

Punteros con enchufe: Un modelo formal acerca de la compra de votos y el acceso a recursos

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Resumen

Los modelos formales disponibles retratan a los punteros como agentes de explotación que compran a sus clientes al menor precio posible. Si así fuera, entonces deberíamos esperar que los votantes más pobres fueran indiferentes respecto del puntero con el que pactan, dado que podrían esperar el mismo precio mínimo de parte de cualquiera de ellos. Por el contrario, la evidencia de relaciones a largo plazo entre el puntero y el cliente sugiere que a los clientes sí les importa quién es su puntero. El modelo formal en este documento, en correspondencia con la evidencia extraída de 120 entrevistas realizadas a punteros políticos, aclara por qué los clientes se ocupan de saber quiénes son sus punteros. Los punteros no están del todo seguros sobre los valores de reserva de los votantes (es decir, la cantidad mínima de beneficios que les va a garantizar su voto). Debido a esta incertidumbre, mayor es la cantidad de recursos que los punteros son capaces de obtener, también es mayor la cantidad de recursos que transfieren a sus clientes para asegurarse sus votos. Los votantes se benefician de la capacidad de sus punteros para acceder a mayor cantidad de recursos como consecuencia de dicha incertidumbre.

Abstract

Available formal models portray brokers as exploitative agents who buy their clients at the minimum possible price. If this were the case then we should expect that poor voters be

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indifferent as to which broker they deal with, since they could expect the same minimum price from any broker. On the contrary, evidence of long-term broker-client relationships suggests that clients do care about who their broker is. The formal model in this paper, in correspondence with evidence drawn from 120 interviews with brokers, illuminates the reason why clients care about who their brokers are. Brokers are uncertain about voters' reservation values (i.e., minimum amount of benefits that will secure their vote). Due to this uncertainty, the more resources brokers are able to obtain the more they transfer to clients to assure their votes. Therefore, given this uncertainty over reservation values, voters benefit from brokers' abilities to access more resources.

Introduction

"He does not give me everything that I want, but he supplied me with school uniforms for my children and he always helps me out with food. If I go to somebody else I might well end with less than that. He has my loyalty." This statement by a poor woman from a slum in the outskirts of Buenos Aires illustrates two important facts about vote-buying. First, clients care about who their brokers are. Second, and relatedly, brokers and clients develop enduring relationships that can last even decades. These two facts pose a crucial puzzle to the formal literature on vote-buying, which presents brokers as having all or most of the bargaining power. If brokers held the majority of the bargaining power, then clients should be indifferent as to which broker they work with; every broker would pay them the same (minimum) amount, and therefore all brokers would be the same from the voter's perspective and long-lasting relationships would not consistently occur. In reality, poor voters do care about which brokers they work with, and this article will utilize a simple model to explain why.

Brokers discretionally deliver goods to voters to convince them to vote for their bosses. Each voter works exclusively with one broker, and voters care which broker they work with. They prefer to

deal with good brokers; that is, with brokers who have access to resources. Good brokers and clients develop long-lasting relationships. Confirming this and supporting her infinite game model, Stokes explains that “it is entirely appropriate to think of the inter-actions between machine operatives and their constituents as repeated over many iterations” (2005; 318).

In Stokes’ model (and in other existing models), brokers are assumed to know the exact price at which their clients will sell their support and are thus able to buy them at the lowest possible price. If this were indeed the case, each poor voter should be indifferent as to which broker they deal with because all brokers would equally hold them down to the cheapest price. The formal model in this paper, to the contrary, shows why clients care about who their brokers are and develop long-lasting relationships with good brokers.

Different brokers have varying access to resources. Upon receiving resources, brokers promise part of these resources to voters in exchange for their votes, and keep the rest for themselves. In order to continue securing resources for themselves, brokers must win elections; this is so because when an election is lost the broker will be fired by his boss.²

Contrary to the assumption made by Stokes’ (and others’) models, brokers are not certain about each voter’s reservation value (the lowest level of benefits for which a voter will sell her vote). Due to this uncertainty, the more resources that a broker is able to obtain, the more he will transfer to her clients, so as to reassure his clients’ votes and retain his own position and rent. As a broker’s access to resources increases, not only does the broker’s profit increase but the client’s profit as well. Therefore, voters benefit from brokers’ abilities to access more resources. This account is consistent with other empirical phenomena that have not been accounted for, such as long-lasting broker-client relationships and brokers’ limited knowledge of voters’ reservation values.

² From now on, I use masculine for the Broker and feminine for the Voter.

Succinctly, three combined factors in this model account for why clients care about who their brokers are: (a) brokers' varying level of skills at accessing resources, (b) the repeated nature of the game, and (c) brokers' uncertainty about voters' reservation values. Brokers transfer more when they access more resources only because they want to keep their positions as brokers and they are not sure of how much they need to promise to voters to buy their votes. In other words, in the model that follows the voters extract an informational rent.

Furthermore, by introducing brokers' uncertainty about reservation values, this model provides a theoretical basis for analyzing the determinants which shape the level of clientelistic transfers between brokers and voters. It shows that the amount that brokers offer to voters depends on the broker's skills at accessing resources and on the size of the available budget.

In addition to showing the relevance of brokers' ability to access to resources for clients, this paper provides insights into clientelistic parties' frequent electoral hegemony. While the model shows that brokers' access to resources makes a difference for voters, the evidence from the field shows that not all brokers have the same access to resources. Voters will support the brokers that have more access to resources and can offer more benefits in exchange for the voter's vote. Because brokers working for incumbent clientelistic parties have more access to resources, these parties have an important electoral advantage. This dynamic contributes to clientelistic parties' electoral hegemony.

The literature on vote-buying and brokerage has given the most attention to the Peronist Party (PJ) (Auyero 2001; Levitsky 2003; Brusco, Nazareno, and Stokes 2004; Stokes 2005; O'Donnell 2005; Nichter 2008). There is a broad consensus among scholars that the only party with a network of brokers extensive enough to permeate most of the poorest areas in Argentina is the Peronist Party (Brusco, Nazareno, and Stokes 2004; Stokes 2005; Schaffer and Schedler 2007;

Nichter 2008). In a groundbreaking paper, Calvo and Murillo (2013) apply an innovative technique to measure the size of political parties' networks in Argentina and Chile. The Peronist Party has the largest network, and voters closer to this network perceive that they are more likely to receive excludable goods than those with few contacts in the Peronists' network. Likewise, Levitsky (2003) describes the extensive Peronist broker network as a key factor in the transformation of the Labor based Peronist party into a successful clientelistic machine. For this reason, and given that scholars have long attested to the PJ machine's extraordinary record of electoral success (Levitsky 2003; Calvo and Murillo 2004), I illustrate the results of the formal analysis with evidence drawn from 120 in-depth interviews with Argentine brokers, 112 of which were Peronist. In the course of these interviews PJ brokers emphasized that having access to resources which they could distribute to their clients was essential for their own survival in the political arena.³

By focusing on brokers' access to resources, this paper bridges two currents in the present literature about vote-buying and brokerage. Over the course of intensive fieldwork, past researchers have observed the stability of broker-clients' relationships (Auyero 2001; Finan and Schechter 2012; Lawson and Greene 2011), however the literature has yet to produce a rational explanation for this phenomenon. While politicians are portrayed as rational, self-interested actors, the poor are portrayed as myopic and altruistic actors. The poor support their brokers either because they are culturally or affectively identified with them (Auyero 2001; Ostiguy 1998) or in order to show gratitude to them (Finan and Schechter 2012; Lawson and Greene 2011). On the other hand, authors who portray the poor as being rational and self-interested fail to

³ I carried on the field work for this particular paper between 2008 and 2010. To locate brokers, I asked people in each neighborhood of four municipalities in the rustbelt around the city of Buenos Aires, which concentrates 27% of the national electorate, if they knew any brokers and if they could provide their names. With this information I was able to assemble maps locating the brokers and their regions of influence for each municipality. I interviewed each broker for an average of two hours. The four selected municipalities to interview brokers were: La Matanza, Malvinas Argentinas, Merlo and San Miguel. While these four municipalities concentrate 5.5 % of the national electorate, they are representative of the rustbelt of poor municipalities that surround the city of Buenos Aires where the PJ machine has its stronghold.

recognize the fact that clients care about which broker they support (Dixit and Londregan 1996; Stokes 2005; Nichter 2008; Zarazaga 2011). The present paper shows that though clients act strategically, they still care about who their brokers are because brokers skills at accessing resources affects their well-being. By accounting for brokers' uncertainty as to voter's reservation values as well as brokers' varying ability to access resources, this paper shows exactly what voters have at stake when deciding which broker to support.

Vote-buying models with complete information

In a complete information model for vote-buying, brokers know the exact price for which voters will sell their votes; accordingly, brokers buy each voter at their reservation value. This model is hereafter summarized as a common one-shot game with complete information, using Stokes' model as a base.

In this model there are two parties competing for votes; the party machine and the opposition party. Only the party machine offer rewards to voters for their. Let the ideological position of the broker's party on a one dimension policy be defined by L , and the ideological position of the opposition party relative to the broker be defined by R . Let x^* be the midpoint between the broker's party and the opposition party (See Figure 1). While both parties use their ideological position to attract voters, the political machine can also use its broker network to entice voters with rewards.

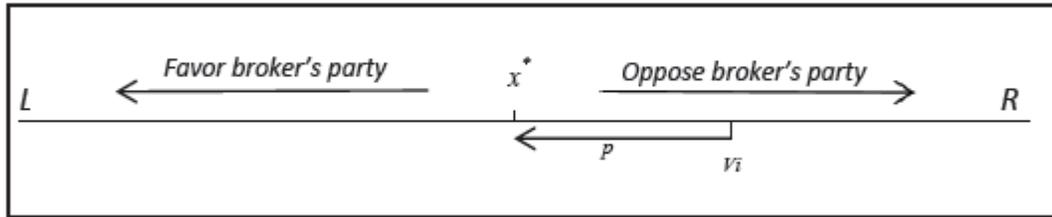


Figure 1

A voter's (V) utility for voting for the broker's party is given by $Uv_i = -\frac{1}{2}(V_i - L)^2 + z$, where L represents a vote for the party machine, the subindex i the voter's ideological position, and z the reward offered by the party machine broker. Similarly, the voter's utility for voting for the opposition party is given by $Uv_i = -\frac{1}{2}(R - V_i)^2$. The voter votes with the broker if $-\frac{1}{2}(V_i - L)^2 + z \geq -\frac{1}{2}(R - V_i)^2$ or $z \geq \frac{1}{2}((V_i - L)^2 - (R - V_i)^2)$. Let z^* be the reward that leaves the voter indifferent between one party or the other; that is, $z^* \geq \frac{1}{2}((V_i - L)^2 - (R - V_i)^2)$. Note that I kept the usually assumed tie-break rule that if the voter is indifferent it votes for the party machine.

Note that in this complete information model the broker knows the exact ideological position of each voter and therefore he always knows the exact amount he must pay her for her vote. If the broker wants to buy V_i 's vote, he will pay her z^* . He will never pay more or less than z^* . If he pays more he will be wasting money as he could pay less (z^*) for getting the same vote, and if he pays less he will be wasting money as the voter will not vote for his party for a reward $z < z^*$. He will never pay more or less than z^* ; if he paid more than z then he would be spending more resources than are necessary to acquire her vote; if he paid less than z then his payment would garner no vote because he did not meet her reservation value. In this model, given that there exists no source of differentiation across brokers and that brokers have complete information about voters'

political positions, any broker that decides to buy a voter V_i will offer her exactly the same reward z^* . This means that every broker would hold voters down to their reservation values. For example, in Figure 1, in order to buy voter V_i ; the broker needs to offer a reward commensurate with length p . If he does offer amount p , he can be certain that he has secured her vote. Therefore, no brokers will have any incentive to offer V_i an amount greater than p . Consequently, V_i will be indifferent as to which broker she works with because all brokers will hold her down to p .

In this baseline model, party machine supporters— that is, those voters to the left of the median ($v_i < z^*$) — do not receive any reward. For these voters it is always true that $-\frac{1}{2}(V_i - L)^2 > -\frac{1}{2}(R - V_i)^2$ and therefore their dominant strategy is to vote for the party machine, even in the absence of rewards. For this reason, Stokes argues that party machines only target opposed voters. On the contrary, Nichter (2008) points out that there is evidence to suggest that party machines target loyal supporters. To capture this, he adds to Stokes' baseline model a constant cost of voting across voters to argue that party machines target strong supporters to make them turn out. While he rejects Stokes' model on the grounds that loyal voters are targeted by party machines, his turnout-buying model also assumes that parties have perfect knowledge of each voter's ideological position. Consequently, as in Stokes' model, every broker will offer the same reward to voters. In complete information models (whether concerned with vote-buying or turnout-buying), voters have no incentive to prefer one broker over another. In this regard, complete information models fall short by failing to account for a widely observed phenomenon in the field: the long-lasting relationships between voters and brokers.

To solve voters' commitment problems, Stokes turns her baseline one-shot game into an infinite game and assumes that brokers can, although imperfectly, monitor how voters cast their votes. In this infinite game, the party machine engages in a grim trigger strategy whereby it rewards the

voter until she fails to cooperate, after which it punishes her with-holding rewards forever. Nichter also develops an infinite game with a grim trigger strategy in which the party machine monitors whether voters turn out or not.

As Stokes affirms for the case of party machines, “it is appropriate to assume that parties and voters see their interactions as extending into the indefinite future” (Stokes 2005, 318). In these infinite games, however, there are still no incentives for voters to prefer one broker over another. Given that all brokers in these infinite models still have complete information about each voter’s ideological position, any broker will continue to offer to a voter a reward just equal to the discounted sum into the future of her reservation value. These models also fail to explain why voters care about who their brokers are and develop long-lasting relationships with them.

In contrast with previous models, I next develop an infinite game model in which brokers are characterized by their level of access to resources and are uncertain about voters’ exact reservation value. The infinite game with these two features let me account for why voters care about who their brokers are and develop long-lasting relationships with them.

The model

Access to resources is a crucial component of brokerage. A PJ broker declared, “90 percent of my problem is to keep contacts in the municipality. If you have friends there, then doors will open when you knock. It is not easy, you need to be here in the streets of the neighborhood listening to people’s needs, but you need to be also at the municipality getting resources.” In this model, I capture how brokers’ skills for accessing resources— given their uncertainty over voters’ reservation values— affect voter’s payoffs. Brokers receive resources from the candidates they endorse and decide what portion to keep for themselves and what portion to offer voters for their

support. Brokers face a trade-off between promising more to voters (increasing their probability of being supported and reinstated upon his candidate winning) and keeping a bigger portion of the pie for themselves. For example, brokers in Argentina often keep for themselves part of the food handouts that they receive to distribute among voters. One interviewed broker was very upset with a fellow PJ broker because in the last election, “[the mayor] gave us food handouts with everything: noodles, soups, oil, sugar, flour, yerba. . . but he kept for himself the most expensive items like sugar, oil, and flour. The poor people only got the noodles. It is unfair. I understand you need to make a living, but just keep the oil not the sugar and the flour too. I only keep the oil for myself.” They also demand from people to whom they gave workfare programs a percentage of their salaries.

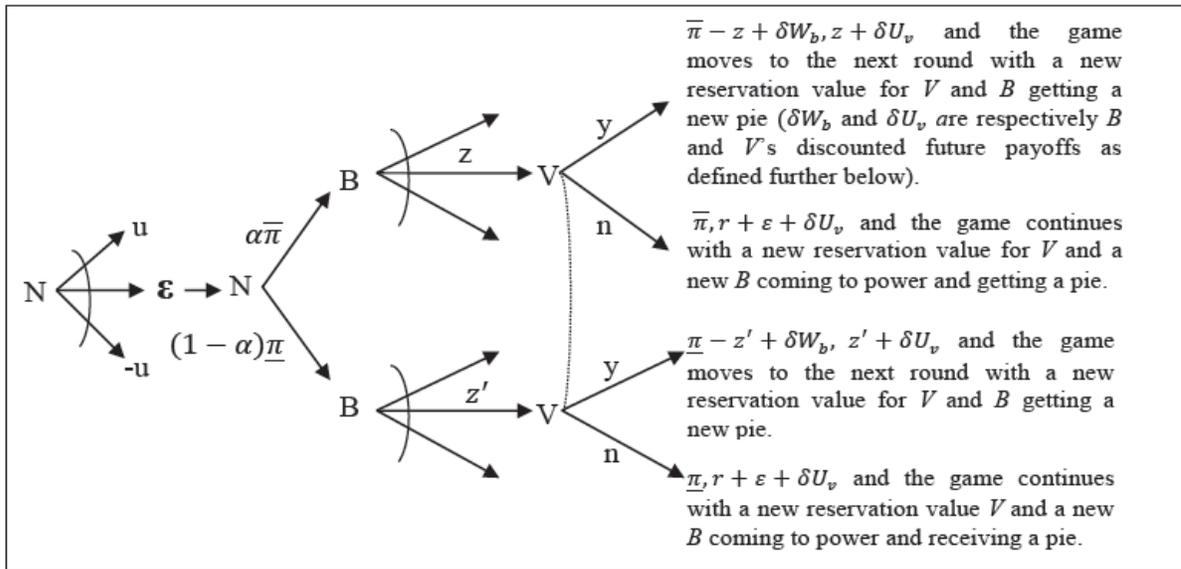
The model shows that when brokers have access to ample resources they will make bigger offers to voters because they have more at stake brokers in maintaining their job in the party machine. If they remain brokers, they will have chances to receive sizeable resources in the future and so will be able to take more for themselves over time. And when brokers with access to resources make offers in excess of voters’ reservation values, voters benefit. To capture this mechanism, I develop a model in which the broker’s ability to access resources is characterized by a value $\alpha \in [0, 1]$. Substantially, a broker with high α is a broker with strong relationships with politicians who provide him with sizeable resources; i.e. a broker that can "knock on doors". On the contrary, a broker with a low α does not have many valuable contacts and can only access meager resources. A broker (B) will have access to resource level $\pi \in \{\bar{\pi}, \underline{\pi}\}$ where $\bar{\pi} > \underline{\pi}$, and $\bar{\pi}$ is drawn with probability α , and $\underline{\pi}$ with probability $1 - \alpha$. While in reality brokers are distinguished from one another based upon their skill for accessing resources (α), I simplify the model by assuming that all brokers entering the game after the initial broker will possess the same skill α that was assigned to the

initial broker; this assumption is acceptable because it will not undermine the principle goal of the model, which is to show that both voters and brokers benefit from a higher α .

The game goes as depicted in the tree in Figure 1. First, the voter (V) that plays the game has a payoff for voting for her own candidate; $r + \varepsilon$. Because this is the minimal amount that B would have to pay to switch her vote in favor of his candidate, we refer to it as the voter's reservation value. Since the economic and political situation changes from one electoral term to the other, the voter's reservation value $r + \varepsilon$ also changes. Thus, we assume that ε is drawn for V at the beginning of each round from a uniform distribution between $-u$ and u . The value r represents public information relevant to the voter's reservation value while the value ε represents private information; broker B has the correct belief that $\varepsilon \sim u [-u, u]$, however B is unsure of the exact value of ε . In other words, V knows her own reservation value but B only knows that it falls between $r - u$ and $r + u$.

Second, a broker B comes to power and depending on his ability to secure resources, he will receive from his boss an amount of resources $\bar{\pi}$ or $\underline{\pi}$. Conditional on the size of the pie available to him, B next makes an offer to secure the voter's vote. Let $z_t \in \{0, \bar{\pi}\}$; be the offer at time t if $\pi = \bar{\pi}$ and $z_t \in \{0, \underline{\pi}\}$ be the offer at time t if $\pi = \underline{\pi}$. After receiving B 's offer, the voter decides whether or not she will accept the offer and support B 's candidate. If the voter accepts B 's offer then they both move to the next round which starts with a new reservation value for the voter and a new pie $\pi \in \{\bar{\pi}, \underline{\pi}\}$ for B . If the voter rejects B 's offer, then B exits the game and the next round starts with a new B coming to power and receiving a pie $\pi \in \{\bar{\pi}, \underline{\pi}\}$ and the voter learning her new type ε .

Figure 2: Game Tree



I will now explain how the players derive utility. In this game, the voter derives utility from voting for her preferred candidate (as measured by her reservation value for voting for B 's candidate) and from B 's transfers. If the voter does not accept B 's offer, she votes for her own candidate, receives her reservation value $r + \varepsilon$, and moves to the next round in which a new B will make her a new offer. If the voter accepts B 's offer, she receives the offer and both players move to the next round in which B will make a new offer. Note that because our model assumes each successive broker's skill to be identical to the initial broker's, all brokers will make in equilibrium the same offer given the same amount of pie. Therefore, over any given history, the voter's payoff is given by the discounted sum of the maximum of each period's offer and her reservation value.

B gains utility from the portion of the pie he keeps for himself in each round he plays. If the voter does not accept his offer, B keeps the entire $\pi \in \{\underline{\pi}, \bar{\pi}\}$ for himself but loses his position as a broker. If the voter accepts his offer, B receives that period's available pie minus the offer, and moves to

the next round where he will receive a new pie and make a new offer to the voter. As I assume B fulfills his promises, he will stay in power as long as the voter accepts his offers.

The strategies

A behavioral strategy for B has to specify the offer he is going to make to V at each period as a function of whether he received or in that period, his beliefs about the voter's type, and the preceding history of offers and replies. A behavioral strategy for V has to specify the voter's reply to each possible offer she could receive from B in any round given her type and the preceding history of offers and replies (For a more technical definition see in the Appendix, Strategies). In the following section I characterize the class of equilibrium of interest, but not before I lay out some assumptions that simplify the game's analysis.

The equilibrium

To simplify the model, I assume that $\underline{\pi} < r - u$. Therefore, in the event that B receives $\underline{\pi}$, the voter's reservation value would be larger than the available pie. Substantially, in this case B does not have a budget big enough to buy V . This simplifies the game since, as I explain below, when B receives his offer will always be rejected by V regardless of her type. On the other hand, I assume $\pi \geq r + u$. This insures that upon receiving π , B can afford to buy off any type of voter. When receiving π , B faces a trade-off between promising more to the voter (increasing his probability of remaining as the broker) and keeping a bigger portion of the pie for himself. While these assumptions simplify

the problem, they do not prevent the model from retaining the essential dynamic of interest, that is, that voters benefit from brokers' skills to consistently access ample resources.

The environment underlying this game is static in the sense that the only variables that should be of interest to the broker are the size of the available pie and the type of voter in each round. Similarly, the voter is indifferent over past actions and cares only about the offer of that period's broker. Note that all the brokers have the same ability α to access resources in this game. If one broker is rejected, a new broker comes to power who is indistinguishable from the rejected one; all the brokers are identical. Thus, I can further simplify things by focusing on Markov Perfect Equilibria (MPE). In an MPE, the players' strategies depend only on the current state, here defined by π . As such, players choose their action as a function of the current state, independent of preceding history. Because each broker is the same and voters' strategies do not account for past history (there are no punishment strategies), MPE ensures that the continuation value for voters is constant over time and behavior. This makes the problem tractable as the solution reduces to finding B 's optimal offer and a threshold for V to accept an offer. I focus next on finding these.

Given that there are no punishment strategies and that brokers are of the same type, the voter's strategy depends only on the offer she gets and her myopic reservation value. The voter accepts or rejects B 's offer by comparing only the value of the offer in that round to her myopic reservation value; $r + \varepsilon$. Whether or not she accepts the offer has no effect on her continuation value, which will remain the same because the new broker will be identical to the rejected one. Therefore, for the unique pure MPE of this game, the voter's strategy is rather simple:

Accept any offer z if $z \geq r + \varepsilon$,

Reject any offer z if $z < r + \varepsilon$.

In the case of B 's strategy, it is clear that if nature selects $\underline{\pi}$ because $\underline{\pi} < r - u$; B cannot buy the voter's support, so any offer $z' \in [0; \underline{\pi}]$ is payoff equivalent for him. Whatever he offers, his offer will be rejected and he will keep $\underline{\pi}$ for himself and be out of the game. In reality, this is what happens to brokers when they do not have substantial resources and end up making meager promises.

On the other hand, if he receives π , B can make an offer z to gain the voter's support. If B receives π , his optimal offer z gives the maximum of the utility of having that pie π and of making an offer that can be accepted or rejected by the voter. In this case B has sufficient resources to make a substantial offer to V for her vote; besides securing her vote and his own position as broker, however, he is also interested in keeping as much of the pie π for himself as possible. The broker faces a maximization problem in which he needs to find the optimal offer. Formally, conditional on having π , B maximizes

$$P_b(z) = \left[\bar{\pi} - z + \delta \left((1 - \alpha)\underline{\pi} + \alpha P_b(z) \right) \right] \frac{z - r + u}{2u} + \bar{\pi} \left(1 - \frac{z - r + u}{2u} \right) \quad (1)$$

The first term of $P_b(z)$ captures what B gets if his offer is accepted. Note that if his offer is accepted then B gets the pie minus the offer, plus the discounted value of being the broker in the next round, where $\delta \in [0; 1]$ is a common discount factor and $(z - r + u) / (2u)$ is the probability that $z \geq r + \varepsilon$ given that $\varepsilon \sim u [-u; u]$; that is, the probability that the voter V accepts the offer z . The second term of $P_b(z)$ captures what B gets if his offer is rejected; he simply keeps the big pie π . The factor $1 - (z - r + u) / (2u)$ multiplying π in this second term is the probability that $z < r + \varepsilon$; that is, the probability that the voter rejects the offer z .

Given that the broker receives the big pie π , $P_b(z)$ is his payoff for a given offer z . Because B only decides over an optimal offer when he receives π , we can solve B 's maximization problem conditional on B having π . The FOC of $P_b(z)$ with respect to z , is quadratic on z .

Solving yields,

$$z = \frac{1}{\alpha\delta} \left(2u + r\alpha\delta - u\alpha\delta \pm \sqrt{2u} \sqrt{\frac{1}{u} (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)} \right) \quad (2)$$

The solution for z with a positive discriminant can be discharged because it is out of the feasible values (See Appendix, Lemma 1), and the SOC verifies that the negative solution to the square root (that I denote from now on by \tilde{z}) is a maximum (See Appendix, Lemma 2). Therefore, I can next formally characterize the proposed equilibrium and prove its existence.

Proposition 1. There is a unique pure MPE in which the voter's strategy is:

To accept any offer greater than or equal to her myopic reservation value, $r + \varepsilon$, and to reject otherwise.

And B 's strategy is:

- i) Upon receiving $\underline{\pi}$, to offer $z' \in [0, \underline{\pi}]$, and
- ii) Upon receiving π to offer

$$z^* = \begin{cases} [0, r - u] \text{ for } \tilde{z} < r - u \\ \tilde{z} \text{ for } r - u \leq \tilde{z} \leq r + u \\ r + u \text{ for } \tilde{z} > r + u, \end{cases}$$

$$\text{Where } \tilde{z} = \frac{1}{\alpha\delta} \left(2u + r\alpha\delta - u\alpha\delta + \sqrt{2u} \sqrt{\frac{1}{u} (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)} \right) \quad (3)$$

Heuristic Proof. It is easy to see that the voter's strategy is optimal. If the state is $\underline{\pi}$, meaning that B received a small pie, the voter would reject any offer $z' \in [0; \underline{\pi}]$ because by assumption $\underline{\pi} < r - u$. In this case, by accepting the offer the voter would do worse in the present round and get the same continuation value she would receive if she rejected the offer, because the new broker would be identical to the rejected one. Formally, because $z' + \delta Uv < r - u + \delta Uv$, every type of voter rejects z' .

If the state is π and $z < r + \varepsilon$, then in the present round the voter derives more utility from supporting the candidate she prefers ($r + \varepsilon$) than from supporting B 's candidate and receiving z . Let us consider now what happens with the continuation value in this case. If the voter accepts an offer $z < r + \varepsilon$, her continuation value δUv is the same as if she rejects it because all the brokers are identical. Therefore, by accepting an offer $z < r + \varepsilon$, the voter would do worse in the present round and would receive the same continuation value as she would if she rejected. Clearly, the voter never accepts an offer $z < r + \varepsilon$ because $z + \delta Uv < r + \varepsilon + \delta Uv$.

By the same argument, it is not optimal for the voter to reject an offer $z \geq r + \varepsilon$. In this case, the voter would do worse in the current period and get the same continuation value in the future as she would if she had accepted. Formally, the voter accepts an offer $z \geq r + \varepsilon$ because $z + \delta Uv \geq r + \varepsilon + \delta Uv$.

Regarding B 's strategy, we have already seen that if B receives $\underline{\pi}$ any offer $z' \in [0; \underline{\pi}]$ would be an optimal offer for him because it would always be rejected by the voter. If B receives π , then he

faces the maximization problem I solved above. If the solution is z^{\sim} with $r - u \leq z^{\sim} \leq r + u$, then the optimal offer z^* is interior and $z^* = z^{\sim}$.

Now, note that making a promise $z > r + u$ is always suboptimal for B , as he would be spending more resources than needed to secure the support of even the voter with the highest possible reservation value $r + u$. Promising z strictly above $r + u$ does not increase B 's utility but decreases her current consumption. Therefore, if the $z^{\sim} \geq r + u$ then B offers $Z^* = r + u$. Also note that any offer $z < r - u$ would always be rejected. Therefore, if $z^{\sim} < r - u$, then any offer $z \in [0; r - u]$ is payoff equivalent for the broker in equilibrium.

The strategies specified in Proposition 1 thus constitute a subgame perfect equilibrium. As I have shown, neither the broker nor the voter can increase utility by making any changes in their strategies at the start of a subgame in which they are moving. In Appendix - Proposition 1, I offer a formal proof showing that if, in practical terms, B is not absconding (he is not making an offer smaller than $r - u$) then in equilibrium his optimal offer z^* is unique. I next discuss the properties of this equilibrium.

Brokers' access to resources and clients' payoff

I show here that voters have an interest in brokers' access to resources. Formally, this means that the voter's equilibrium payoff, denoted by $U_v(z^*)$; rises with B 's increasing ability to gain resources as measured by α . The partial derivative of the voter's equilibrium payoff with respect to α is positive; $dU_v(z^*)/d\alpha > 0$ (See Appendix - Proposition 2 for formal proof). Substantially, this explains why a voter cares about the identity of her broker — every voter with a reservation value smaller than the offer z^* benefits from brokers' increasing abilities to access resources. The positive sign

of this partial derivative shows that the better the brokers' access to resources, the greater the benefit for the voter.

This result resonates with evidence from the field in three important ways. First, brokers express a degree of uncertainty about their clients' political behavior. They admit that they are never sure whether or not their transfer has secured the vote of their client. They confess that they cannot be certain of how their followers will cast their votes. Eighty three percent of the brokers believe that at least some of the people who get help from them do not vote for their bosses. A broker, for example, declared "You never know. You always have some people that get handouts from you and they ask you for a ballot, but then in the booth they stab you in the back." Revealing that brokers cannot know for sure voters' reservation values, one broker explained that he used food coupons for US \$12 and for US \$25 to buy votes and that he "needed to be careful because [the voters] pretend that they will go to another broker just to get the bigger ones." In order to minimize losses from overpaying or underpaying clients, parties recruit and employ brokers with strong roots in the neighborhoods where the party is politically active. Brokers who are fixed members of the community can collect more accurate information about clients' reservation values and thereby minimize the costs of buying votes for the party.

Second, it is crucial for clients that their brokers have access to resources; brokers with good connections and easy access to resources are prized by their clients as "plugged in" brokers (In Spanish *con enchufe*). Clients perceive their welfare to be tied to the amount of resources that their brokers can secure. If their brokers have resources, they will have them too. An old man from a slum stated it clearly, "If Carlos [his broker] does well, so do we. He knows that he cannot improve only his personal situation. If he gets resources he helps us too. The better he is, the better we are." Voters' perceptions match that of their brokers. When asked what they needed to

fulfill their political goals, 72 percent (86) of the brokers mentioned having access to resources. As a broker told me, "It is about getting as many resources as you can. Once the people know that you handle plentiful resources, they will not leave you." Brokers invest a considerable share of their time in developing connections that allow them "to knock on doors" and access resources.

Third, upon accessing sizeable resources brokers can keep their positions for lifetime. The average age of brokers is 48 years and their tenure is 19 years. As captured by the model, brokers with high access sizeable resources, deliver to their clients, and have long-lasting relationships with them. When I asked why the relationships with their clients were so stable, brokers uttered phrases such as "I always have my people in good conditions," "if you want their loyalty you better be generous with them," and "if you are too cheap, sooner or later they will find someone that helps them more than you do and they will leave you." The counterpart to this story is given by brokers that do not have access to resources and, therefore, are not able to generously deliver to their clients. In the model, if brokers have a low α sooner than later they abscond. A broker explained, "Here it is distribute or disappear. Once you are not able to deliver food, mattresses, or anything you are out of the game, probably forever." Similarly, Trotta reports that a broker told him, "Here we all know each other. So, when someone is not able to deliver concrete stuff. . . bye bye, let's go to another one" (Trotta 2003, 137). Access to and distribution of resources are necessary conditions to survive as a broker.

The determinants of the size of the transfer

It is already established above that the size of the transfer the broker promises to the voter increases in α (Appendix - Proposition 2). I will next prove that z^* is increasing with $\bar{\pi}$, thereby showing that B will offer more to his clients as the size of the $\bar{\pi}$ he receives increases. The substantive interpretation of this is that as the size of the available $\bar{\pi}$ increases, the more B has at

stake in being the broker in the next round and cashing in on the difference between the big pie $\bar{\pi}$ and the offer he makes, z^* . Thus, in response to an increase in $\bar{\pi}$, the broker will improve his chances for winning the voter's support by increasing his offer z^* . I take the partial derivative of z^* with respect to when $z^* = \tilde{z}$.

$$\frac{\partial \tilde{z}}{\partial \bar{\pi}} = \frac{\alpha \delta u}{\sqrt{2} \sqrt{u (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)}}$$

The positive sign of this partial derivative shows that the bigger the budget B handles, the more he offers to the voter. It is interesting to note that for B , even when the pie becomes big, the option of making a smaller offer and keeping more for himself is outweighed by the option of making a more generous offer and increasing the probability of keeping his position. Effectively, a bigger pie does not tempt B into keeping everything for himself.

Brokers' narratives show that brokers do keep for themselves part of the pie which is given to them by their bosses for distribution to clients. Brokers regularly accused other brokers of siphoning off resources for themselves or their families. Even though it is illegal, eight brokers admitted to keeping 10 percent of the monthly salaries of individuals to whom they had given workfare programs. One of them told me: "We all do the same. Do not believe them if they tell you otherwise. I only ask for 10 percent but some even ask for 50 percent of the salary".

However, brokers do not keep everything for themselves. The conventional wisdom on the subject is that, if not monitored, brokers will ". . . divert as much as possible of a party's electoral resources to their private use" (Kitschelt and Wilkinson 2007, 14). On the contrary, the model in

this paper shows that brokers have incentives to not keep all of the resources for themselves; because brokers benefit substantially from keeping their positions, they have more incentive to secure their clients' votes and will therefore transfer more resources given a bigger budget. If they do not distribute enough resources, their clients may not support them and they may lose their valuable brokerage positions. A broker proudly explained that he had received more support from the Mayor as of late, and that with that support he was able to improve not only his personal welfare but also that of his group: "I am handling many more resources now than a year ago. I have 60 positions in cooperatives. We are doing ...ne. I got a new car and a new house. But also my people are doing better. Now they are getting a much better income than a year ago and I always have a 100 box bill to slip in their pockets as an extra reward. Now it will be hard for anyone to defy me in my territory." Similarly, a broker narrated: "Many people follow me, at least 140 people. I move three buses. Thank God people are responsive to my calls. They follow me because I was never cheap to them. If I eat beef, they eat beef too. You cannot be in this business for too long if you keep all the best stuff for yourself and only distribute the crumbs."

Further Implications: Electoral Hegemony

An interesting consequence that arises from the model is that, all other things being equal, the voter will always prefer a broker with access to resources over a broker without access to resources. Hence, clientelistic parties that access office and control public resources can be hard to challenge; voters prefer to deal with their brokers than with any other party brokers. This may account for clientelistic parties frequently and persistent electoral hegemony.

The model shows that the better access to resources the broker has, the better off the voter will be. While for the sake of simplicity this model featured only one type of broker, in reality clients

face brokers that differ in their skills to access resources. In the language of the model α varies across brokers, as shown by the fact that in the poor neighborhoods of Argentina people specifically distinguish brokers between "plugged in" brokers and "smoke merchants" (In Spanish *Vende humo*, meaning someone that pretends to be what he is not or to have what he does not). A plugged in broker is sufficiently well-connected to politicians in office and therefore has access to enough resources to fulfill generous promises. A "smoke merchant" is a broker who lacks connections and, as a consequence, ends up giving meager rewards. Voters prefer to deal with the plugged in broker rather than with the smoke merchant, because, as shown by the model, the better the brokers' access to resources the bigger the benefit for voters. Let's illustrate this with an example using the technicalities of the model.

Suppose that a voter faces the option of dealing with a plugged in broker or with a smoke merchant. I denote the plugged in broker by $\bar{\alpha}$ and the smoke merchant by $\underline{\alpha}$. Since the plugged in broker has more access to resources than the smoke merchant, it can be established that $\bar{\alpha} > \underline{\alpha}$. Because the utility of the voter (U_v) is increasing in α (as was previously shown), the voter derives more utility from choosing to deal with the plugged in broker than with the smoke merchant; $U_v(\bar{\alpha}) > U_v(\underline{\alpha})$. Voters prefer to deal with plugged in brokers because they can expect more generous rewards from them. If voters know that brokers from a "pool A" have more access to resources than brokers from a "pool B", they will prefer to deal with brokers in the former pool to those in the latter. This explains why voters prefer brokers that work for an incumbent candidate; these brokers belong to a pool with more access to resources. Therefore, it is difficult for brokers from challenger parties to defy brokers from incumbent clientelistic parties. In fact, after dealing with plugged in brokers, clients stick to them. One slum dweller exemplifies this dynamic in saying that "every election new guys appear making promises; I remain loyal to Juan [his broker]. The new guys disappear after the election and I could end up with nothing. I prefer a bird in my hand than a

thousand flying in the sky". They do not see brokers as perfect substitutes, and consequently they develop long-term strategic loyalty with brokers skilled at accessing resources. Confirming this from the broker's perspective, one Peronist broker commented, "People know that I am not one of those smoke sellers that never solve problems for them. I have been here helping them for years. That is why they are always with me."

The dynamics described above may help to account for party machines' electoral hegemony. In Argentina these dynamics benefit PJ brokers as they have controlled, since re-democratization in 1983, most of the executive positions which give access to state resources. People know that PJ brokers have better access to resources than other parties' brokers. This phenomenon is manifested very clearly in the rustbelt outside the city of Buenos Aires; between 1983 and 2011, Peronists have won 84% of mayoral elections in this area (207 out of 247) and today govern 30 of its 33 municipalities.

Conclusion

Available evidence on clientelism and brokerage shows that clients care about who their brokers are and develop long-lasting relationships with them. The model in this article explains why this is the case; clients are better off working with brokers with access to sizeable resources and consequently support these brokers with their votes. Furthermore, this model provides a theory of the determinants of brokers' transfers to voters, and it offers some insights into why brokers from incumbent clientelistic parties are hard to challenge. Although my analysis focuses exclusively on the case of Argentina, the dynamics of the client-broker relationship that I have explained will

apply in other countries as well. For future research, a comparative analysis collecting data across countries will be a major contribution to the existent literature.

Because the central aim of this model was to capture the relevance of brokers' access to resources, I was able to make a simplifying assumption that all subsequent brokers entering the game would have the same skill for accessing resources as the first. A follow up model that allows for different types of brokers and that captures the dynamic of building reputation and exploiting it by brokers would be another major contribution. As brokers vary in their skills to access resources and voters prefer those that access more resources, brokers try to develop a reputation among their clients for delivering to them. Voters' preferences for brokers with good reputations can account also for why in many countries only one party can benefit from clientelism, as has been the case for the Peronist Party in Argentina. Reputation building influences clients to prefer brokers who are known for delivering over newcomer. Given the same offer, a poor voter will go with the broker with a reputation for delivering, thus requiring new brokers to offer greater transfers than established brokers in order to purchase the same vote. This dynamic opens up an interesting avenue for research that may deepen our understanding of the mechanisms that sustain the electoral hegemony of party machines around the world.

Appendix

Strategies

A behavioral strategy for B specifies his offer $z_t \in [0, \pi_t]$ to the voter at each period as a function of the history preceding that period, and whether he received $\bar{\pi}$ or $\underline{\pi}$. In other words, a behavioral strategy for B is a set of offers z_t for all possible information sets defined by the previous history of offers and replies h_{t-1} and by the size of the pie available at time t , $\pi_t \in \{\underline{\pi}, \bar{\pi}\}$. The previous history

is given by all the actions the players have taken in previous rounds; it is the list of offers the broker (s) made from round 0 through round $t - 1$: $\{z_j\}_{j=0}^{j=t-1}$, and all the replies the voter provided to these offers $C_j \in \{0,1\}_{j=0}^{j=t-1}$ where 0 is reject and 1 is accept. Any particular

history before time t is then given by $h_{t-1} = \{(z_j, C_j)\}_{j=0}^{j=t-1}$, where I express for each round first the brokers' offer and then the voter's reply, and where the subscript indicates the round in

which they are playing. I denote H_{t-1} as the set of all possible histories h_{t-1} . The set of strategies for

B for any time t is then given by $\{z_t\}_{t=0}^{\infty} : H_{t-1} \times \pi_t \rightarrow [0, \pi_t]$

A behavioral strategy for the voter has to specify the voter's reply to each possible offer she could receive from B in any round, given her type and previous history. The voter's strategy is a sequence of acceptance functions that specify the probability $K_t(z | h_{t-1}) \in [0,1]$ that she will accept an offer z at any information set. Where, for example, $K_t(z | h_{t-1}) = 1$ means the voter accepts B 's offer for sure, $K_t(z | h_{t-1}) = 0.5$ means the voter accepts with 50 percent probability, and $K_t(z | h_{t-1}) = 0$ means the voter rejects for sure. Therefore, a strategy for the voter is a mapping to an acceptance probability from all possible information sets defined by her type, previous history h_{t-1} ,

and given the offer she receives from B at time t ; $z_t \in [0, \pi_t]$. A sequence of behavioral strategies for the voter at each time can thus be formally expressed as $\{K_t\}_{t=0}^{\infty}: \varepsilon_t \times H_{t-1} \times z_t \rightarrow [0, 1]$

Equilibrium

Lemma 1. Only the negative solution (that I denote by \tilde{z}) to square root that solves for z is feasible.

Proof. Two roots solver for z (Equation 2)

$$z = r - u + \frac{2u}{\alpha\delta} \pm \frac{1}{\alpha\delta} \sqrt{2u} \sqrt{\frac{1}{u} (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)}$$

Note that since $\alpha\delta < 1$, then $((2u) / (\alpha\delta)) > 2u$. Therefore, the solution taking the positive root is greater than $r + u$. Since B would never make an offer greater than what is required to buy the highest voter type ($r + u$), the positive root is out of the feasible offers. However, this positive root could possibly determine a corner solution at $r + u$. This is not the case because the asymptote, determined by the denominator of the expression that defines $P_b(z)$ is at $z = r - u + 2u / \alpha\delta$ (see in Equation 2 if $z^* = r - u + 2u / \alpha\delta$ then denominator is equal to 0), this is at a larger value of the horizontal axis than $r + u$ and at a smaller value than the positive solution to the square root. This establishes that the entire side of the equation at the right side of the asymptote does not cross the point $r + u$; it is entirely to the right of it, and, therefore, a solution at the positive root is out of the feasible values and cannot indicate a corner solution.

Lemma 2. The negative solution to the square root (denoted by \tilde{z}) is a maximum.

Proof. The SOC of $P_b(z)$ with respect to z is given by

$$\frac{\partial^2 P_b(z)}{\partial^2 z} = \frac{4u \left(\alpha^2 \delta^2 (\bar{\pi} - \underline{\pi}) - 2u + \alpha \delta (\delta \underline{\pi} - r + u) \right)}{(2u + \alpha \delta (r - u - z))^3}$$

The numerator is negative. The factor multiplying 4u in the numerator is the negative of the discriminant above. Since the discriminant must be positive, its opposite must be negative. The denominator is positive for \tilde{z} . Hence, the second derivative of $P_b(z)$ with respect to z is negative at \tilde{z} and \tilde{z} is a maximum.

Proposition 1. Upon receiving $\bar{\pi}$, B 's optimal offer to the voter is unique.

Proof. $P_b(z)$, as defined by Equation 2. Is the broker's payoff when he is deciding what to offer given that he received the big pie $\bar{\pi}$. B wants to maximize $P_b(z)$ with respect to his offer z . The partial derivative of $P_b(z)$ with respect to z is:

$$\frac{\partial P_b(z)}{\partial z} = \frac{2u (\delta \underline{\pi} + r - u - 2z) + \alpha \delta (r^2 + 2\bar{\pi}u - 2\underline{\pi}u + u^2 + 2uz + z^2 - 2r(u + z))}{(2u + \alpha \delta (r - u - z))^2}$$

Note that the denominator is always positive. Hence, the sign of the partial derivative of $P_b(z)$ with respect to z is determined by the sign of its numerator. By collecting terms in the numerator we can see that it is quadratic in z with positive sign:

$$\alpha\delta z^2 + z(2\alpha\delta u - 2\alpha\delta r - 4u) + \alpha\delta r^2 + 2\alpha\delta\bar{\pi}u + 2\delta\underline{\pi}u - 2\alpha\delta\underline{\pi}u + 2ru - 2\alpha\delta ru - 2u^2 + \alpha\delta u^2$$

Therefore, the numerator is a convex parabola and has a minimum value. There are three different cases, according to where this minimum is, that need to be considered: (1) If this minimum is positive then the derivative of $P_b(z)$ with respect to z is always positive. This means that $P_b(z)$ is always increasing in z and that it achieves its maximum at the upper bound $r + u$. In this case the solution to the optimal solution is unique and given by the corner solution $z^* = r + u$. (2) If the minimum equals zero, then the quadratic expression of the numerator has only one root. Note that the derivative of $P_b(z)$ with respect to z is zero at that root and that it is positive everywhere else. Because in this case there is only one root, it must be that the discriminant of the quadratic formula is zero. From Equation 4 it is clear then that the optimal occurs at $z^* = r - u + 2u/\alpha\delta$. However, the asymptote determined by the denominator of the expression that defines $P_b(z)$ is exactly zero at $z^* = r - u + 2u/\alpha\delta$ (see that in Equation 2 if $z^* = r - u + 2u/\alpha\delta$ then the denominator is equal to 0), establishing that the derivative of $P_b(z)$ with respect to z is increasing for $z < r - u + 2u/\alpha\delta$, and hence the maximum is again at the corner solution $z^* = r + u$ (3). Finally, I consider the case in which the minimum is below zero and there are two distinct real roots solving for $\partial P_b(z)/\partial z$. these are the two roots given by Equation 2. For the roots to be real and distinct in this case, the discriminant must be positive, so $(\delta^2\delta^2(-\bar{\pi} + \underline{\pi}) + 2u - \alpha\delta(\delta\underline{\pi} - r + u)) > 0$. If $P_b(z)$ is strictly concave it will have a unique maximum. $P_b(z)$ is strictly concave if its second derivative with respect to z is negative. I show next that this is the case. The second derivative of $P_b(z)$ with respect to z is given by $\frac{\partial^2 P_b(z)}{\partial z^2} = \frac{4u(\alpha^2\delta^2(\bar{\pi} - \underline{\pi}) - 2u + \alpha\delta(\delta\underline{\pi} - r + u))}{(2u + \alpha\delta(r - u - z))^3}$. The denominator is positive for any value of z smaller than the asymptote; $z < r - u + 2u/\alpha\delta$. The factor multiplying

$4u$ in the numerator is the negative of the discriminant above. Since the discriminant must be positive, its opposite must be negative. Hence, the second derivative of $P_b(z)$ with respect to z is negative and $z^* = \tilde{z}$. Therefore, when B tries to buy the voter there is a unique optimal offer z^* .

The determinants of the size of the transfers

Proposition 2. The voter's payoff in equilibrium is increasing in α .

Proof. I denote by $U_v(z^*)$ the ex-ante expected equilibrium payoff for the voter (prior to knowing her type), and by $U_v(z^*, \varepsilon)$ the equilibrium payoff for a voter that already knows her type. Note that since brokers are all identical, the voter can expect all the brokers to make the same offer. This means that depending on the size of the pie, the optimal offer is always the same. The ex-post payoff for a voter (upon learning her type ε) is given by

$$U_v(z^*, \varepsilon) = \begin{cases} r + \varepsilon + \delta U_v(z^*, \varepsilon) & \text{if } \varepsilon > z^* - r \\ (1 - \alpha)(r + \varepsilon + \delta U_v(z^*)) + \alpha(z + \delta U_v(z^*), \varepsilon) & \text{if } \varepsilon < z^* - r \end{cases}$$

where the first line captures the payoff for a voter that will reject the offer z^* ; and the second line captures the payoff for a voter that will accept the offer z^* . Note now that the payoff in equilibrium for a voter at the beginning of the game before she knows her reservation value is equal to the expectations of $U_v(z^*, \varepsilon)$ over realizations of ε . Under the assumption of uniformity of ε this is formally: $Uv(z^*) = \int_{-u}^u Uv(z^*, \varepsilon) d \frac{\varepsilon}{2}$. Therefore,

$$U_v(z^*) = \int_{\hat{\varepsilon}}^u r + \varepsilon + \delta U_v(z^*) d \frac{\varepsilon}{2u} \\ + \int_{-u}^{\hat{\varepsilon}} (1 - \alpha)(r + \varepsilon + \delta U_v(z^*)) + \alpha(z^* + \delta U_v(z^*)) d \frac{\varepsilon}{2u}$$

Where the first integral captures the payoffs for types of the voters that will reject the offer z^* , the second integral captures the payoff for types that will accept the offer z^* , and where $\hat{\varepsilon}$ is the indifferent voter to the offer z^* such that $\hat{\varepsilon} = z^* - r$. Solving the integrals and then solving for

$U_v(z^*)$ yields, $U(z^*) = \frac{1}{1-\delta} \left(r + \frac{\alpha(z^* - r + u)^2}{4u} \right)$. So now we want to prove that this payoff $U_v(z^*)$

is increasing in α . Because $\frac{dU_v(z^*)}{d\alpha} = \frac{\partial U_v(z^*)}{\partial z^*} \frac{\partial z^*}{\partial \alpha} + \frac{\partial U_v(z^*)}{\partial \alpha}$, it suffices to prove that $\frac{\partial U_v(z^*)}{\partial z^*} \frac{\partial z^*}{\partial \alpha} +$

$\frac{\partial U_v(z^*)}{\partial \alpha} > 0$, where

$$z^* = \frac{1}{\alpha\delta} \left(2u + r\alpha\delta - u\alpha\delta - \sqrt{2u} \sqrt{\frac{1}{u} (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)} \right)$$

The partial derivative of $U_v(z^*)$ with respect to z^* is equal to $\alpha(z^* - r + u) / 2u(1 - \delta)^4$. Since the solution is interior it must be that $z^* \geq r - u$, thus $\partial U_v(z^*) / \partial z^* > 0$. I prove next that the partial derivative of z^* with respect to α is given by

$$\frac{\partial z^*}{\partial \alpha} = \frac{(4\sqrt{2u} - \sqrt{2}\alpha\delta(\delta\underline{\pi} - r + u) - 4\sqrt{u}(2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2))}{2\alpha^2 d \sqrt{u(2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)}}$$

⁴ Note that since the offer z would not increase further if equal to $r + u$, and that the voter rejects the offer if $z < r - u$, I check if the voter's payoff increases with when the optimal offer is interior; that is, when $z = \check{z}$.

Note that the denominator is always positive. Therefore, we need the numerator to be positive too. Note that if the numerator is positive for the highest possible value of the discriminant it will always be positive. If the offer is interior, it has to be that $\tilde{z} > r - u$, which implies – from Equation 4 – that $\left(\sqrt{2} \sqrt{u (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)} \right) / (\alpha\delta) < 2u / (\alpha\delta)$.

If not $\tilde{z} > r - u$. Setting this expression equal to its greatest possible value yields

$$\sqrt{u (2u + r\alpha\delta - \underline{\pi}\alpha\delta^2 + \underline{\pi}\alpha^2\delta^2 - u\alpha\delta - \bar{\pi}\alpha^2\delta^2)} = \sqrt{2}u.$$

Note now that by replacing the root in the numerator with $\sqrt{2}u$ we get $u (4\sqrt{2}u - \sqrt{2}\alpha\delta (\delta\underline{\pi} - r + u) - 4\sqrt{2}u)$, which simplifies to: $-u\sqrt{2}\alpha\delta (\delta\underline{\pi} - r + u)$. Since $\delta\underline{\pi} < r - u$, then $\delta\underline{\pi} - r + u < 0$. Therefore, $-u\sqrt{2}\alpha\delta (\delta\underline{\pi} - r + u)$ is always positive, which means that the numerator is positive and that $\partial z^* / \partial \alpha > 0$. Finally, the partial derivative of $U_v(z^*)$ with respect to α is equal to $(z - r + u)^2 / (4u(1 - \delta))$, which is positive. Therefore, $\partial U_v(z^*) / \partial z^* \geq 0$; $\partial z^* / \partial \alpha > 0$ and $\partial U_v(z^*) / \partial \alpha > 0$ implies that, $dU_v(z^*) / d\alpha > 0$

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