Auctioning Financial Assets; Discriminatory vs. Uniform, Which Method is Preferred?*

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Abstract

Many financial assets, especially government bonds, are issued by an auction. An important subject is the auction design: Uniform vs. Discriminatory. Theoretical papers do not supply a definite answer. We turned to the sovereign issuers that conduct auctions and found that the majority of the issuers/countries in our sample use a discriminatory auction mechanism for issuing T-bills. We have also turned to potential bidders and have asked for their preferences in a bidding game. The majority has chosen the uniform method. We look for explanatory variables to explain the country choice. It was interesting to find that more open economies tend to use a uniform method. Our interpretation is that in these countries the issuers try to cater to the bidders demands and thereby potentially generate wider participation which may result in higher revenues.

JEL ***classification: G1, F3***

Keywords: Uniform auction, discriminatory auction, treasury bonds, T-bills

1. Introduction

Many financial assets such as treasury bonds, corporate bonds and stocks are issued to the public via auctions. Most of the current, public and academic, debate with respect to financial auctions revolves around two main issues. The first is, whether to use an auction or another selling mechanism (e.g. should equity IPOs be done by book building or via an auction)[1]. Given an auction offering, the second question is, what pricing rule should be used in the auction: uniform pricing or discriminatory pricing.[2]

The focus of this paper is on this second main issue; the design of the auction mechanism. We have examined the auction mechanisms offered by treasuries around the globe. Which country is using a uniform price auction (UPA), which one is using a discriminatory auction (DA) and which one is using both or any other method? We then have investigated the preferences of potential investors. Would bidders prefer a uniform price auction or a discriminatory one? Would this preference show up in higher bidding prices?

To learn about the auction practices around the globe, regarding sovereign bonds, we have contacted Treasury ministries and central banks around the globe and received answers from 48 countries. Our sample consists of countries from different continents, different population, and economic size, including almost all (83%) the OECD countries.[3]

[1] The recent Google and Morningstar auctions, may have started a new approach to IPOs of stocks in the U.S. and elsewhere (e.g. the proposed IPO of Telstra which is owned by the Australian Government).

[2] In the **Uniform Price Auction (also known as Single Price Auction),** the objects are awarded to the bidders that bid above the market clearing price. All bidders pay the same price, the market clearing price, for the entire quantity that they are awarded. In the **Discriminatory Price Auction (also known as Pay Your Bid Auction or Multiple Prices Auction),** the objects are also awarded to the bidders that bid above the market clearing price. However, each bidder pays the price that he bid.

[3] We do not have in our sample the following OECD countries: Czech Republic, Denmark, Netherlands, Spain and the Slovak Republic.

In most countries that answered our survey a discriminatory auction is used. We investigate the factors which may explain the choice of auction mechanism by a sovereign. We find that countries that have more open financial markets, and practice Common law, tend to employ uniform price auctions. A possible explanation could be that the issuers in these countries are more attuned to the preferences of investors and have chosen the mechanism which reflects these preferences and allow for a wider participation of bidders.

Since the issuance of government debt plays a major role in any financial market, the debate regarding the design of the auction mechanism is an important one. Friedman (1960) has argued that the discriminatory format will drive out uninformed participants because of the "winner's curse" (consistent with the preference of our survey participants). Thus, it will be concentrated among better informed, typically large players, and then will be more susceptible to collusion. Hence he predicts that the discriminatory auction will lead to lower revenue, and yet we find that most countries use the discriminatory system (though some countries have switched to the uniform one).

More recent work in the theory of divisible-unit auctions investigates the trade-offs that the central planner faces in the use of the different mechanisms.[4] These papers ask the question: When the central planner (the auctioneer) sets the rules, given n exogenous participants, which mechanism will maximize his revenue? They show that there exist non-cooperative equilibria under the uniform-price format that support collusive outcomes.

[4] See, for example, Wilson (1979), Back and Zender (1993), Ausubel and Cramton (1996) or Wang and Zender (2002) for theoretical evidence on strategic bidding in multi-unit auctions. A survey article on auction theory by Das and Sundaram (1996) discusses the lessons from theoretical models for T-bill auctions, and presents some empirical evidence.

They also show that these outcomes are not supported by discriminatory auctions. The model predicts that the uniform price mechanism may result in multiple equilibria. Also, in a UPA the participants may collude, in which case the revenue to the seller may be lower under the uniform price mechanism than under the discriminatory one. Thus, in the case of divisible units the theory does not tell us whether the UPA will generate higher revenue than the DA. This remains an empirical issue that our research is trying to contribute to.

There is a growing strand of literature in experimental economics investigating divisible good auctions[5]. The number of participants in the experiments is set in advance and the bidders (either students or professionals) have to play a specific pre-determined game, either discriminatory or uniform, without asking them which type of game they prefer to play. However, if the auction results depend upon the auction mechanism coupled with the number of participating bidders, then investigating which mechanism would be preferred by the potential bidders should be of great interest.

Recently, financial markets have become more global and international barriers to conduct transactions are decreasing dramatically as manifested in the growing foreign participation in Treasury auctions around the world (e.g. Finland)[6]. In global financial markets, traders have the ability to shop across countries to find their preferred auction system. Since the number of participants may affect auction results,[7] a central planner that

[5] Starting from the early papers by Smith (1967), Miller and Plott (1985), Cox, Smith and Walker (1985) to the more recent papers by Goswami, Noe, and Robello (1996) and Sade, Schnitzlein and Zender (2006).
[6] See, for example, the evidence from Finland, "The introduction of the euro has boosted market volumes as well as numbers of active counterparties and final investors. Already during the first year of the euro, domestic banks lost much of their earlier dominant position as the share of foreign demand increased to 75%, and the share is still increasing", Salavirta and Taipalus (2003, pp 44).
[7] See, for example, Engelbrecht-Wiggans, List, and Reiley (2006) and Bulow, and Klemperer (1996)

would like to attract wide participation can no longer act as a monopoly but rather needs to take into account the preferences of potential bidders for auction designs.

There have been attempts, in the single unit auction literature, to investigate empirically and experimentally bidders' choices among existing mechanisms and to theoretically incorporate the notion that the sellers in the auctions may need to compete for the buyers[8]. Yet, to the best of our knowledge our study is the first attempt to investigate bidders' choice in **divisible** good auctions which is the appropriate setting for the auctioning of financial assets.

It is essentially impossible to get relevant data regarding bidders' actions and their preferences for specific auction mechanisms, while controlling for other effects, therefore using surveys to find out their preferences seems a natural alternative which we have used in this study.

We conducted a survey among a variety of potential bidders and business educated people. We surveyed advanced business undergraduates, MBAs which had a few years of work experience, Executive MBAs and financial professionals in 6 different countries (US, Israel, Norway, South Africa, Luxembourg and Switzerland) and got about a 50% response rate (220 qualified answers).[9] The survey revolved around the main question of their preference for a specific auction design; do the participants have a strong preference for either, a uniform auction or a discriminatory one.

The main findings are: First, 90.91% of the participants are not indifferent with respect to the pricing rule of the auction mechanism.

[8] See, for example, Ivanova-Stenzel and Salmon (2004), McAfee (1993), Levin and Smith (1994)

[9] All the university students that participated in our survey attended advance finance courses. Hence, they also had a background in economics and statistics. The students in the MBA programs that participated in the survey come from many different countries.

Second, most of those that have a specific preference toward a price mechanism, prefer to participate in a uniform price auction (65.5% of those who are not indifferent). This is true regardless of the country, and type of education (MBAs, executive MBAs or professionals)**.**

Third, the choice of auction design is affected by experience in the financial markets. The more experienced prefer the uniform mechanism, while exposure to financial assets auction is not significantly correlated with that choice. Our survey results indicate that bidders are bidding more aggressively under the uniform price mechanism than under the discriminatory price mechanism and on average the uniform price mechanism leads to higher revenue to the issuer.[10,11]

The paper is organized as follows. Section 2 looks at the auction practices of different countries. We try to explain the country's choice by factors such as the legal system, wealth, and other economic factors. Section 3 describes the hypotheses relating to bidders' choices and discusses the design of the survey. In section 4 we present the results. Section 5 provides concluding remarks.

2. Auction Methods Used by Issuers of Government Bonds

We first investigated the current practices used worldwide at treasury auctions.[12] We have sent via e-mail a short survey (see appendix A) to

[10]Our results are consistent with the experimental finding of SSZ (2006), the empirical investigation of Umlauf (1993) who examined the Mexican T-bill auctions, with Feldman and Reinhart (1995) that studied the international monetary fund's auction of gold and with Tenorio (1993) that studied Zambia's weekly auctions of foreign exchange.

[11] The experimental work by Goswami, Noe, and Robello (1996) shows that discriminatory auctions yield higher revenue than uniform auctions.

[12] Most of the documentation and analysis of pricing rules for financial auctions was done with respect to treasury auctions, mainly due to data availability and the size of these auctions

central banks and treasuries around the globe[13]. We received answers from 48 countries, listed in Table 1.

Our results (Table 1) indicate that most countries in our sample, 50%, use a discriminatory price mechanism to issue government debt, about 19% use a uniform price auction while approximately 19% use both mechanisms depending on the type of debt instruments being issued.[14] The rest of the countries, about 12%, use a pricing format that is different than the two conventional ones (*e.g* Austria).

Interestingly, even among countries with the same currency and relatively similar monetary policy (for example, the EU countries that use the Euro) different types of auctions mechanisms are used to sell their debt instruments. Finland, for example, which used a uniform price mechanism,[15] does not use auctions anymore, while France and Germany[16] currently use a discriminatory price mechanism. We also find that in some countries the mechanism that is being used to sell treasury debt has changed over time (*e.g*. the US has recently switched from a discriminatory mechanism to a Uniform one, while Mongolia switched from the uniform mechanism to the discriminatory one, and Singapore introduced a uniform price mechanism to some of the debt that they sell). In some countries (*e.g.* Israel) a discriminatory auction is used for Treasury securities while a uniform auction is used for corporate bonds and stocks.

Given all this evidence, it is clear that auction designs would be of great interest to a variety of issuers, be it governments or corporations, who

[13] The survey was sent via e-mail to all the central banks that their e-mails were listed at Bank for International Settlements, international directory and to the treasuries and Central banks that their e-mails/ home pages were listed at the IMF home page.
[14] For previous documentation of cross-country practices on the design of Treasury auctions see Bartolini and Cottarelli (1997).
[15] See Keloharju, Nyborg and Rydqvist (2003)
[16] See Rocholl (2004)

would like to know the profile of the potential bidders and their preferences. At the same time, potential participants would like to know why some countries use one method while others use another method. Thus, we have examined the features which make up the profile of a country to see if there are common features that can be associated with one auction design or another.

2.1 What may affect auction mechanism choice by a country?

We have searched the literature to find out whether the country choice of bidding mechanism is explained by other variables than maximizing revenues. The question is what determines the practice in the different countries.

An experiment conducted by the U.S. Treasury between 1992 and 1996 compared the two auction systems. The results (see Malvey Archibald and Flynn (1995) and Malvey and Archibald and (1998)) were inconclusive with regard to the total revenues generated by the two methods. The experiment, however, gave indications of wider participation and less concentration in the uniformprice mechanism. Aside from this we could not find a documented answer to our query. We thus examined the recent literature which investigates the different global financial systems, trying to explain their growth and efficiency, as well as other characteristics, by their legal system and other economic and non-economic variables. We based our indicators for the development of financial markets on some of the indicators that are used in research that investigate the relationship between financial intermediaries, legal systems and economics growth. La Porta et al (1998), Levine (1999) and others, investigate the role of the legal system and argue that legal systems that protect creditors and enforce contracts are likely to

encourage greater financial intermediary development than legal and regulatory systems that impede creditors from gaining access to their claims or that ineffectively enforce contracts. Rajan and Zingales (1998 and 2003) discuss how to measure financial development and suggest that the measures would capture the ease with which any entrepreneur or company or country can obtain finance, and the confidence with which investors anticipate an adequate return. We follow the above articles and use some of the variables that they use in order to see if some of these proxies may shed some light on the question at hand.

2.2 Empirical Results

In our empirical investigation of the variables that may explain the auction system chosen by a country we use the following variables:

- **Type of Auction**: U=uniform, D= discriminatory, B= both O = not using auctions to sell debt instruments.
- **Moody's Sovereign debt ratings : (Source: Moody's** August 2005.) The ratings serve as a proxy for the riskiness of the country.
- **Indebtedness Classification. (Source: World Bank- 2003.)** The World Bank classifies countries by their level of indebtedness for the purpose of developing debt management strategies. It uses a three-point scale: severely indebted (S), moderately indebted (M), and less indebted (L).[17] The Indebtness classification also serves as proxy for the riskiness of the

[17] The most severely indebted countries may be eligible for debt relief under special programs, such as the HIPC Debt Initiative. Indebted countries may also apply to the Paris and London Clubs for renegotiation of obligations to public and private creditors. In 2003, countries with a present value of debt service greater than 220 percent of exports or 80 percent of GNI were classified as severely indebted, countries that were

country**.**

- **Civil (Roman) Law versus Common Law.** This variable was proposed by La Porta et al (1998). We try to see whether the auction mechanism is associated with the legal system in a country.
- **Stock Market Capitalization as Percentage of the GDP. (Source: World Bank – 2003.)** Market capitalization is the share price times the number of shares outstanding and is calculated as percentage of the GDP.
- **GDP. –(Source: World bank – 2003.)** GDP is measured in current US dollars.
- **Ease of Doing Business 2006.(source: IFC - published in 2005)** The ease of doing business index ranks economies from 1 to 155.[18]

Table 2 describes the averages and medians of these variables with respect to the mechanism being used. One result that stands out is the fact than the proportion of countries with civil law that use discriminatory auctions is much higher that the proportion for countries using the uniform mechanism. We further conducted additional statistical tests that yielded the following results:

First, we find that countries that use discriminatory price mechanism have on average significantly lower capitalization to GDP ratio compared with countries that use a uniform price mechanism (P=0.03) [19] and countries that use both mechanism (P=0.04). There is no significant difference in the

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not severely indebted but whose present value of debt service exceeded 132 percent of exports or 48 percent of GNI were classified as moderately indebted, and countries that did not fall into either group were classified as less indebted.

[18] The index is calculated as the ranking based on the simple average of country percentile rankings on each of the 10 topics covered in Doing Business in 2006.

[19] Equal variance is not assumed in all the t-tests described in this section.

average of this ratio between countries that use both mechanism and those that use the uniform price mechanism.

Second, we find that the type of law that practiced in countries that employ discriminatory price mechanism is significantly (p=0.038) different than the law system in countries that use a uniform price mechanism. Specifically we find that countries that use a discriminatory price mechanism tend to be countries with a civil law system. The same applies to the difference between countries that use a discriminatory mechanism and countries that use both types of mechanisms.

Third, we do not find the GDP to be significant difference, on average, between countries that use the discriminatory mechanism and countries that use the uniform price mechanism.

Fourth, although we find that the frequency of Indebtedness Classification is higher for countries that use a discriminatory price mechanism compared with those that use uniform price mechanism, the difference is only marginally significant.

Fifth, we find, using a standard non parametric test, that on average the ranking for the easiness of doing business for countries that use uniform price mechanism is significantly higher than those that use discriminatory price mechanism.

We conducted multinomial regression analysis in order to estimate which variables affect the mechanism choice. Our dependent variable was classified as follows:

Countries that use the Uniform price mechanism = 1

Countries that use the Discriminatory price mechanism = 2

Countries that use both mechanisms = 3

Countries that use other type of auctions= 4

We estimated 4 different models: In Table 3 we present the coefficient values and statistical significance only for the comparison between the uniform price mechanism and the discriminatory price mechanism.

Our main finding is that the capitalization as percentage of the GDP is positively and significantly correlated with the choice of a uniform price mechanism, over the discriminatory price mechanism. The dummy variable for civil law is significantly correlated with the bidding system (see Table 4.) When the two variables are used together to estimate the mechanism choice, only the capitalization as percentage of the GDP remains significant. This result is probably due to multicolinearity; the Pearson correlation between these two variables is --**0.354** which is significant. (See Table 5.) Neither the GDP nor the Dummy for Indebtedness Classification are significantly correlated with the mechanism choice.

Next we examined the choice between using both mechanisms vs. using only the discriminatory price mechanism. The only variable that is significant, and negatively correlated with the decision to use "both" mechanisms compared to using the discriminatory mechanism is the dummy variable for civil law. All the other variables examined in this section are insignificant.

3. The Hypotheses and Survey Design

3.1. Hypotheses about Bidders' Choices

As discussed above the existing theory does not provide us with a definitive answer regarding the choice that an issuer of financial assets should make in designing an auction. One possible alternative is to try to get a reading of the preferences of the potential bidders. Presumably, more bidders will participate in an auction which is to their liking, for whatever

reason, and consequently this should result in higher revenues to the issuer. Though it may be possible that sophisticated players will prefer a mechanism attracting less players, and thus allowing them to benefit from a lower price. This issue is partially investigated in our survey, by asking potential bidders what they think other players will choose. The purpose of our study is to provide evidence, obtained from surveys, on the preference of potential market participants. Based on the answers to our survey we can test several hypotheses. We start with an elementary query regarding the preferences of participants.

H_0: Auction participants have no preference (are indifferent) for a specific type of mechanism, be it uniform (UPA) or discriminatory (DA).

H_1: Auction participants are not indifferent between UPA and DA.

A rejection of H_0, leads to the next hypothesis;

H_0: Auction participants prefer UPA over DA.

H_1: Auction participants prefer DA over UPA.

Given the choice of an auction mechanism, how does the bidding schedule (price/quantity) look like?

This is expressed by the following hypothesis:

H_0: The bidding aggressiveness is similar in both mechanisms.

H_1: The bidding aggressiveness is not similar in both mechanisms.

A rejection of the above hypothesis, $H_{0,}$ would lead to the next hypothesis

H_0: Bidding is more aggressive in the UPA.

H_1: Bidding is more aggressive in the DA

The above hypotheses are tested using the survey data.

3.2 Survey Design

3.2.1 Methodology

The responses to surveys, which were conducted among different groups in several countries, are our main source of data. In designing the survey we used standard survey techniques to minimize potential biases. A copy of the survey is provided in Appendix B.

In order to keep the identity of the participants confidential the survey does not ask for specific individual identification such as name, birth date, or social security number except for gender. Yet, in order to understand the potential impact of financial experience, in particular financial auction experience, we do ask questions about experience in the financial markets.

The first part of the survey describes the objectives of the research and provides a detailed example of the two auction mechanisms. The second part consists of the questionnaire, including questions with regard to the participants' experience.

3.2.2 Survey Questions and the Main Example

In our survey (see Appendix B), the participants were asked to imagine that the market consists of 10 participants, and each participant can decide in which auction mechanism to participate. As in reality, the decision of each member of the group affects the number of bidders that he or she will eventually be bidding against. The design of our survey is based on SSZ(2006) which is described next.

In their study there are N = 5 bidders in each auction mechanism (5 in the uniform and 5 in the discriminatory) who compete for Q = 26 units of a good. The after-market value of a unit is known in advance and is equal to 20. Prices are discrete and the "tick size" is 1. In particular, bids were

submitted for quantity orders at 4 distinct prices contained in the set {17, 18, 19, 20}. Quantities are in integers and the aggregate quantity demanded by each bidder is 26. Each quantity order is an offer to purchase the specified number of units at a given price (or below in the case of the uniform-price auction). The stop-out price is determined as the highest price at which demand equals or exceeds the supply of Q = 26 units. Winning bids are those submitted at or above the stop-out price. All quantities demanded at prices strictly above the stop-out price are filled while orders bid at the stop-out price are rationed on a pro-rata basis.

Given this structure, SSZ (2006) describe the Nash equilibria of the one-shot auctions. While the uniform price mechanism supports multiple equilibria (at all possible prices), the discriminatory price mechanism supports only one equilibrium at the auction price of 19.

In our setting, the SSZ(2006) experimental design which allocates 5 bidders to each mechanism, can be thought of as a special case where either all the 10 participants choose to be indifferent between the two auction mechanisms or 50% of them choose to participate in a uniform price mechanism and the other 50% choose the discriminatory price mechanism. It should be noted that the equlibria described in the case where 10 players are divided into two groups of 5 each is not necessarily the equilibria obtained in other possible division of the 10 players. If, for example, only one participant decided to choose the uniform price mechanism, while the rest (9) decided to choose discriminatory price mechanism, then the only equilibrium in the uniform price mechanism is 17.

In our survey the participants are presented with two identical firms which try to issue debt via an auction. The only difference between the two firms is the auction mechanism; one firm is using a uniform method and the

other is using a discriminatory method. It is important to note that while the participants in our survey choose between two firms, we could have replaced the word "firm" with the word "country". Since we wanted the participants to think be unbiased by the common practice of their own home country we choose to use a firm as the auctioning party.

We asked the participants if they have any preference (and which one) or whether they are indifferent. Given their choice, they were asked to submit a schedule of bids. We also asked them which mechanism they think most of the other participants will choose (including those who are indifferent). Although we did not ask questions about the identity of the participants, we did ask each of them about their previous exposure to financial auctions, years of experience in the financial industry and their gender. We did not reward the participants with monetary prizes and the participation in the survey was strictly voluntary.

3.2.3 Survey Sample

We conducted the survey during 2004 and 2005 in 6 different countries getting a varying rate of response. [20] Our final sample consists of 220 participants. (USA (43.2%), Israel (22.7%), Switzerland (8.2%), Luxembourg (12.3%), Norway (7.7%) and South Africa (5.9%). The participants (see Table 6) consisted of advanced business undergraduates from the USA, advanced MBA students from the USA, Israel, Luxemburg and Switzerland, Executive MBA students from Israel and Norway, bankers

[20] We excluded from the sample few rare cases of participants that did not answer the question of the mechanism choice, or did not submit bids or in rare cases where they have submitted bids for more than 26 units.

from South Africa that attended a risk management course and financial professionals from one of the leading financial institutions in Israel.[21]

The participants in our sample have on average 2.33 years of experience in the financial markets (the maximum is 25 and the minimum is zero). 11.4% of them had previous experience with financial assets auctions. 21.8% of the sample are female.

4. Analysis of the Results

The first main result is that about 91% of the participants are **not** indifferent to the pricing rule of the auction mechanism and most of those that have a preference for a specific price mechanism (65.5 percent) have chosen to participate in a uniform price mechanism. This is true across countries (in the sample) and across types of education (Executive MBA versus MBA versus Undergraduates). (See Table 6 for detailed results). In other words, the majority of the participants in each country and in each education group chose the **uniform** price mechanism.

Given these results, the next question is, to what extent did experience, gender and country (U.S.) affect bidders' choices. To investigate this question we estimated the following logit (probit) equations on the sample of participants who had a specific preference ("not indifferent") and reported all the needed variables (n=194):[22],[23]

$$UPM = \alpha + \beta_1 YE + \beta_2 Dummy(AE) \qquad (1)$$

[21] Many of the students in the classes in Switzerland and Luxembourg are citizen of other countries such as Germany, France, Belgium and Holland.

[22] We also conducted a multinomial logit test that included the group that was indifferent. The results were essentially the same.

[23] In five cases the participants did not indicate the years of experience and those were not included in the analysis.

$$UPM = \alpha + \beta_1 YE + \beta_2 Dummy(AE) + \beta_3 Dummy(G) + Dummy(US) \quad (2)$$

Where:

UPM(Uniform Price Mechanism) is a dummy variable that receives the value 1 if the participant chooses the uniform price mechanism and 0 if the participant chooses the discriminatory price mechanism.

YE is the years of experience that the participant has in the financial industry.

Dummy(AE) is a dummy variable that receives the value of 1 if the participant has experience with financial assets auctions.

Dummy (G) is a dummy variable that equals 1 if the participant is a female and 0 if he is a male

Dummy (US) is a dummy variable that equals 1 if the survey was done in the US and 0 elsewhere.

The results obtained from estimating the above logit (probit) equations are as follows: From equation (1) we find that the preference for the uniform price mechanism is positively correlated with years of experience in financial markets but it is barely significant (p=0.08 for the logit and 0.07 for the probit). However, exposure to auctions of financial assets has a non significant negative correlation with the auction choice. The pseudo R- square is rather low (0.017 for the logit and 0.018 for the probit) indicating that we are explaining a very small part of the variation in the auction choice. The basic result and the explanatory power of the model do not change when we add gender or a dummy for the US location as control variables (equation 2).[24] These two control variables were both insignificant.

We next divided the sample of participants into three groups according to their reported years of experience in the financial markets: The

[24] The P value of the chi-square test for the model is also insignificant.

first group reported no experience in financial markets (n= 104), the second group is the group that reported experience of up to (including) 2 years (n= 32) and the last group is the group that reported experience of more than 2 years (n= 78). Figure 1 shows the preference of the participants for each of the three groups. Though all three groups show a preference for the Uniform mechanism, the relatively strongest support for this mechanism is provided by the participants who reported to have experience of over two years in the financial markets.[25]

Moreover, we find that not only do most bidders prefer the uniform price mechanism, they are also willing to bid more aggressively in the uniform price mechanism. The weighted average, (by quantity demanded), of the price submitted by bidders that chose the uniform price mechanism is 18.72 while the weighted average of the price submitted by bidders that chose the discriminatory price mechanism is 18.59. This result is statistically significant at the 10% level and is consistent with the finding of SSZ (2006).

To test whether the difference between the weighted average price submitted to the two mechanisms is statistically significant, while controlling for relevant variables, we use the following Tobit regression[26]

$AP=\alpha + \beta_1 YE + \beta_2$ Dummy(AE) + β_3 Dummy(G) + β_4Dummy(UPM)+β_4 Dummy(DPM)

Where:

AP is the weighted average of the price submitted by bidders calculated as:

[25] It is interesting to note that the preference for the uniform mechanism among those that have work experience of about two years is only slightly more than for the discriminatory mechanism.

[26] We use Tobit since the bidding prices in the survey are limited to the range between 17 and 20

$$AP = \frac{\sum_{i=17,18,19,20} i * Qi}{\sum_{i=17,18,19,20} Qi}$$ Where Qi represent the quantity demanded at that price.

Dummy (UPM) is a dummy variable that receives the value 1 if the participant choose the uniform price mechanism and 0 if the participant choose the discriminatory price mechanism or is indifferent. Dummy (DPM) is a dummy variable that receives the value 1 if the participant choose the discriminatory price mechanism and 0 if the participant choose the uniform price mechanism or is indifferent. YE is the amount of experience in round years that the participant has in the financial industry. Dummy (AE) is a dummy variable that receives the value of 1 if the participant has experience with financial assets auctions. Dummy (G) is a dummy variable that equals 1 if the participant is a female and 0 if he is a male. Dummy (US) is a dummy variable that equals 1 if the survey was done in the US and 0 elsewhere.

The only significant variable at the 10% level (P=0.07) is UPM and its coefficient is positive, which gives additional support to the hypothesis that those choosing to participate in the uniform price mechanism, bid more aggressively on average

In order to investigate which mechanism will yield the higher revenue to the auctioneer while incorporating the participants' choices, we randomly assigned the 220 participants answers to twenty two groups of 10 each. In each group we divided the participants answers according to their mechanism choice; either discriminatory or uniform[27]. We calculated the auction price for the two mechanisms for each of the 22 groups. On average, the uniform price mechanism leads to significantly higher revenue than the

[27] Participants who were indifferent between the two mechanisms were randomly assigned.

discriminatory price mechanism (t=2.95 paired test). Consistent with SSZ (2006) we also find that there is higher variation in the obtained revenue under the uniform price mechanism than under the discriminatory price mechanism. Table 7 shows the revenues for each of the 22 groups. In most groups the Uniform bids brought much higher revenues (14 out of 22 groups). In 13 cases the Uniform bidders actually yielded the highest possible revenue of 520. The highest revenue for the Discriminatory bidders was 514 only.

Finally, we wanted to find out what the participants thought about the choice that other participants will make. About 20% of our sample did not answer this question. Hence the relevant sample decreased to 175. Out of them 10.3% predicted that most participants will be indifferent, 66.3 % predicted that most participants will choose the uniform price mechanism and 23.4% predicted that most participants will choose the discriminatory price mechanism. Overall, the predictions of our participants were in line with the actual responses. Most of them thought that the majority will choose the uniform price mechanism and most of them did. It is interesting to note that 76.6% of the participants thought that most participants will choose the mechanism that is the same as their preferred one. The reason that this is an interesting observation is that it may not be optimal to participate in the mechanism that most players will choose.

5. Summary and Conclusions

In issuing financial assets governments and corporations face a major decision; what is the optimal offering process to sell their debt or equity? Most governments and some corporations use an auction mechanism. There are basically two common types of auctions for financial assets: the UPA and DA. The existing theoretical and empirical work is ambivalent about the method that issuers should choose.

An important consideration in selecting the mechanism in a global competitive market should be the preferences of potential bidders. In this paper we provide some experimental evidence on the preference that potential bidders may have with regard to these two auction mechanisms. We surveyed over 200 business educated people and financial professionals in order to learn about their preferences between the two auction mechanisms. The overwhelming majority of our participants are not indifferent with respect to the auction mechanism and the majority preferred to participate in a uniform price auction. The only variable that we found to be positively related to the auction type choice is the years of experience in financial markets. This is the first attempt to investigate bidders' choice in financial markets auctions.

In our study a large majority of the bidders preferred a UPA[28] while our survey of countries which use auctions to issue debt shows that most of them use the DA, despite the arguments advanced by Friedman (1960) and others[29], claiming that a UPA will generate more revenue. Though the evidence from the experiment done by the U.S. treasury in 1992[30], following

[28] Though it has been shown that in the in-divisible good UPA the bidder will end up paying more than the average bidder in the DA one, the bidder may prefer the UPA since it is a less risky strategy and more defensible.

[29] See the survey by Das and Sundaram (1996) and the references to papers which make the same point.

[30] See Malvey, Archibald and Flynn (1995) and Malvey and Archibald (1998).

the Salomon Brothers scandal[31], was ambiguous with regard to the revenue generation it did show that the UPA invites a wider range of participants which may be an important factor in establishing liquidity in the secondary market. Following the experiment the U.S. treasury has moved to UPA in all their bond issues.

So why do we find so many countries using the DA method? our conjecture is that the financial markets in many of these countries are dominated by a few large financial institutions and it is in their interest, paying lower prices, to have a DA rather than a UPA. These few institutions are better informed than the rest of the public simply because they hold a large portion of the potential bids either as proprietary bidders or as agents for other bidders. This conjecture is supported by our tests that show that the DA method is used more in countries which have less developed financial markets[32] and are dominated by a few, large financial institutions.

[31] For an analysis of the Solomon squeeze see Jagadeesh (1993)

[32] An additional explanation for the origin of using a given rule or method has to do with the evolution of financial markets around the globe. Since the development of financial markets around the globe has, by and large, lagged behind the U.S many countries have just followed the U.S example without questioning its rationale and whether it is appropriate and fits the market structure of that country.

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Table 1
Survey Answers Regarding the Type of Auctions Used to sell Government Debt in Different Countries around the World as of April - October 2005

The Table describes the answers to a survey that were obtained from treasuries and central bank during 2005 and 2006 regarding the auction mechanism being used to sell the country's debt. The questions are presented in Appendix A.

Name of the Country	Using Auctions to Sell Govern Debt	Type of Auction	Different Selling Mechanism Used in the Past	Discretionary Effective Supply
Argentina	√	Uniform Price	No	No
Australia	√	Uniform Price	√ Tap mechanism	No, although the Treasurer has the right to cancel a tender
Bangladesh	√	Discriminatory Price	√	√
Belgium	√ Only the launching of new OLO benchmarks is done by syndication	Discriminatory Price	√ Underwriting by a consortium of banks (prior the adoption of the primary dealers system in 1989)	The Treasury only announces a target issuance range before the auction. Primary dealers have the right to submit non competitive subscriptions after the auction, as a function of their successful

				bids.
Brazil	√	Both Uniform and Discriminatorily Price	No	No
Cambodia	√	Discriminatory Price	No	Yes But with budget considerations
Canada	√	Primary: Discriminatory Price, yet Real return bonds are auctioned via Uniform Price	√ syndicated issuance	√ Not in use
Colombia	√	Uniform Price	√ Some securities are placed directly by the Treasury Department. In the past inflation linked bonds (only the coupons were indexed) were placed directly by the Treasury	√
Ecuador	√	Discriminatory Price	No	No
Fiji	√	Tender	√ Uniform Price	√
Finland	No Use syndicated issue	_____	Auction – Uniform Price	√
France	√	Discriminatory Price	No (however, new/innovative products can be	No

			issued by syndication)	
Germany	√ Except for US-Dollar-Bond, which Germany issued for a first time in May 2005, using a consortium	Discriminatory Price	√ until 1997 (consortium, led by the Deutsche Bundesbank, i.e. the central bank)	√
Ghana	√	Both Discriminatory and Uniform Price	No	No
Greece	√	The main method: Discriminatory Price, in addition, syndications	√ syndicated issuance	√ If prices given for 80% of the amount diverge significantly from those given for the remaining 20%, the issuer has the right to accept only 80% of the auction amount.
Hungary	√	Discriminatory Price	No	No
Ireland	√	Competitive Auction - Best Price using the Bloomberg Auction System	No	√
Israel	√	Discriminatory		√

		Price		From recently
Italy	√	Uniform Price for Bonds Discriminatory Price for T-Bills	No	Only for index-linked bonds, the treasury can select a minimum acceptable price (therefore, quantity)
Jamaica	√ Auction is used but it is not the main mechanism. The main mechanism is FIFO (Direct Placement at a pre-determined coupon)	Discriminatory Price	No	No
Japan	√	Competitive price auction, noncompetitive auction, Dutch-style yield auction, and so on	√	Not Relevant
Korea	√	Uniform Price	√ discriminatory price mechanism	√ _but strictly refrained from using it
Latvia	√	Discriminatory Price where the 80% of debt is offered at the	√ discriminatory price mechanism where the 100%	√

		Bank of Latvia the next day the 20% of debt is offered at the Latvian Central Depository	of debt were offered at the Bank of Latvia	
Lithuania	√ For the LTL denominated securities sold in the domestic market.	Discriminatory Price	No	√
Luxembourg	No Due to long history of budgetary surpluses	----	No	----
Macedonia	√	Discriminatory Price	No	No
Malta	√	Discriminatory Price (known as American Auction)	√ Issued in the past at par without the possibility of investors bidding at a different price	Yes for T-bills No for Malta Government Stocks
Mauritius	√	Discriminatory Price	No	No
Mexico	√	Both Discriminatory and Uniform Price	√ Tap with a fixed rate	√
Mongolia	√	Discriminatory Price	√ Used in the past Uniform price mechanism	√
Norway	√	Uniform Price	√ Discriminatory	No

			Price	
New Zealand	√	Discriminatory Price for nominal bonds and treasury bills	Uniform Price for inflation-linked bonds Not auctioned recently.	√ Reserve the right to issue less than the full amount of securities offered in any auction. It is rare, that it exercise that right
Panama	√	Discriminatory Price	No	√
Poland	√	"American" = Discriminatory Price	-----	√
Portugal	√ Portuguese government bonds are launched via syndicate and subsequently reopened through auction	Discriminatory Price	-----	√
Republic of Austria	√	Multiple Price - The coupon is calculated on the basis of the weighted average of the accepted yields and an issue price which shall be as close to par as	issued bonds under several programs (DIP, EMTN-Program, AUD-Program for long term bonds (EUR and FX) and ATB-Program for money market instruments) by	In case the bookfinding shows huge demand the Republic is allowed to increase the issue amount

		possible, after considering the maturity-dependent commission (1,05 % for 5 years, 1,50 % for 10 years).	selling them to a group of dealers	
Republic of Cyprus	√	Discriminatory Price	√	√ It may decide to sell less than the amount announced
Sierra Leon	√	Uniform Price for Bearer Bonds and Discriminatory Price for Treasury Bills	√ Fixed Interest Rate	√ +/- 30% of the offered amount
Singapore	√	Uniform price auction for Government Bonds and multiple price auction for T-bills	√ MAS previously have used multiple price auction for both Government Bonds and T-bill	No
Slovenia	√	Uniform price for short-term securities (T-bills), discriminatory price for long-term bonds	No	
Solomon Islands	√	Discriminatory Price	√	No
Sweden	√	Discriminatory Price	No	√

Switzerland	√	Uniform Price	√	√
Trinidad and Tobago	√	Uniform Price	√ Tendering by Underwrites	No
Turkey	√	Discriminatory Price	√ Uniform Price	√
United Kingdom	√	Uniform Price for index-linked gilt auctions and Discriminatory Price for conventional gilt auctions	√ Until the early 1990s gilts were usually issued by "tap"	√ The DMO reserves the right not to allot all the stock on offer at a gilt auction in exceptional circumstances where it judges bids to be at an unacceptably deep discount - was done only twice
U.S.A	√	Uniform Price	Discriminatory Price	√ Yet, was not in use
Venezuela	√	Discriminatory Price	No	No

Table 2
Countries Different Characteristics According to Their Auction Mechanism Choices

The table describes different characteristics of the countries in our sample. The variables that are described are as follows: Type of Auction: U=uniform, D= discriminatory, B= both Another = not using auctions to sell debt instruments. *Moody's Sovereign debt ratings* : (Source: Moody's August 2005.) The ratings serve as a proxy for the riskiness of the country. *Indebtedness Classification*. (Source: World Bank- 2003.) The World Bank classifies countries by their level of indebtedness for the purpose of developing debt management strategies. It uses a three-point scale: severely indebted (S), moderately indebted (M), and less indebted (L). The Indebtness classification also serves as proxy for the riskiness of the country.. *Civil (Roman) Law versus Common Law*. This variable was proposed by La Porta et al (1998). We try to see whether the auction mechanism is associated with the legal system in a country. *Stock Market Capitalization as Percentage of the GDP*. (Source: World Bank – 2003.) Market capitalization is the share price times the number of shares outstanding and is calculated as percentage of the GDP.*GDP*. –(Source: World bank – 2003.) GDP is measured in current US dollars. Ease of Doing Business 2006.(source: IFC - published in 2005) *The ease of doing business index* ranks economies from 1 to 155.

Name of the Country	Type of Auction	Moody's Sovereign debt	Indebtedness Classification	Civil (Roman) Law versus Common Law	Stock Market Capitalization as % of the GDP	GDP (current US $)	Ease of Doing Business
Finland	----	Aaa	---	Civil	105.2	1.62E+11	13
Luxembourg	----	Aaa	---	Civil	*NA*	2.65E+10	*NA*
Fiji	Another	Ba2	*NA*	Common	*NA*	2.24E+09	34
Ireland	Another	Aaa	---	Common	55.3	1.54E+11	11
Japan	another	Aaa	---	Civil	70.7	4.30E+12	10
Republic of Austria	Another	Aaa	---	Civil	21.5	2.53E+11	32
Brazil	B	B1	S	Civil	47.6	4.92E+11	119

Canada	B	Aaa	---	Common	104.4	8.57E+11	4
Ghana	B	*NA*	L	Common	18.7	7.62E+09	82
Italy	B	Aa2	---	Civil	41.87	1.47E+12	70
Mexico	B	Baa1	L	Civil	19.6	6.26E+11	73
New-Zealand	B	Aaa	---	Common	41.5	7.96E+10	1
Sierra Leon	B	NA	S	Common	NA	9.90E+08	136
Slovenia	B	Aa3	---	Civil	25.7	2.77E+10	63
United Kingdom	B	Aaa	---	Common	134.4	1.79E+12	9
Bangladesh	D	*NA*	L	Common	3.1	5.19E+10	65
Belgium	D	Aa1	---	Civil	57.5	3.02E+11	18
Cambodia	D	NA	M	Civil	NA	4.30E+09	133
Ecuador	D	Caa1	S	Civil	7.9	2.72E+10	107
France	D	Aaa	---	Civil	77.1	1.76E+12	44
Germany	D	Aaa	---	Civil	44.9	2.40E+12	19
Greece	D	A1	---	Civil	62	1.72E+11	80
Hungary	D	A1	M	Civil	20.2	8.27E+10	52
Israel	D	A2	---	Common	68.7	1.10E+11	29
Jamaica	D	B1	M	Common	104.3	8.15E+09	43
Latvia	D	A2	S	Civil	10.3	1.11E+10	26
Lithuania	D	A3	M	Civil	19.3	1.82E+10	15
Macedonia	D	*NA*	L	Civil	*NA*	4.67E+09	81
Malta	D	A3	*NA*	Civil	*NA*	4.77E+09	*NA*
Mauritius	D	Baa2	M	Civil	37.4	5.24E+09	23
Mongolia	D	*NA*	M	Civil	3.3	1.27E+09	61
Panama	D	Ba1	M	Civil	23.91	1.29E+10	57
Poland	D	A2	M	Civil	17.7	2.10E+11	54
Portugal	D	Aa2	---	Civil	39.4	1.48E+11	42
Republic of Cyprus	D	A2	*NA*	Common	*NA*	1.14E+10	*NA*
Solomon Islands	D	*NA*	*NA*	NA	*NA*	2.53E+08	53
Sweden	D	Aaa	---	Civil	95.3	3.02E+11	14
Turkey	D	B1	S	Civil	28.4	2.40E+11	93
Venezuela	D	B2	M	Civil	4.5	8.54E+10	120
Argentina	U	B3	S	Common	30	1.30E+11	77
Australia	U	Aaa	---	Common	112.1	5.22E+11	6
Colombia	U	Ba2	M	Civil	18.1	7.87E+10	66
Korea	U	A3	---	Civil	54	6.08E+11	27

Norway	U	Aaa	---	Civil	42.9	2.21E+11	5
Singapore	U	Aaa	---	Common	158.9	9.13E+10	2
Switzerland	U	Aaa	---	Civil	226.7	3.20E+11	17
Trinidad and Tobago	U	Baa2	L	Common	100.9	1.05E+10	*NA*
U.S.A	U	Aaa	---	Common	130.3	1.09E+13	3

Table 3
Descriptive Statistics

This table describes the descriptive statistics of the countries according to the auction mechanism employed by them. *Indebtedness Classification*. (Source: World Bank- 2003.) The World Bank classifies countries by their level of indebtedness for the purpose of developing debt management strategies. It uses a three-point scale: severely indebted (S), moderately indebted (M), and less indebted (L). The Indebtness classification also serves as proxy for the riskiness of the country. *Civil (Roman) Law versus Common Law*. This variable was proposed by La Porta et al (1998). We try to see whether the auction mechanism is associated with the legal system in a country. *Stock Market Capitalization as Percentage of the GDP*. (Source: World Bank – 2003.) Market capitalization is the share price times the number of shares outstanding and is calculated as percentage of the GDP.*GDP*. –(Source: World bank – 2003.) GDP is measured in current US dollars. Ease of Doing Business 2006.(source: IFC - published in 2005) *The ease of doing business index* ranks economies from 1 to 155.

	Discriminatory (N=24)	**Uniform** (N=9)	**Both** (N=9)
% of civil law	83%[33]	44%	43%
Avg Stock Market Capitalization % of GDP	38%[34] (std=32%)	97% (std=69%)	54% (std=42%)
Median Stock Market Capitalization % of GDP	28%[35]	101%	42%
Avg GDP	2.49E+11 (std= 5.80E+11)	1.43E+12 (std = 3.56E+12)	5.54E+11 (std = 6.36E+11)
Percentage of Indebtedness Classification	67%[36]	33%	44%

[33] Based on 23 observations since we do not have the classification for the source of law of Solomon Islands.
[34] Based on 19 observations since data was not available for Cambodia, Macedonia, Malta, Cyprus and Solomon Islands.
[35] Based on 19 observations since data was not available for Cambodia, Macedonia, Malta, Cyprus and Solomon Islands

Avg Ranking of Ease of Doing Business	56[37] (std=34)	25[38] (std=29)	62 (std=49)
Median Ranking of Ease of Doing Business	52[39]	11[40]	70

[36] Based on 21 observations since data was not available for Malta, Cyprus and Solomon Islands
[37] Based on 22 observations since data was not available for Malta and Cyprus.
[38] Based on 8 observations since data was not available for Trinidad and Tobago.
[39] Based on 22 observations since data was not available for Malta and Cyprus.
[40] Based on 8 observations since data was not available for Trinidad and Tobago

Table 4
What Explains Mechanism Choices? – Multinomial Analysis.

THE DEPENDENT VARIABLES: For completeness and statistical accuracy we conducted Multinomial analysis that included 4 categories: Uniform, Discriminatory, Both and Other mechanism. We present here only the comparison between the Uniform and the Discriminatory mechanism. Discriminatory Mechanism is the comparison group. THE DEPENDENT VARIABLES: dummy for *Indebtedness Classification*. (Source: World Bank- 2003.) The World Bank classifies countries by their level of indebtedness for the purpose of developing debt management strategies. It uses a three-point scale: severely indebted (S), moderately indebted (M), and less indebted (L). The Indebtness classification also serves as proxy for the riskiness of the country.. *Civil (Roman) Law versus Common Law*. This variable was proposed by La Porta et al (1998). We try to see whether the auction mechanism is associated with the legal system in a country. *Stock Market Capitalization as Percentage of the GDP*. (Source: World Bank – 2003.) Market capitalization is the share price times the number of shares outstanding and is calculated as percentage of the GDP.*GDP*. –(Source: World bank – 2003.) GDP is measured in current US dollars. Ease of Doing Business 2006.(source: IFC - published in 2005) *The ease of doing business index* ranks economies from 1 to 155.

Z values are in parenthesis. ** = significant at 5% level. * = significant at 10% level. We estimated 4 different specifications as follow.

	1	2	3	4
CONSTANT	-2.572** (-2.995)	-0.503 (-0.765)	-0.110 (-0.154)	-1.535 (-1.233)
Cap / GDP	0.030 ** (2.579)	_____	_____	0.025** (2.075)
Dummy (Indebtedness Classification)	_____	-1.069 (-1.085)	_____	_____
GDP	_____	3.66e-13 (0.847)	7.60e-13 (1.459)	_____

Dummy (Civil Law)	_____	_____	-1.823 ** (-2.020)	-1.140 (-1.071)
Pseudo R2	0.096	0.106	0.088	0.126
Prob > chi(n)	0.023**	0.069*	0.115	0.057*

Table 5

Pearson and Spearman's Rho Correlation Matrix

Spearman rho non parametric correlation result is the lower line. ** = significant at 5% level. * = significant at 10% level

	Civil	Cap / GDP	GDP	Ease of Doing Business Ranking
Civil	1	-0.354** -0.368**	-0.127 0.113	0.210 0.276*
Cap / GDP		1	0.299* 0.518**	-0.551** -0.633**
GDP				-0.279* -0.407**

Civil stands for civil law
Cap stands for capitalization
GDP stands for Gross Domestic Product

Table 6
Bidders Choices Between the Auction Methods

The table summarizes the answers obtained by participants in a survey conducted during 2004 and 2005. Participants specify the location, academic institution, type of education or type of occupation of the participants. Month and year specifies the time that the survey was conducted. Number indicates the qualified answers from this sub group. % uniform indicates the percentage of the qualified answers that choose uniform as their preferred mechanism. % uniform indicates the percentage of the qualified answers that choose discriminatory as their preferred mechanism % indifferent indicates the percentage of the qualified answers that indicate indifference between the two proposed price mechanism.

Participants	Month and Year	Number	% Uniform	% Discriminatory	% Indifferent
Executive MBA and Executive Courses					
Israel-Hebrew U- Executives MBA-Finance	June 2004 And April 2005	18	55.56%	38.89%	5.56%
South Africa-Bankers	June 2004	13	46.15%	30.77%	23.08%
Norway – Executive MBA at BI	May 2005	17	76.47%	17.65%	5.88%
MBA					
Luxemburg - School of Finance	February 2004 and January 2005	27	70.37%	25.93%	3.70%
Switzerland - Lausanne-MBA finance	May 2004	18	50.00%	33.33%	16.67%
Israel – Hebrew U – Advanced MBA - Finance	November 2004	10	40.00%	60.00%	0.00%

NYU- -MBA 2-3 year part time MBA	December 2004	24	66.67%	20.83%	12.5%
NYU- full time 2nd year MBA	December 2004	40	62.50%	32.50%	5.00%
NYU- 2nd year MBA- investment banking, Business & law School	December 2004	19	52.63%	31.58%	15.79%
Advanced Undergraduate					
NYU-Business Undergraduate- – Seniors	December 2004	12	41.67%	33.33%	25.00%
Professionals					
Financial Professionals from a leading financial institution in Israel	January 2005	22	63.64%	36.36%	0.00%
TOTAL		***220***	***90.91%***		***9.09%***
TOTAL		***220***	***59.55%***	***31.36%***	***9.09%***

Table 7

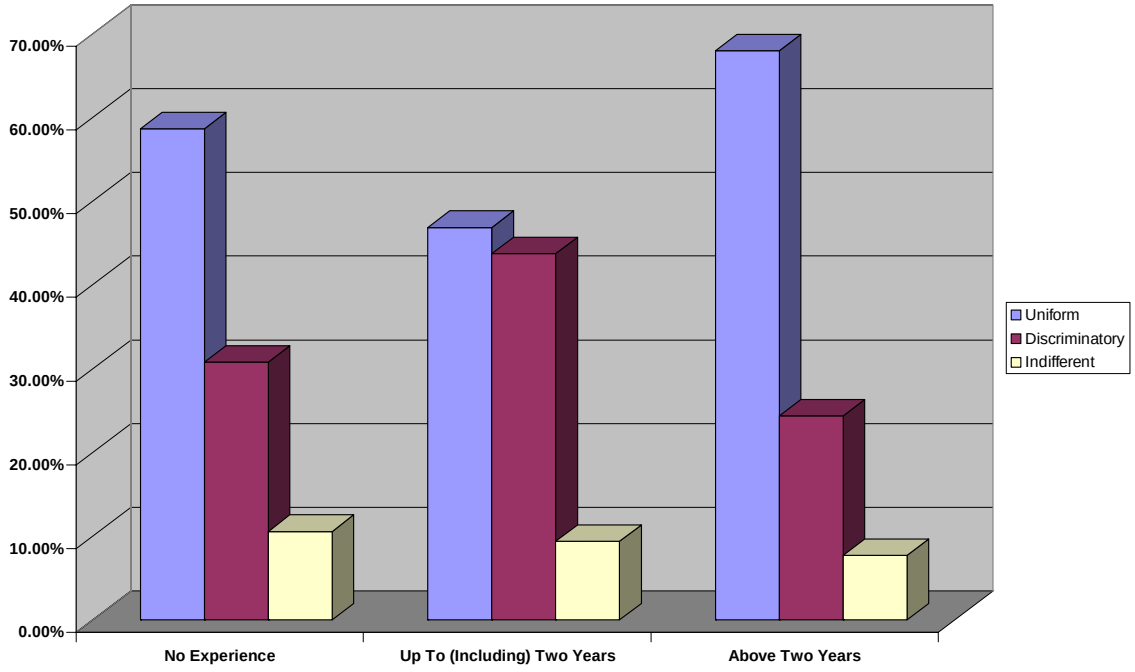
Revenues for each random group for both groups of bidders

U and D are the revenues for the Uniform and Discriminatory Bidders for each group respectively. U-D represents the difference in revenue obtained under the uniform price mechanism to the revenue obtained under the discriminatory price mechanism. Avg Represent the average of each of the variables.

Market	U	D	U-D
1	520	508	12
2	520	481	39
3	494	507	-13
4	520	494	26
5	520	495	25
6	520	494	26
7	520	478	42
8	520	496	24
9	520	495	25
10	520	494	26
11	494	497	-3
12	494	496	-2
13	520	494	26
14	494	494	0
15	520	500	20
16	494	513	-19
17	520	504	16
18	494	514	-20
19	494	495	-1
20	494	499	-5
21	520	505	15
22	494	495	-1
AVG	**509.36**	**497.64**	**11.73**

Figure 1
Mechanism Choice and Experience in Financial Markets

Figure 1 describes the distribution of choices of the participants among the pricing mechanism as a function of their years of work experience in the financial markets. “No Experience” represents the group of participant with no work experience in the financial markets. “Up to (including) Two Years” represents the group of participants that have positive work experience in financial markets that is less than (including) two years. “Above Two Years” represents the group of participants with above two years of work experience in financial markets.



Appendix A – Survey Submitted to Treasuries and Central Banks

Professors Dan Galai and Dr. Orly Sade *from the Finance Department at the School of Business Administration, Hebrew University of Jerusalem and* ***Professor Menachem Brenner*** *from the Finance department at New York University Stern School of Business are conducting academic research in an attempt to better understand auction design mechanism. The two main mechanisms employed by governments around the globe are: the Uniform Price auction (one price, the clearing price, applies to all) and the Discriminatory Price auction (bidders pay their price, which is at and above the clearing price).*
The survey is very short and answering it should take only a few minutes. We thank you in advance for your cooperation.

1. Name of the country _____

2. Does your country use mainly auctions to sell government debt instruments?_____

a. Yes
b. No

*If the answer to question 2 is **yes,** please continue to question 3. If the answer is **no** please continue to question 4.*

*3. What type of auction mechanisms does your country use **currently** in order to sell government debt instruments? _____*

a. Uniform price mechanism (one price)
b. Discriminatory price mechanism (pay your bid, multiple price mechanism)
c. Other _____

*4. Did your country use in the **past** a different mechanism to sell government debt? _____*

a. Yes
b. No

*If the answer to question 4 is **yes** please continue to question 5. If the answer is **no** please continue to question 6.*

5. *What was the main reason for the change?*
   _____
   _____
   _____

6. *Does the treasury (or the central bank) have the right to change the quantity of the debt that is being sold after viewing the demand?*_____

   a. Yes
   b. No
   c. Not relevant

7. *Are you aware of any research paper or report (written in English) that is investigation the auction mechanism of government instrument in your country? If you do we would truly appreciate if you can attach a copy to your reply e-mail or refer us to the source.*

We would like to thank you for your help. We will obviously be more than happy to share with you the results of this survey. Please indicate to which e-mail to send the working paper:

Thank you,

Menachem Brenner, Dan Galai and Orly Sade

Appendix B – Survey Submitted to Individuals

Professor Dan Galai and Dr. Orly Sade *from the Finance Department at the School of Business Administration, Hebrew University of Jerusalem and* ***Professor Menachem Brenner*** *from the Finance department at New York University* ***Stern School of Business*** *are conducting academic research in an attempt to better understand auction design mechanism. For the purpose of this research we would like you to answer a few questions. Everything contained in these instructions and everything you hear in this session is an accurate representation of this research. Be sure to ask any questions that you may have during the instruction period, and ask for assistance, if needed, at any time. All subjects receive the same instructions.* ***(no minors are allowed to participate).***

Your identity will be confidential with regard to the participation in this study. The survey does not ask for specific individual identification. The survey responses will be combined, and results will be presented only in aggregated form. Participation in this study is strictly voluntary. Omitting answers to specific questions is at the participant's discretion.

This Survey includes:

1. Case description
2. Examples
3. Survey

1. Case Description:

Two identical firms decided to issue bonds and to sell them via auctions. Each of the firms is going to sell 26 units. The economic value of each of the bonds in the secondary market is known with certainty and is equal to 20. The minimum price that can be submitted in the auction is 17. Bids can be made only in integers. Each participant can participate only in one of the auctions. The only difference between the two firms is the auction mechanism that is used: Firm “A” uses uniform price auction while firm “B” uses discriminatory (pay your bid) price auction. Each participant can bid for 26 units at most.

Firm "A"

This firm is going to issue bonds and sell them via "Uniform Price Auction"

The Auction Method:

There will be **26** units available for sale. You can submit bids for up to 26 units. Your resale value for each unit is **20.** (This means that after the auction your profit will be 20 for each unit that you hold, less what you paid for each unit). Prior to the auction, you are required to submit a schedule of bids. This schedule indicates the number of units you are willing to buy (including zero units) at each possible price level. The possible price levels will be 17, 18, 19, and 20**.** The sum of all of your bids may not exceed 26 units.

Once all participants have submitted their bids, the auctioneer will calculate the highest price at which all 26 bonds can be sold and will allocate units to players that submit bids that are equal to or higher than this price (if needed, the units will be allocated proportionally to the units demanded at the clearing price). **The price paid for each bond will be equal to the clearing price. The market-clearing price will be the highest price at which the total demand for bonds summed across all bidders is equal to 26.** If the total demand will be smaller than 26 at any of the suggested prices, the maximum total demand will be sold. A numerical example that illustrates this type of auction will be presented.

Firm "B"

This firm is going to issue bonds and sell them via "Discriminatory (Pay Your Bid) Price Auction"

The Auction Method:

There will be **26** units available for sale. You can submit bids for up to 26 units. Your resale value for each unit is **20.** (This means that after the auction your profit will be 20 francs for each unit that you hold, less what you paid for each unit). Prior to the auction, you are required to submit a schedule of bids. This schedule indicates the number of units you are willing to buy (including zero units) at each possible price level. The possible price levels will be 17, 18, 19, and 20. The sum of all of your bids may not exceed 26 units.

Once all participants have submitted their schedule of bids, the auctioneer will calculate the highest price at which all 26 bonds can be sold, and will allocate units to players that submit bids that are equal to or higher than this price (if needed, the units will be allocated proportionally to the units demanded at the clearing price). **The price you pay for each unit you receive, is equal to the**

price that you bid for that particular unit. This means that it is possible that you will pay different prices for the bonds you buy, and it is possible that different bidders will receive bonds at different prices. If the total demand will be smaller than 26 at any of the suggested prices, the maximum total demand will be sold. A numerical example that illustrates this type of auction will be presented.

You will randomly be assigned to a group that contains 10 participants, you will not know in advance who are the members of your group. You must choose your preferred auction mechanism. Then, you will participate in the chosen mechanism and submit your bids accordingly. At the time that you submit your bids you will not know how many of your group members decided to play the type of auction as you have decided upon.

The number of units allocated to you and the price per unit will be determined based on the results of the auction mechanism of your choice and the bids submitted for that mechanism by members of your group.
The profits are calculated as: number of bonds purchased * 20 – total purchase cost

2. Examples

The following examples are for illustration purposes only. They are not intended to be suggested as "best" strategies and simply demonstrate the implications of a possible set of actions.

In the examples, for simplicity, we assume that 5 participants decided to choose the Uniform Price Auction and 5 participants decided to choose the Discriminatory Price Auction.

2.1 Results for the Uniform Price auction

Uniform Price Auction Example
(Numbers in the table are units)

	Participants					Demand	Aggregate Demand	Supply
Price	**A**	**B**	**C**	**D**	**E**			
20	11	0	5	0	0	16	16	26
19	5	0	3	2	0	10	26	26
18	5	0	8	6	18	37	63	26
17	5	26	10	18	8	67	130	26

The demand at each price is the sum of the demands of bidders A, B, C, D, and E. For example the demand at price 20 is equal to 11+0+5+0+0 = 16. The aggregate demand is equal to the total demand at that price and all higher prices. For example the aggregate demand at the price of 19 is 26: (Demand at 20) + (Demand at 19) = 26 units. The clearing price is the highest price at which the cumulative demand equals the supply. In this case, the cumulative demand equals the supply at price equal 19.

The allocations in units and profits of the participants i as follows:

	Participants				
Price	**A**	**B**	**C**	**D**	**E**
Allocation	16	0	8	2	0
Profit	6*(20-19)=16	0	8*(20-19)=8	2*(20-19)=2	0

Since the resale value of the bond for each player is 20, each player makes a positive profit for each unit that he/she buys at a price below 20. The equilibrium price is 19 hence each player will profit one for each unit allocated.

2.1 Results for the Discriminatory Price auction

Discriminatory Price Auction Example
(Numbers in the table are units)

	Participants					Demand	Aggregate Demand	Supply
Price	**A**	**B**	**C**	**D**	**E**			
20	1	0	0	0	0	1	1	26
19	20	0	3	2	0	25	26	26
18	0	0	13	6	18	37	63	26
17	5	26	10	18	8	67	130	26

The demand at each price is the sum of the demands of bidders A, B, C, D, and E. For

example the demand at price 20 is equal to $1+0+0+0+0 = 1$. The aggregate demand is

equal to the total demand at that price and all higher prices. For example the aggregate

demand at the price of 19 is 26: (Demand at 20) + (Demand at 19) = 26 units. The clearing

price is the highest price at which the cumulative demand equals the supply. In this case, the

cumulative demand equals the supply at price equal 19.

The allocations and profits of the participants are as follows:

			Participants		
Price	**A**	**B**	**C**	**D**	**E**
Allocation	21	0	3	2	0
Profit	1*0+20*1=2	0	1*3=3	2*1=2	0

Since the resale value of the bond for each player is 20, each player makes a positive profit for each unit that he/she buys at a price below 20. Player A receives one unit that he demanded at price 20 and pays 20 for it, and receives 20 units at price 19, and hence his profit is 20.

Questionnaire

1. I choose to participate in the auction of firm: (circle the appropriate answer)
    a. "A" Uniform Price Mechanism
    b. "B" Discriminatory Price Mechanism
    c. I am totally indifferent between participating in each of the two mechanisms
    d. I prefer not to participate in any of the suggested mechanism.

If your answer is either a or b please continue to question number 3 if your answer is c please continue to question 2 and if your answer is d please continue to question 4.

2. Please randomly select between the mechanisms. Your random selection is _____

Now continue to question 3

3. My bids are:

Price	Quantity Demanded
20	
19	
18	
17	

4. I believe that most of the participant will choose: A / B / indifferent

5. Gender:

    a. Female
    b. Male

6. Did you ever participate in financial assets' auction?
    a. Yes
    b. No

7. Years of work experience in financial markets_____