

Migrant Distribution in the European Union - A New Scope of Application for Auction Mechanism Design

Wolfgang Eggert^{*}

Gideon Goerdt[†]

Maximilian Stephan

Abstract

This paper will analyze migrant distribution in the European Union and therefore add a new scope of application to auction mechanisms. If bidders have to pay a share of the expenditures, auction mechanisms can solve distributional problems between individuals, groups, or countries preferable. In this case, the incentives for bid shading are more ambiguous than in standard multi-unit auctions. Therefore, we derive a gambling condition for bid shading in the Uniform Price Auction and the Vickrey Auction. Based on these results we introduce a strategy-proof distribution mechanism. Additionally, we analyze the main characteristics for a country's value function and the respective bid vector. Finally, we show how the European Union could implement such a preference based migrant distribution mechanism.

Keywords: Auction Design; Migrant Distribution

JEL-Classification: D30, D44, D61, D82

^{*} University of Freiburg and ifo Institute for Economic Research at the University of Munich.

[†] University of Freiburg, gideon.goerdt@vwl.uni-freiburg.de (corresponding author).

1. Introduction

The European Refugee Crisis has shown that the current European Asylum System is not functional in case of a mass influx of refugees.¹ The consequences are debates about how to handle such a situation and how to change the current system to prevent future problems. The aim of this paper is to discuss exactly these questions and to introduce an efficient migrant distribution system. Thereby, we will focus on the distribution mechanism and do not analyze topics like border protection, detecting and removal of illegal immigrants, or causes of flight. Therefore, we define migrants as the proportion of the whole group of refugees, which have a legal claim to seek asylum in the European Union.

As a union, which the EU obviously is, we need consensus about some general questions and topics. First, a new system should distribute the emerging burden as fair as possible across the Member States. Second, a new system should minimize the costs of the migrant distribution in the sense that those countries, which have the lowest real effort, receive the migrants. Third, the emerging costs should be distributed across all countries to ensure that a fair burden distribution can be achieved. Fourth, the asylum procedure in the European Union has to be harmonized and controlled to prevent that countries have negative incentives.

Actually, without regulation every country has an incentive to behave like a free rider, as it would never be a rewarding possibility to receive migrants voluntarily in consideration of an expected burden. Furthermore, the countries would rather appreciate every other country that will accommodate migrants. As mentioned, it is not questionable that the inflow of migrants will create a burden for the countries, or to be more precise the countries at least expect the existence of the burden. However, countries try to avoid uncertainty. In a scenario without regulation, this will become difficult, because of the variety of possible effects that

¹ In the European Refugee Crisis the so far existing Dublin-III Regulation, which organized the migrant distribution within the European Union, is ignored by many member states. The Dublin-III Regulation determines that an asylum procedure takes place in the country where the migrant first entered the European Union. Thus, this system leads to a shift of migrants to the Border States. This applies equally to states with a maritime boundary. In combination with the increasing number of migrants, this causes in an increasing burden in the affected states, since they have to pay the costs for the asylum procedure. Due to the disregard of the Dublin-III Regulation, an unequal distribution of the migrants across the European Union can be observed.

will affect the decision. Additionally, countries cannot exclude themselves from the distribution, since this would cause in other burdens based on the structure of the European Union. Therefore, the distribution of migrants can be characterized as a public good, because no one can be excluded and there exists no rivalry. That is why; regulation is needed to reduce inefficiencies in the asylum procedure.

The combination of the arguments leads to a solution of cross-subsidization between the countries. If the migrants cause a burden and the admission of refugees cannot be prevented, a situation arises where the asylum procedure can be defined as a deficient universal service. Usually a universal service is characterized as a politically desired infrastructure performance in a deficient part the supply of infrastructure services like telecommunication networks, water supply, or power grids. A solution to enable potential competition in these areas is to provide external subsidies through a universal service fund. The fund is financed through some tax in the profitable part of this sector. Potential competition will arise in deficient areas throughout this mechanism. Hence, the firm will receive the subsidies, which can provide the infrastructure the cheapest. Migrant distribution across the European Union could work in a very similar way. When countries would obtain a transfer for the accommodation of migrants financed by all countries competition could arise between the Member States and maybe end up in a more efficient scenario than the current negotiations about a European Quota System. As until now, such questions are solved throughout negotiations between the involved countries. Negotiations are often long-term processes with high costs especially if there are many negotiators with different interests, which are characterized by different economic preconditions. Moreover, every negotiation includes the possibility of a failure that leads to a further expensive delay. Consequently, a universally applicable mechanism could solve the distribution problem preferable in that way that changing preferences and differences between the negotiators only influence the mechanism outcome and not the mechanism itself.

Hence, the idea is to implement an auction mechanism instead of negotiations. The major advantage is the fact that countries can carry out a cost-benefit analysis and base their bidding strategy on the results. Furthermore, the process of migrant

distribution would be well ordered, which reduces uncertainty within the member states. The paper has to make some general assumptions. First, we assume that the migrants are a homogenous group and each migrant in the group has the same expected productivity. It is clear, that this will not match with reality but if it would not be possible for the countries to have an influence on the distribution of single migrants; it is useful to think about it in this way. It is logical to assume the same average risk distribution for all countries, since it is impossible to estimate the distribution for an explicit country. Second, every involved country has to submit its offer. Third, the lowest bids win the auction and receive the respective transfer for the auctioned object.

This leads to the question: how to design an auction mechanism where countries maybe have an incentive to show their real preferences during the distribution process. Furthermore, the amount of expenditures a central institution has to spend via transfers differs between different mechanisms and so has to be considered in the decision process. The most important question is what the incentives for the bidding countries are if they have to pay the expenditures. In every traditional auction format, the assumption is made that the bidder and the seller are not the same. In this paper, we use auction mechanisms for distributional reasons in a federal system. We assume that buyers and sellers can be the same, since the countries afterwards have to pay a share of the expenditures determined by the auction mechanism outcome. This consideration will add a new scope of application to auction mechanisms. Auction mechanisms cannot only be used to sell and buy goods but also to organize distribution problems between different individuals, groups, or countries.

Therefore, the paper shows how auction mechanisms can solve a distribution problem like migrant distribution in the European Union, which previously needed long-lasting negotiations. Besides, questions concerning the revenue, efficiency, and truthful revelation of preferences are analyzed. In the following, we will discuss and compare three different auction types, a Discriminatory Auction, a Uniform-price Auction, and a Vickrey Auction. The decision for the types is justified because of their practical and theoretical relevance. We show that a modified

Vickrey auction outperforms the other auction types even if the bidders have to finance a share of the auction outcome. The auction will be strategy proof and solve the distribution of migrants preferable.

The paper is organized as follows. Section 2 presents the auction mechanism designs and discusses the results. Section 3 discusses the implementation of such a mechanism. Section 4 offers some concluding remarks.

2. Auction design

Everyone knows auctions for what they mostly are a way to sell or buy goods through specialized mechanism designs. Therefore, a standard auction assumption defines that buyers and sellers are different from each other. If we relax this assumption and assume that the group of buyers and the group of sellers are the same, bidders in the auction afterwards have to pay a share of the total expenditures. We will use this new approach to analyze how migrant distribution in a federal system like the European Union could be organized in the future.

Due to the auctioned transfer price, which the countries receive in case of a winning bid, this paper should deal with descending auction formats. For simplicity, we transform the transfer in a negative bid and thus use standard auction frameworks. In this case, the third assumption changes and the bids with the highest requirements win the auction. A higher negative bid implies a lower transfer. If migrant distribution shall take place via an auction, it has to be a multi-unit auction. Additionally, it is an auction with independent private values. We assume that the value does not change with the behavior of the other bidders. Besides, the individuals exhibit an own value. The number of participants in the auction is characterized with $n = \{2, \dots, i, \dots, N\}$ and the assumption is made that at least two bidders $n > 2$ take part. We assume that each bidder has monotonically non-increasing marginal values for the objects. Furthermore, related to the restrictive findings of Baisa (2016) we assume the standard

quasilinearity restriction on bidder preferences.² It is impossible to carry out the auction while the migrants still attain the countries. The auction has to take place before anyone is able to know the number of migrants, because of the time structure. Thus, it is an auction on a future and unknown number of migrants. Therefore, countries should have beliefs concerning the estimated number of migrants if they submit their bids. In order to know the number of auctioned goods beforehand the design of the auction should distribute percentage objects of the future number of migrants to the countries. Consequently, the supply function will be a vertical line because the number of units is fixed. This is the case, since the percentage objects are always sold irrespective of the real future number of migrants.

In the auctions, a bidder has to submit M bids β_m^i ($i = 1, 2, \dots, N; m = 1, 2, \dots, M$) and so $N \times M$ is the total number of bids. Every bidder has to submit exactly this number of bids to ensure the functionality of the mechanism. If bidders are allowed to submit any number of bids below M , it maybe could be impossible to allocate all objects. Otherwise, it could happen that bidder submit extremely high bids, since they have no interest to win further units. In this case, the auction mechanism has to implement a situation where this behavior is not a preferred action. We will call $\beta^i = (\beta_1^i, \beta_2^i, \dots, \beta_M^i)$ a bid vector. Every bid in the bid vector β^i is negative in the migrant distribution setting. The vector can be interpreted as an inverse demand function.

Although they are common knowledge, we will now shortly repeat the different payment structures in the auction types as background for the efficiency analyses to allow a consistent reading of our further explanations.

The discriminatory auction works like a pay-your-bid auction. Each country has to pay the sum of their winning bids. Every bid under the M highest of the total $N \times M$ bids is a winning bid. For this reason M_i defines the number of winning bids of bidder i . Therefore, country i has to pay $\sum_{m=1}^{M_i} \beta_m^i$. In our setting the negative payment β_m^i is equal to the transfer the respective country i receives.

² We assume this for two reasons. First, bidders bid on subsidies they will receive and so wealth has in our opinion no influence on this decision. Second, wealth in our case is used as exchange medium for other public goods. Hence, we modulate it as a numeraire.

In a uniform-price auction, the pricing rule sets an equal price for all winning bids. In this case, the auction includes M objects. The price is equal to the market-clearing price such that it is above the highest non-winning bid and beyond the lowest winning bid. Hereafter, it is assumed that the price to pay for the good is equal to the highest non-winning bid. A bidder i wins $M_i > 0$ units if his bid is $\beta_{M_i}^i > \beta_{M-M_i+1}^{-i}$. β^{-i} is the respective bid of all other bidders. Additionally, $\beta_{M_i+1}^i < \beta_{M-M_i}^{-i}$ has to hold. The first condition states that the bid of bidder i for M_i units should be larger than the sum of the other bids for the bidding number of goods, such that the bidder receives the good. The bid of the bidder i is lower as the bids of the other bidders for further units of the good. Consequently, the bidder does not receive any further units of the good. The negative price can be interpreted as a transfer the winning country receives, because of the negativity condition. The other countries offered a lower price and will not be served.

In a Vickrey auction, a bidder i has to pay the price determined by the M_i highest losing bids of all other bidders. When a bidder wins M_i objects he has to pay $\sum_{m=1}^{M_i} \beta_{M-M_i+m}^{-i}$. Therefore, the pricing rule allocates exactly the generated externality as price to the bidder. Every price is independent of the bidder's own bids.

2.1. Efficiency and Bid Shading

The efficiency of an auction means that the outcome of the auction is efficient from an aggregated point of view. This would be the case if all migrants were distributed across the countries for a minimized amount of expenditures, since the mechanism only redistributes the paid expenditures and the received transfers across the countries. This is the case, if the amount of winning bids each country receives is not changed throughout bid shading. This means every country wins as many objects as they would win if every country would reveal their true willingness to pay. If this would not be the case, the countries would pay more in total as it would be necessary and a welfare loss occurs. As it is known through the work of Asubel (2004) and Asubel et al. (2014), standard auctions like the discriminatory and the uniform-price auction are not efficient if multiple units of

the good are auctioned, because bid shading occurs. This applies equally for homogeneous and heterogeneous goods. Otherwise, the Vickrey auction is a strategy-proof mechanism. In this section, we will discuss the efficiency of these three types of auctions when we add the share of expenditures every bidder has to pay to the analyses.

Discriminatory Auction

In a discriminatory auction, bidders have no incentive to bid an amount equal to their willingness to pay, inasmuch as they would not realize any gains from the trade. Consequently, it can only have positive aspects for the bidder to increase his bids. If the bidder is still winning the auctioned object with the shaded bid, the mark-up will enlarge the bidder's revenue. On the other hand, if the shaded bid is not further able to win the auction no revenue losses occur.

In our case, when the winning country also should pay a share of the emerging expenditures, the results are more ambiguous than in the standard case. Throughout the cost share, every bidder is faced with a counterpart to the positive revenue incentive triggered by bid shading. In the discriminatory auction it might be that a bidder has to pay for an additional bid, another bidder receives if one of his winning bids becomes a non-winning bid throughout bid shading. Since the new winning bid previously was a non-winning bid, the bidder has to deal with a higher expenditure than without bid shading.

Nevertheless, in the discriminatory auction there are always incentives to shade the bids also in the case of the cost share. This happens, because if a bidder shades his bid he will receive the full mark-up as transfer but only has to pay a share of this as additional expenditure. Therefore, bid shading is always profitable as long as the number of winning bids stays the same for the bidder. This will lead to a scenario where every bidder will shade his bids at least a little bid and truth telling is never a dominant strategy.

Uniform-price Auction

The intuition for bid shading and demand reduction in the uniform-price auction is as follows. If a bidder wants to require more than one unit in the auction, there is a probability that one of the further bids is the pivotal one. This bid determines

the price for every winning bid. Hence, the bidder has an incentive to shade this bid to achieve a lower price for all his winning bids (Asubel (2004)).

In the uniform-price auction, a similar argument occurs for the case with the share of expenditures than in the discriminatory auction. The advantage of bid shading is to increase the price for all other winning bids the bidder will receive. Therefore, one of his bids has to become the new highest losing bid. This is only possible if the bidder will win one unit less. On the one hand, he will decrease his effort by his real willingness to pay for this bid. On the other hand, the higher price leads to a higher share of expenditures he has to pay for all winning bids he will not receive. There is only one special case where the bidder will not win one unit less. The bid vector of the bidder has to include the highest non-winning bid before bid shading. This would reduce the effort effect and make bid shading more probably.

Let us denote that formally. M_i describes the number of all winning bids bidder i receives. M denotes the number of all winning bids in total. α_i is the share of expenditures bidder i has to pay. p is the price of the highest non-winning bid before bid shading and p^* denotes the price for the highest non-winning bid after bid shading through bidder i . The willingness to pay for the bid, bidder i will not win in case of bid shading, is determined by λ_i . Based on this,

$$\frac{M_i}{M} - \alpha_i > \frac{p^* - \lambda_i}{M(p^* - p)} \quad [1]$$

can be derived as bid-shading condition for the case where bidder i is not the pivotal agent (for the proof see Appendix A1). If equation [1] holds, the bidder has an incentive to shade his bids. When the left hand side equals the right hand side, the bidder is indifferent between the opportunities. Equation [1] allows some general statements. First, if the share of winning bids bidder i receives is lower than the share of expenditures, he has to pay; bid shading is never a rewarding possibility. The higher the share of winning bids the higher the probability that the bidder will shade his bids. In contrast, a higher share of expenditures will reduce this probability. Moreover, the right hand side cannot become negative, because every single variable is defined to be positive and $p^* - p$ as well as $p^* - \lambda_i$ are also always positive. Furthermore, the right hand side will decrease for an increase in

p^* and also decreases with an increase in λ_i . If this happens, bid shading becomes more likely.

In the special case that the bid vector of bidder i also includes the highest non-winning bid before bid shading, the bid-shading condition reduces to $\frac{M_i}{M} > \alpha_i$ (for the proof see Appendix A2). Due to this, bid shading becomes always profitable when the share of winning bids is higher than the share of expenditures for bidder i . The combination of these two results through the probability of being the pivotal bidder beforehand would not change the results. Additionally, you maybe can notice that the higher the probability for being the pivotal bidder the more likely becomes bid shading. Let us clarify that for a deeper understanding. In a symmetric information setting were every esteem belongs to the same distribution function, the probability of being the pivotal bidder is equal for every participant, since a bidder has only information about his own bidding strategy. Hence, the probability is $\frac{1}{N}$. Based on this,

$$\frac{M_i}{M} - \alpha_i > \frac{N-1}{N} \frac{p^* - \lambda_i}{M(p^* - p)} \quad [2]$$

can be derived as the combined bid-shading condition (for the proof see Appendix A3). The only difference between Equation [1] and [2] is the probability of not becoming the pivotal agent, $\frac{N-1}{N}$. That is why the combination of the two scenarios indeed influences the amount of all effects but not the direction. Moreover, the higher the number of participants in the auction the more unlikely becomes bid shading. If the right hand side increases, the gains from bid shading decrease.

However, the decision whether and how to shade bids becomes a very complicate one, because of the variety of unknown information in this setting. Since, a bidder has no information about the bid vectors of any other bidder he will not know his share of winning bids and the price of the highest non-winning bid in both cases before and after the possible bid shading. Therefore, bid shading becomes some kind of a gambling decision and inefficient solutions can be reached.

Vickrey Auction

The standard Vickrey Auction is an efficient and strategy-proof mechanism in multi-unit auctions. Truth telling is the dominant strategy for every bidder in this setting (Vickrey, 1961). In the case with the share of expenditures, this result will not hold. The intuition behind this is as follows. The winning prices a bidder receives in a Vickrey auction is independent from the bid vector of the respective bidder. When a bidder has to pay a share of the total expenditures, he can have incentives to influence the price the other bidder will receive (for the Proof see Appendix A4). Therefore, the mechanism has to implement a situation where also the share of expenditures a bidder has to pay is independent of his own bid vector. This is possible, if every bidder has to pay an exogenous given share of the auction outcome, determined just as if the bidder would not take part in the auction.

Let us denote that formally. p_k denotes the price of the k th winning bid, p_k^* the price after bid shading, and b_k the real effort for the k th good. The auction outcome is $\sum_{k=1}^M p_k^{-i}$ if bidder i would not be part of the auction. In this case, p_k^{-i} is the price of the k th winning good, if the auction would take part without bidder i . The comparison of the revenue with or without bid shading can be denoted as

$$\sum_{k=1}^{M_i^*} p_k - \alpha_i \sum_{k=1}^M p_k^{-i} - \sum_{k=1}^{M_i^*} b_k > \sum_{k=1}^{M_i} p_k - \alpha_i \sum_{k=1}^M p_k^{-i} - \sum_{k=1}^{M_i} b_k. \quad [3]$$

The revenue of bidder i depends on three terms. First, the sum of the prices for all winning bids, which is equal to the transfer the bidder will receive after the auction. Second, the cost-share the bidder has to pay, which is characterized as a portion of the sum of all winning prices, is calculated such as the respective bidder would not take part in the auction. Third, the real effort for all winning goods the bidder receives. The left-hand side shows the revenue after bid shading and the right-hand side the revenue beforehand. Bid shading would be efficient if the left-hand side exceeds the right-hand side. Otherwise, truth telling would be a dominant strategy in this mechanism. We can transform equation [3] to

$$\left(\sum_{k=1}^{M_i^*} p_k - \sum_{k=1}^{M_i^*} b_k \right) - \left(\sum_{k=1}^{M_i} p_k - \sum_{k=1}^{M_i} b_k \right) - \alpha_i \left(\sum_{k=1}^M p_k^{-i} - \sum_{k=1}^M p_k^{-i} \right) > 0. \quad [4]$$

As you can see, the last term, $\alpha_i \left(\sum_{k=1}^M p_k^{-i} - \sum_{k=1}^M p_k^{-i} \right)$, has no influence on bid shading, since the amount is independent of the bid vector. Thus, the value has

to be zero regardless whether bid shading is used or not. Consequently, equation [4] reduces to

$$\left(\sum_{k=1}^{M_i^*} p_k - \sum_{k=1}^{M_i^*} b_k\right) - \left(\sum_{k=1}^{M_i} p_k - \sum_{k=1}^{M_i} b_k\right) > 0. \quad [5]$$

This equation can never hold. Consequently, truth telling is a dominant strategy in this mechanism. Let us go through this argument for a deeper understanding. Bid shading can only be the preferred action if the first term, $\sum_{k=1}^{M_i^*} p_k - \sum_{k=1}^{M_i^*} b_k$, which characterizes the difference between the transfer and real effort in the case of bid shading, exceeds the respective term in the case without bid shading, $\sum_{k=1}^{M_i} p_k - \sum_{k=1}^{M_i} b_k$. However, bid shading has to change the number of winning bids M_i , otherwise the left hand side of equation [5] would be zero and truth telling would be at least a weakly dominant strategy. Therefore, the first term has to increase for a change in the number of winning bids. In this setting, there are two different ways, which could maybe end up in bid shading. On the one hand an increase and on the other hand a decrease in the bid vector. First, let us have a look at an increase in the bid vector. As mentioned before, this increase has to cause in a change of the number of winning bids and since we have higher bids, the only possibility is to win a smaller number of objects. The decrease in the transfer is higher than the decrease in the real effort after bid shading, because every winning price in a scenario of truth telling exceeds the real effort in a Vickrey price auction. Second, let us have a look at a decrease in the bid vector. This scenario has to end up in an increase of the number of winning bids if bid shading shall be the preferred action. In this case, the increase in the transfer is lower than the increase in the real effort after bid shading. The new prices for the additional objects won by the bidder have to be at least those prices, which won the objects beforehand. The real effort of the bidder has to be higher than those prices; otherwise, the bidder should also have won these objects without bid shading. As a result, a decreasing bid vector leads to a lower revenue. Altogether, truth telling is always a dominant strategy for every bidder in this mechanism. There are only two related limitation concerning this result. First, the exogenous given share of expenditures α_i has to be determined before the auction and cannot be endogenous connected to the auction outcome. Otherwise, this would lead to

changing incentives toward bid shading. Second, concerned to this the auctioneer has to adjust this share such that the total auction outcome is covered throughout the payments. How this can be ensured will be explained in chapter 3.

Since the group of buyers and sellers is the same, revenue consideration does not play an important role for the comparison of the mechanisms. If we want to achieve a situation where the emerging burden is as small as possible, the mechanism is preferable, which can guarantee truthful preference revelation best. In relation to our assumptions, the modified Vickrey auction as the only one has a dominant strategy of truthful revelation and can outperform the other types. Hence, we recommend using this type of mechanism and we will concentrate on the successful implementation of this mechanism in chapter 3.

2.2. The bid vector

The bid vector depends on two things: the value function of the respective bidder and the chosen amount of bid shading. We already discussed the incentives for bid shading; thus, this section will analyze the main characteristics of a value function in the migrant distribution setting. There is a wide discussion about the question if a migrant generates either costs or benefits in balance in the accommodating country. Sinn (2016) argues that on average migrants compared to other citizens have a below average income and for this reason receive more public goods and social benefits than they give back to the state through taxes and contributions.³ Junker and Fratzscher (2016) follow the same argumentation that in the economic discussion about migrant distribution no one can really expect the existence of fiscal equalization over time.⁴ Admittedly, they argue that the focus on tax income and transfers is too small-minded, since a majority of citizens would generate a financial loss. Therefore, it is important how strong the redistribution mechanisms in a country are. The higher the redistribution, the higher the effects throughout additional migration. Another argument says that the effect is not as high as mentioned, because many public goods would not rise immediately with

³ The theoretical considerations substantiating the argument can be found in Sinn (2002) and Sinn (2003).

⁴ Bonin (2015) as well as Raffelhüschen and Moog (2016) have done exemplary estimates for Germany.

the number of residents such as military costs, interests on national debt, or subsidies for cultural goods. This argument is in opposition to the result of fiscal theory that long-term per capita costs are independent of the number of residents in a country. Furthermore, Aiyar et al. (2016) argues that the generosity of welfare benefits, which varies across the European Union, the age-structure of the migrants as well as rapid labor market integration influences the net fiscal contribution.

It is possible for asylum seekers to receive accommodation and integration support as well as welfare benefits in their work life. There are some barriers to enter the labor market like missing working permits, their uncertain residence permit or simple missing qualifications as well as missing acceptance of qualifications. All this reduces their net fiscal contribution compared to the respective natives. Otherwise, they can receive welfare benefits in case of unemployment. Therefore, the generosity of the welfare benefit system has an influence on migrant's net fiscal contribution.

Compared to native workers immigrants have a stronger net contribution during their working-age phase and a lower net fiscal balance outside this period (Aiyar et al., 2016). Hence, the age-structure of the migrants is an important factor for the expected long-term fiscal contribution. The longer the working-age phase the higher the fiscal contribution, if the positive effects outperform the payment of unemployment benefits on average.

Besides, labor market integration is one of the key determinants to extract the maximum of the potential economic benefits of the migrant inflow. It minimizes the risk of social exclusion for the migrants and increases the long-term net contribution. In addition, Aiyar et al. (2016) points out that successful labor market integration could mitigate the fiscal effects of population aging, although the effect seems not to be a universal remedy for demographic problems.

Due to these points, a strong conflict of interests exists within a society. On the one hand, native taxpayers are not interested to co-finance a negative fiscal contribution triggered through migration. On the other hand, every investor benefits, since capital becomes more expensive compared to labor. Furthermore,

low-skilled native workers are afraid of losing their jobs because they have to compete with the majority of the migrants on the labor market.

Otherwise, also selfish political interests play a crucial role. If the population has a certain meaning about the number of migrants, which should accommodate in the respective country, a selfish politician or party will consider this, during their decision about the bidding strategy.

Moreover, the expectation of the future number of migrants affects the bid vector in an important way. The auction mechanism sells homogeneous percentage objects to the winning bidders. When the auction takes place, the bidders do not know how many migrants one object will contain for sure. Therefore, every bidder has to determine an expected value of future migration. In case of an underestimation of the number of migrants, the bidder will receive a too low transfer. In contrast, if he overestimates future migration, he maybe will win some objects less and has to pay higher expenditures than necessary.

However, all these effects determine the cost-benefit analysis of a country. The bid vector depends on this result, because the bid vector reflects the country's incentives toward the needed transfer. Certainly, how the bid vector emerges is an important question, but only influences the mechanism outcome and not the mechanism itself. The auction solution can handle all changing incentives toward the needed transfer, since the used mechanism can stay the same. Admittedly, the bid vector is important for another reason. The auctioneer has to estimate the auction outcome to set the exogenous given cost-share α . As a result, the complexity of the bid vectors can lead to another over- or underestimation.

3. Implementation and the auctioneer's role

The implementation of an auction mechanism is connected to various questions, which should be answered beforehand.

First, there are some remarks concerning the process. The auctioneer has to accomplish the auction simultaneous. Therefore, it has to be a sealed-bid auction with an independent auctioneer. One of the EU institutions could undertake the auctioneer's role. In this case, there is a need for an independent institution. The

independence can be divided in four parts, namely in functional, personal, institutional and financial independence. Functional independence means that an institution should be able to set its policy instruments without interference. Unquestionably, to achieve the objectives has to be the subordinate task. In our case, the institution is limited through the given mechanism, but free to choose the shares of expenditures. Institutional independence goes one-step further. The institution has to be independent from every other government body. Smaghi (2008) reports that this is possible through the arrangement of contracts. In addition, also personal independence has a major influence on the overall independence. The main criteria are the term of office, professional qualifications, political affiliations and collegiality, which should be considered by the political authorities. Finally, financial independence has to be ensured. Only those institutions can decide without regard to the financier, which not need financial benefits from other actors. Therefore, the estimation of the shares has to entail all institutional costs. Thus, there is a need for a control mechanism to avoid self-interests of the institution members. The European Central Bank could be used as role model.

Second, it has to be clear who is responsible for the emerging expenditures and how the share each country has to pay is calculated. The share of expenditures each country has to pay within the federal system fulfills some tasks. First, bid shading in the auction mechanism becomes more unlikely through the share. Furthermore, this simplifies to achieve a redistribution, which includes an efficient allocation of migrants across countries. Second, it is ensured that those countries who accommodate the migrants not have to carry the whole burden and the chance to implement such a mechanism is higher. One possible solution could be to use the same share each country has to submit to the budget of the federal system. For example in the European Union, the share depends on the gross national income and the respective VAT rise.⁵ Another possibility could be an orientation on the mechanism of the European Central Bank.

⁵ 2007/436/EG, EURATOM, Council Decision of 7 June 2007 on the system of the European Communities 'own resources.

On the other hand, every other solution calculated through a formula appointment could be used. Additionally, the institution has to determine a solution, which covers the emerging costs. Thus, an estimation of the expected auction outcome is needed, inasmuch as we have seen a correlation of the share and the auction outcome leads to inefficiency. To be very precise at this point, if the determined shares influence the auction outcome, countries will capture this and change their bidding strategy.

In consequence, someone might argue that the whole mechanism only shifts the negotiations on a downstream level. This argumentation would underestimate two important advantages. On the one hand, the negotiation would be a unique process, because afterwards all changes in incentives and situations would be considered through the auction mechanism, the decision about the bid vector, and the formula appointment. On the other hand, it is a big difference if the countries negotiate the migrant distribution and the cost allocation or if one of those decisions can be outsourced in a preference based mechanism.

Besides, some distorting incentives could occur after the auction. It has to be clear who is responsible for counting the asylum requests and there has to be a harmonized framework for the asylum procedure decision in the European Union. When the border countries are instructed to count the number of migrants or to undertake the asylum procedure decision before the migrants are distributed across countries, they have the chance to manipulate the calculation. Once, a country won a high number of auctioned objects there is an incentive to reduce the number of migrants per object and thereby slow down the registration or increase the number of negative replies. In contrast, a small number of objects would speed up the registration and increase the positive replies. Moreover, this would also influence the long term bidding strategy, because the expected future number of migrants is now in some manner controllable. This would end up in a scenario with asymmetric information and change the whole mechanism outcome. For this reason, there is a need for controlling mechanisms by the Institutions of the European Union.

4. Conclusion

How to distribute migrants across countries in a federal system has become an important question in the European Union these days. The refugee crisis has shown that the existing regulation is not able to achieve a stable organized situation within the countries. Hence, there is a need for a well-organized migrant distribution mechanism. This paper suggests the use of auction mechanism design. This new application leads to an auction mechanism where the bidders have to pay a share of the expenditures. We could show that the results are more ambiguous than in standard multi-unit auctions in which buyers and sellers are complete different groups. This concludes in incentive changes concerning bid shading. We examined these changes in the discriminatory, the uniform-price and the Vickrey auction. We derived a gambling condition for bid shading in the uniform-price auction and showed strategy-proofness in a modified Vickrey auction. We pointed out that the Vickrey auction is the only strategy-proof mechanism and should be used to allocate the migrant distribution.

Furthermore, we argue that the uniform price auction outperforms the discriminatory auction in this setting, because the only thing needed is a distribution mechanism without revenue consideration. Bid shading occurs only sometimes in the uniform price auction and always in the discriminatory auction. Based on this, we discussed the advantages of such a preference based distribution mechanism and analyzed the main characteristics, which influence the value function of a country and the respective bid vector. Subsequently, the implementation of such a mechanism is connected to several questions, which have to be organized beforehand. The main point is the establishment of a European institution, which has to organize and control the auction process. More importantly, the institution has to set the shares of expenditures each country has to pay. Therefore, an estimation of the auction outcome is necessarily, because it is important that there is no correlation between the real auction outcome and the shares. When they would influence each other, this would lead to a distorting bidding behavior.

Appendix

A1:

$$p^* * (M_i - 1) - \alpha_i * p^* * M - \sum_{j=1}^{M_i-1} b_j > p * M_i - \alpha_i * p * M - \sum_{j=1}^{M_i} b_j \quad [6]$$

The left hand side describes the revenue after bid shading, bidder i receives, and the right hand side the revenue beforehand.

Therefore, the following has to hold,

$$M_i * (p^* - p) - p^* - \alpha_i * M * (p^* - p) + \lambda_i > 0. \quad (\lambda_i = \sum_{j=1}^{M_i} b_j - \sum_{j=1}^{M_i-1} b_j) \quad [7]$$

Now we put p^* and λ_i on the right hand side and divide the equation by $M * (p^* - p)$ and receive the result,

$$\frac{M_i}{M} - \alpha_i > \frac{p^* - \lambda_i}{M * (p^* - p)}. \quad [8]$$

A2:

In this case, equation [2] simplifies to

$$p^* * M_i - \alpha_i * p^* * M - \sum_{j=1}^{M_i} b_j > p * M_i - \alpha_i * p * M - \sum_{j=1}^{M_i} b_j. \quad [9]$$

Therefore, the following has to hold,

$$(p^* - p) * M_i - \alpha_i * M * (p^* - p) > 0. \quad [10]$$

Now we divide the equation by $M * (p^* - p)$ and receive the result,

$$\frac{M_i}{M} - \alpha_i > 0.$$

[11]

A3:

The combination of equation [8] and equation [11] with the probability of being the pivotal bidder $\frac{1}{N}$ leads to

$$\frac{N-1}{N} \left(\frac{M_i}{M} - \alpha_i - \frac{p^* - \lambda_i}{M * (p^* - p)} \right) + \frac{1}{N} \left(\frac{M_i}{M} - \alpha_i \right) > 0. \quad [12]$$

Through mathematical transformation of equation [12], we receive the result,

$$\frac{M_i}{M} - \alpha_i > \frac{N-1}{N} \frac{p^* - \lambda_i}{M^*(p^* - p)}. \quad [13]$$

A4:

$$\sum_{k=1}^{M_i^*} p_k - \alpha_i \sum_{k=1}^M p_k^* - \sum_{k=1}^{M_i^*} b_k > \sum_{k=1}^{M_i} p_k - \alpha_i \sum_{k=1}^M p_k - \sum_{k=1}^{M_i} b_k. \quad [14]$$

The left hand side describes the revenue after bid shading, bidder i receives, and the right hand side the revenue beforehand.

Therefore, the following has to hold,

$$\left(\sum_{k=1}^{M_i^*} p_k - \sum_{k=1}^{M_i^*} b_k \right) - \left(\sum_{k=1}^{M_i} p_k - \sum_{k=1}^{M_i} b_k \right) - \alpha_i \left(\sum_{k=1}^M p_k^* - \sum_{k=1}^M p_k \right) > 0. \quad [15]$$

The explanation of equation [5] shows that the term $\left(\sum_{k=1}^{M_i^*} p_k - \sum_{k=1}^{M_i^*} b_k \right) - \left(\sum_{k=1}^{M_i} p_k - \sum_{k=1}^{M_i} b_k \right)$ is always negative, as well for over- as underreporting. In case of an underreporting the price vector for all winning goods $\sum_{k=1}^{M_i^*} p_k$ will be smaller than $\sum_{k=1}^M p_k$. Therefore, $\sum_{k=1}^M p_k^* - \sum_{k=1}^M p_k$ will be positive and could have an incentive changing influence on the bid shading condition. This happens, whenever equation [15] is satisfied.

5. References

Aiyar, S., B. Barkbu, N. Batini, H. Berger, E. Detragiache, A. Dizioli, C. Ebeke, H. Lin, L. Kaltani, S. Sosa, A. Spilimbergo and P. Topalova (2016): The Refugee Surge in Europe: Economic Challenges. *IMF Staff Discussion Note*, pp. 1-50.

Asubel, L. (2004): An Efficient Ascending-Bid Auction for Multiple Objects, *The American Economic Review*, Vol. 94, No. 5, pp. 1452-1475.

Asubel, L., P. Cramton, M. Pycia, M. Rostek and M. Weretka (2014): Demand Reduction and Inefficiency in Multi-Unit Auctions. *Review of Economic Studies*, 81(4), pp. 1366-1400.

Baisa, B. (2016): Overbidding and inefficiencies in multi-unit Vickrey auctions for normal goods. *Games and Economic Behaviour*, 99, pp.23-35.

Bonin, H. (2015): Langfristige fiskalische Erträge künftiger Zuwanderung nach Deutschland, *Wirtschaftsdienst*, 95(4), pp.262-268.

Fratzcher, M. and S. Junker (2016): Eine wirtschaftswissenschaftliche Perspektive zu Geflüchteten. *ifo-Schnelldienst*, 69(4), pp.7-10.

Raffelhüschen, B. and S. Moog (2016): Zur fiskalischen Dividende der Flüchtlingskrise: Eine Generationenbilanz. *ifo-Schnelldienst*, 69(4), pp.24-29.

Sinn, H.-W. (2002): EU Enlargement and the Future of the Welfare State. *Scottish Journal of Political Economy*, 49(1), pp.104–115.

Sinn, H.-W. (2003): *The New Systems Competition*. Basil Blackwell, Oxford, ISBN: 978-0-631-21951-4.

Sinn, H.-W. (2016): So kann es nicht weitergehen. *ifo-Schnelldienst*, 69(4), pp.3-6.

Smaghi, L., B. (2008): Central Bank Independence in the EU: From Theory to Practice. *European Law Journal*, 14(4), pp. 446–460.

Vickrey, W. (1961): Counterspeculation, Auctions, and Competitive Sealed Tenders. *Journal of Finance*, 16, pp. 8-37.