).

⁷⁵CR4 index: Purchases made by the 4 biggest enterprises or individuals, as a percentage of the overall purchases made by the industry.

CR5 index: Purchases made by the 8 biggest enterprises or individuals, as a percentage of the overall purchases made by the industry.

Cattle auction market concentration index Monteria (% of animals purchased)				
Index (%)	Year			
	2003	2004	2005	2006
CR4	11.8	13.8	13.8	17.3
CR8	18.3	20.4	20.3	24.3

Source and calculations: Castillo, O. (2008). Market structure of growing cattle auctions in Monteria and Sincelejo cities (Colombia).

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Table 19: Sincelejo Index

Cattle auction market concentration index Sincelejo (% of animals purchased)				
Index (%)	Year			
	2003	2004	2005	2006
CR4	21.5	10.7	12.8	12.5
CR8	29.3	18.5	19.4	19

Source and calculations: Castillo, O. (2008). Market structure of growing cattle auctions in Monteria and Sincelejo cities (Colombia).

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These results were compared in 2 indexes called Herfindhal (HI) and Rosenbluth (RI)⁷⁶, the evolution of the indexes in those years revealed that auction markets were working similarly to what is known in economic theory as perfect competition. This can only mean that efficiency relies in the English auction mechanism (*Krishna, 2009*). Moreover, we can see in the 2 tables above that in Monteria, the biggest market concentration for the CR4 and CR8 indexes was found in 2006, but in Sincelejo the biggest concentration was in 2003 for both indexes and since then the market concentration has been decreasing.

Table 20: Market Concentration

Monteria				
Index (%)	Year			
	2003	2004	2005	2006
HI	0.8	0.9	0.9	1.4
RI	0.4	0.3	0.4	0.6

⁷⁶Methodology and index intervals can be consulted in the link mentioned above or whatever standard Industrial Organization Text-Book.

Source and calculations: Castillo, O. (2008). Market structure of growing cattle auctions in Monteria and Sincelejo cities (Colombia).
 Revista pecuaria de ciencias humanas.

Table 21: Market Concentration

Sincelejo				
Index (%)	Year			
	2003	2004	2005	2006
HI	2.2	0.9	0.9	0.9
RI	0.8	0.7	0.7	0.5

Source and calculations: Castillo, O. (2008). Market structure of growing cattle auctions in Monteria and Sincelejo cities (Colombia).
 Revista pecuaria de ciencias humanas.

Finally, the market structure indexes shown in the tables above yield that markets were competitive so collusion does not seem to be an issue.

5.6.3 Conclusions

The English auction used to allocate cattle speaks for itself as well as the results concerning market structure. The only question that may arise from this design is how the fee that marketers charge for intermediation between the bidder and the seller affects the initial price: However, in terms of optimality (i.e. *revenue*) the auction is not affected, because a higher initial price doesn't change the way bidders will bid up to their valuation and in consequence their expected payment (*Krishna, 2009*). Nevertheless, this bargaining between the marketer and the cattle seller seems right and profitable.

The tradeoff between the risk of selling the cattle by themselves (*without COGASUCRE or SUBASTAR S.A*) and raising more revenue, and the idea of paying a fee for the intermediary to auction can be seen as a prime risk that the cattle rancher is willing to pay in order to get a deal. We must remember that if the auction is bid-less (i.e. no offers are made *for the package*) COGASUCRE will pay the initial price per kilogram taking the commission out of the total revenue.

5.7 Yellow Corn, Soy Beans and White Corn Auction

5.7.1 General

The Ministry of Agriculture⁷⁷ and the Fenalce⁷⁸ institution have been running this auction through *MAC* regulations⁷⁹ since 2009 and on average three times a year for each product (*yellow and white corn and soy bean*). This is a multiunit auction that works similarly to a uniform auction. Nevertheless, due to all the *MAC* regulations some differences can be pointed out.

To begin with the procedure of the auction demands that all the bidders registered in the minister's web page submit a sealed bid⁸⁰ taking in account the *IBSA*⁸¹ boundaries published by the agricultural minister. After collecting all the bids, known only by the respective bidders, taking into account the annual quota (*the estimated imports volume that would be allowed for the agricultural products yellow corn, soy beans and white corn*), each competitor must name a middleman to represent him or her in the *Bolsa Nacional Agropecuaria (BNA)*⁸² where the auction takes place. Next, during the auction a representative agent from the *BNA* opens all the bids checking if they fulfilled the requirements and also waiting to see if any middleman has any complaints about the bids made by other participants. After that, all the bids, more specifically the *IBSA* index, are organized in ascending order. This means that the lower the *IBSA*, the higher the probability of winning a seasonal quota allocation (*the estimated imports volume that would be auction in each period, set by Fenalce. This quota allows all the bidders who win an amount of importations, for the products named above, with a special charge*), measured in tons. They will be winner bids until the fixed national crop available runs out according to the demands made in the bids. Therefore, priority will be for the bidders who submit a lower *IBSA*. Note that this could be achieved if the imports demand is low or if the national production demands for the product is big enough in the fraction.

The uniform price of the auction can be seen as the intra quota tariff (*the tax the importer will pay if he wins the seasonal quota allocation, this intra quota tariff will never be higher than the tariff notified to the World Trade Organization*) that all the winners must pay for their imports. This fee is set previously by the

⁷⁷Agricultural minister is a government institution in charge of all agricultural policy and fair and efficient use of land resources in rural areas. For further information visit the following website in Spanish <http://www.minagricultura.gov.co/inicio/default.aspx>.

⁷⁸Fenalce is the Federación Nacional de Cultivadores de Cereales y Leguminosas, a nonprofit entity that represents cereal and legumes growers. For further information in Spanish check the official website <http://www.fenalce.org/>.

⁷⁹MAC is the Public administration mechanism for the agricultural quota. More information about these regulations can be found in the following document in Spanish, <http://www.fenalce.org/archivos/dec430.doc>.

⁸⁰The bid content is: bidder's *IBSA*, quantity of the national product that he wants to buy and some administrative information.

⁸¹*IBSA* is an auction agricultural index, is the bidding instrument. The definition of the index is the following: $IBSA = \frac{Q_i}{Q_n}$, where Q_i is the importation demand and Q_n is the national production demand, all this demand is refer to the agricultural products above.

⁸²*BNA* is the agricultural domestic exchange, were commodities and agricultural services are trade. Further information can be consulted in Spanish at <http://www.bna.com.co:8080/LABNA/tabid/36/Default.aspx>.

agricultural minister, but the actual bidding competition is made by the incentive of winning a spot in the seasonal quota allocation, trying to reduce the amount imported and increasing the part being bought to the country. Note that the price represents the opportunity cost of being left out of the seasonal quota, because a higher tariff must be paid, instead it's called the extra quota tariff (*the tax charged on all agricultural products that are imported without the season quota allocation*).

5.7.2 Results

The following results belong to the seasonal quota allocation of the agricultural commodities yellow corn, white corn and soy beans. These tables show a summary of some of the auctions held in 2010⁸³.

Table 22: Yellow corn Auction

Yellow Corn Auction 18/05/2010	
Importation quota auctioned	626,063 Tons
National production	83,475 Tons
Bids presented	82
Winner bids	78
Loser bids	4
Seasonla quota allocated in the auction	626,063 Tons
Residual Quota	0
National production allocated	83,475 Tons
Residual of national production	0

Source and calculation: Fenalce.

The yellow corn auction above, held on May 18th 2010, showed a high participation (or bid competition) clearing the market. An important fact is that the national production allocated, shows how much Colombian production bidders will have to buy at all in order to gain the right to be exempt of fees.

Table 23: Soy Bean Auction

⁸³All the data was taken from http://www.fenalce.org/pagina.php?p_a=7 (link in Spanish).

Soy Beans Auction 23/06/2010	
Importation quota auctioned	97,500 Tons
National production	19,500 Tons
Bids presented	17
Winner bids	16
Loser bids	1
Seasonla quota allocated in the auction	60,170 Tons
Residual Quota	37,330 Tons
National production allocated	12,034 Tons
Residual of national production	7,466 Tons

Source and calculation: Fenalce.

The soy beans auction, held on June 6th 2010, didn't perform as well as the yellow corn auction, because the entire importation quota auctioned wasn't allocated as a result of lack of competitiveness (*note that there was one loser bid with importation quota left, this could be because the bidder didn't have all the requirements fulfilled*). Also, the national production allocated didn't reach the 100% quota of what Fenalce intended to allocate.

Table 24: White Corn Auction

White Corn Auction 18/05/2010	
Importation quota auctioned	41,500 Tons
National production	83,000 Tons
Bids presented	35
Winner bids	30
Loser bids	5
Seasonla quota allocated in the auction	41,500 Tons
Residual Quota	0
National production allocated	83,000 Tons
Residual of national production	0

Source and calculation: Fenalce.

Finally, the white corn auction held on June 8th 2010 had a remarkable performance in comparison to the soy bean auction. The difference between this auction and the yellow corn auction is that bidders entry wasn't as it was for the yellow corn auction.

In sum, only the soy bean auction didn't reach the allocation of the entire quota leaving a residual. In the 3 auctions shown above, we can see that on average, 91.63% of the bids presented were approved, this leaves little percentage for the losers and this could be because of a high IBSA or a mismatch in the MAC requirements (*could be the case of the soy bean*).

Nevertheless, another thing which is important to know are the IBSA boundaries that were considered in each auction. The following table summarizes that information:

Table 25: IBSA Boundaries

	IBSA Boundaries		Reference IBSA
	Min.	Max.	
Yellow Corn	5.912	9.088	7.500
Soy Beans	4.411	5.589	5.000
White Corn	0.270	0.730	0.500

5.7.3 Conclusions

One would think, that a fixed price set previously to the auction could change all its characteristics. However, the competitive incentives to avoid paying a importation tariff higher than the intra quota tariff (oportunity cost) ensure a standard auction. Therefore, competing behavior is not related to price issues, but to quantity.

In two of the three auctions (*shown in the results*), the entire seasonal quota was allocated, but in the soy bean auction all the seasonal quota wasn't allocated. Thus, inefficiency in this particular auction is an important issue because part of the seasonal quota wasn't allocated and the idea of the prize is to achieve a lower tariff for importation. The Government's objective wasn't accomplished and the reason could be because of the number of bidders participating, this is why the size of participants is always important for achieving all the optimality goals and to avoid inefficient results. As in this case, collusion, entry deterrence and predation are not always the reasons for preferring many bidders, as this case shows there is also a concern for avoiding inefficient results.

6 Resume Table

The following table shows a resume of all the auctions that have been mentioned along of this document. The auctions are presented in the same order as in the paper and substantial information such as the sector, the industry, auction type, times held, rounds made and units auctioned, is taken in to account.

It is the intention of the paper to provide a guide through the whole text, so the table is a way to provide some guidance about what to expect from this survey. Readers with particular interests in some industries or some sectors can check this table to pick a topic of interest, but as we mentioned earlier it is desirable to read the whole document as a way to learn about auctions in the Colombian environment.

	Auctions	Times Held	Units	Industry	Sector	Auction Type	Rounds
1	Spot Electricity Market	Multiple	Multiple	E&G	Public	Uniform	Single
2	ECOPETROL's Refinery	One Shot	One	E&G	Both	English	Multiple
3	Ecogas State-owned Co.	One Shot	One	E&G	Public	First-price	Multiple
4	Three Power Companies	One Shot	One	E&G	Public	First-price	Single
5	Colombia: Energy Obligations	One Shot	Multiple	E&G	Public	D.C	Multiple
6	Available Production of F.Gas	One Shot	Multiple	E&G	Both	English	Multiple
7	P. Communication Services	One Shot	Multiple	CMT	Public	English	Multiple
8	TELECOM-COLTEL	One Shot	One	CMT	Public	English	Multiple
9	Colombia Movil S.A (OLA)	One Shot	One	CMT	Both	First-price	Multiple
10	Third Private TV Channel	One Shot	One	CMT	Both	First-price	Multiple
11	Granahorrar Bank	One Shot	One	Finance	Public	First-price	Single
12	OMA: Repo	Multiple	Multiple	Finance	Public	Uniform	Single
13	Class B TES Bonds	Multiple	Multiple	Finance	Public	Uniform	Single
14	FRECH	Multiple	Multiple	Finance	Public	Uniform	Single
15	Call Option	Multiple	Multiple	Finance	Public	Uniform	Single
16	Put Option	Multiple	Multiple	Finance	Public	Uniform	Single
17	FOGAFIN Bonds	Multiple	Multiple	Finance	Public	Uniform	Single
18	Popular Bank: Hammer	Multiple	One unit	Finance	Private	Eng./First-Price	Single
19	Credit Auction: 2007 case	One Shot	One unit	Finance	Public	First-price	Single
20	Stock Market	Multiple	Multiple	Finance	Private	Uniform/Volatility	Single
21	Education Computers (CPE)	Multiple	Multiple	Other	Public	Discriminatory	Single
		Multiple	One	Other	Public	Dutch	Single
22	Real-Estate	Multiple	One	Other	Private	English	Single
23	Procuraduria General	One Shot	One	Other	Public	D.S.B	Single
24	Electronic Auctions in C.P.S	Multiple	Multiple	Other	Both	Dutch	Single
25	Conexión Colombia: Art	Multiple	One	Other	Private	English	Single
26	Cattle	Multiple	One	Other	Public	English	Single
27	Soy beans, Y&W corn	Multiple	Multiple	Other	Public	Uniform	Single

Note: In the industry column, E&G means electricity and gas and CMT means communications. Also, in the auction type column, D.C means descending clock and D.S.B means descending sealed bid (in the popular bank

auction, Eng. refers to English). Finally in the sector column, Both refers to private and public sector.

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8 Appendix

8.1 Appendix 1: Auction description

In this appendix, there is a brief description of the most common auctions, including sealed-bid and open auctions; as well as auctions in which there is only one object adjudicated (i.e. *Single unit auctions*) and more than one object adjudicated (i.e. *Multiunit auctions*). The auction equivalences described below are only consistent in a private valuation context, this means that every bidder knows the value of the object for itself at the moment of bidding. Also, these valuations are identically and independently distributed, in other words, bidders' values come from the same distribution and they are not correlated in a statistical

sense. Meanwhile, with interdependent values the bidders only have partial information on the value of the object for themselves, as well, other bidders may have information that affects the value that a bidder assigns to the object. An important implication of interdependent valuations is that the equivalences between open and closed auctions are broken.

8.1.1 Single Unit Auctions

Some examples of this type of auctions found on this survey can be the "Popular Bank: Hammer auctions", "Ecogas State-owned Gas Company Auction", "Colombia Movil S.A (OLA) Auction" and "Third Private TV Channel Auction", among others.

Sealed-bid auctions The most common sealed-bid auctions are the first price and second price sealed-bid auctions. This type of auctions are different from the open auctions not only in the way they are implemented, but also because in the open format the bidders can acquire more information about the bids and the strategic behavior of the others, while in the sealed-bid format the bids are in closed envelopes and the uncertainty about other's bidding behavior exists.

First price auction This mechanism is a sealed bid auction, where every bidder submits a bid in an envelope that is unknown for the rest. The bidder who had the highest bid wins the auction and pays what he bided. However, Krishna (2009) states that this mechanism is revenue equivalent to the second price auction under several assumptions. Other characteristics are that first price auctions are efficient only in specific symmetric scenarios and avoiding collusion is more likely in this type of formats because of the uncertainty faced by bidders.

Second price auction This mechanism is a sealed bid auction, where every bidder submits a bid in an envelope that is unknown for the rest. The bidder who had the highest bid wins the auction and pays the second highest bid. Revenue equivalence theorem says that this mechanism is revenue equivalent to the First price auction under several assumptions. Other characteristics are that Second price auctions are always efficient.

Open auctions The most common open auctions are the English and Dutch auctions.

English auction This auction is an open ascending price mechanism, where bidders compete between each other. An auctioneer is directing the auction and is constantly calling prices in an ascending way (*beginning with an initial price*). The auction takes place as long as there are at least two bidders participating to acquire the object, and it stops when only one bidder is left, the price that the winner pays is equal to the price at which the second bidder dropped out. Krishna (2009) states that English auctions are equivalent in a weak form to second price sealed-bid auctions. Also, it is considered that if some conditions are accomplished, the mechanism has an ex-post efficient equilibrium and some desirable characteristics could be achieved like optimality (*high revenue if there is a high level of competition*).

Dutch auction The Dutch auction is an open descending price mechanism. An auctioneer starts calling a price that is considerably high for anyone to buy it and then it starts lowering the price until finally one bidder signals that he is interested in the object. Consequently, the object is sold to the bidder at that price. Krishna (2009) states that Dutch auctions are strategically equivalent in a strong form to first price sealed-bid auctions. Therefore, efficiency is not achieved in this mechanism.

8.1.2 Multiunit Auctions

In this type of auctions, more than one object is being sold, these objects may be different (i.e. *complements*), like the "Electronic Auctions in Colombian Public Sector" studied on this survey, but in most cases objects are identical (i.e. *substitutes*), like the "Spot Electricity Market Auction" and "Call Option Auction", among others resumed on this survey. To hold this kind of auctions the auctioneer must prefer to sell each object individually, than selling it in a whole package in a single unit auction.

Sealed-bid Multiunit auctions The most common sealed-bid multiunit auctions are the Discriminatory, Uniform and Vickrey auctions.

Discriminatory auction This mechanism is a sealed bid ascending multiunit auction, where every bidder submits a bid per each of the K units being sold. The bidders who bid the highest K bids win the respective units. The price that the bidders pay for each of the units is a different for each of the bidders and each of the units; each bidder pays its highest bid for the first unit won, its highest second bid for the second unit won and consequently for all the units won, for all the bidders. This auction is reduced to a first price sealed bid auction when $K = 1$.

Vickrey auction This mechanism is a sealed bid ascending multiunit auction, where every bidder submits a bid per each of the K units being sold. The bidders who bid the highest K bids win the respective units. The price that the bidders pay for each of the units is a different for each of the bidders and each of the units, but the price formation is different from the discriminatory auction. Each bidder pays the K highest competing bid for the first unit won, the $K - 1$ highest competing bid for the second unit won and consequently for all the units won, for all the bidders, (*each bidder has different competing bids*). This auction is reduced to a second price sealed bid auction when $K = 1$. With private values this auction allocates the object efficiently.

Uniform auction This mechanism is a sealed bid ascending multiunit auction, where every bidder submits a bid per each of the K units being sold. The bidders who bid the highest K bids win the respective units. The price that the bidders pay for each of the units is a unique price set by the highest losing bid, this is the “Market Clearing price”. This auction is reduced to a second price sealed bid auction when $K = 1$, but this analogy is not correct in the sense of revenue equivalence.

Open Multiunit auctions The most common open multiunit auctions are the Dutch, English and Ausubel auctions.

English auction This auction is an open ascending price mechanism, where an auctioneer is directing the auction begins calling prices in an ascending way (*beginning with a preset initial price*). The objects are sold until at least two bidders are left (*one bidder can acquire more than one object*). When a price is called each bidder calls out how many object would he buy at that price. The auction ends when all the K objects are sold (*when the total demand is K*), the price that the winners pays is equal to the price at which the demand changes from $K + 1$ to K . This auction is “outcome equivalent” in a weak form to the multiunit Uniform auction.

Dutch Auction The Dutch auction is an open descending price mechanism. An auctioneer starts calling a price that is considerably high for anyone to buy it and then it starts lowering the price until one bidder signals that he is interested in one of the K objects at that price. Consequently, the object is sold to the bidder at that price. The price is then lowered and the process continues until the K objects are sold. According to Krishna (2009) this auction is “outcome equivalent” in a weak form to the multiunit Discriminatory auction.

Ausubel auction This mechanism is an open ascending price multiunit auction. An auctioneer starts calling a price and each bidder generates a demand function (*for the K identical objects*) according to that price. This procedure is made with each price while they are rising up, an object is sold when the residual function of a bidder (*this is the number of objects minus the global demand without including his own demand function*) is positive in the marginal change between prices. This means that an object is sold when there is a positive result between the difference of the residual function with the current price, and the residual function with the price announced before. The price each of the L winners pay ($1 \leq L \leq K$) for each object depending on the price that makes the marginal change in the residual function to become positive. This auction is “outcome equivalent” in a weak form to the Vickrey auction.