Clientelism, Income Inequality, and Social Preferences: an Evolutionary Approach to Poverty Traps*

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Abstract

Political clientelism is a dyadic relation in which a politician (the patron) gives material goods and services to a citizen (the client), in exchange for political support. We argue that there is a two-way relation between clientelism and income inequality and poverty. In a poor society in which income inequality is high, clientelism will be a natural outcome. Once clientelism is established, it is harder for democracy to redistribute income and it is easier for the society to be caught in a poverty trap. We develop a two-part game-theoretic model. In the first part, clientelism emerges in a poor and unequal society as a consequence of social preferences, in particular, strong reciprocity. In the second part, using evolutionary and stochastic game theory, we show that clientelism causes income inequality and poverty.

1 Introduction

July of 2007 was the month in which the Colombian government reported that in the past weeks, in 16 states of the country, the *Sisben*, the system used for allocating welfare state expenses, was manipulated by politicians for electoral purposes. This system classifies people according to their income and socio-economic status, and offers benefits, subsidies, and services according to this classification. It can be inferred from this report that the system is an important instrument used by politicians for the establishment of clientelistic links: citizens who give political support and votes to certain candidates that may influence the assignment of subsidies, may benefit from the system. The problem is that some medium-income people are classified as belonging to the first tier of the system, which implies the biggest flow of benefits. In contrast, some low-income citizens are erroneously classified as those not deserving subsidies. This shows that clientelism may become an important obstacle for

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redistributive programs, and, as we will show in this article, may perpetuate income inequality and poverty.

During the 1950's, the time in which *La Violencia* (The Violence) consumed the lives of thousands of Colombians whofought against each other for political reasons, the former peasant Dumar Aljure became the leader of a guerrilla army *Fuerzas Armadas Revolucionarias de Colombia* (FARC).[1] Maullin (1968) and the Rand Corporation document how during a period of several years Aljure established a relation with the liberal senator Hernando Duran, in which the senator, using his influence in the central government at Bogota, secured Aljure's group from being persecuted by Colombian militaries. Apparently, this protection was reciprocated by Aljure with votes and political support by people under his influence. Closing the network, in exchange for their votes, citizens received from Aljure security and guarantees against political persecution that during the 1950's was at its most severe. In 1968 Duran was defeated in the elections, and months later, the Army killed Aljure. The clientelistic link broke up.

Another example illustrates how a whole century of Colombian political history was permeated by clientelism. The 1904 presidential election was won by general Rafael Reyes. For some scholars [Maitre (1964) and Schmidt (1974)] this victory was guaranteed by an important regional leader, *gamonal*[2] Juanito Iguarán [Schmidt (1974), p.9]. The *gamonal* acted as a broker between the national-level politician, and the rural habitants. Naturally, these links permitted the exchange of votes and political support for material goods and services. But clientelism is not an exclusive Colombian phenomenon. Important studies characterize clientelism in southeast Asia [Scott (1972)], tropical Africa [Lemarchand (1972)], Southern Italy [Golden and Picci (2005)], Japan [Kobayashi (2006)], Mexico [Greene (2001)], Argentina [Weitz-Shapiro (2007)], and several other countries and regions. How could we define clientelism? Is clientelism exclusive of twentieth-century democracy or is it found in other political regimes along human history?

Clientelism is a *dyadic* (two-person) relation in which a *patron* gives material goods, services, benefits, or protection to a *client*, who reciprocates with some type of general, political, or military support and assistance. *Political clientelism* is a special case of what we could term *general clientelism.* Political clientelism is characterized by a politician who acts as the patron, offering goods, services, jobs, resources, protection, etc., to a voter, in exchange for political support, which in most cases, includes the vote. The conjunction of several dyads and relations forms a *clientelistic network*, as those described in the examples given above. Nation-level leaders are linked with regional, rural and urban brokers, who establish relations with voters.

Even though clientelism may appear in a developed country, it is frequently associated with poverty, income inequality and underdevelopment. Some questions arise after recognizing this fact: what causes clientelism? What are the consequences of

[1]It is not clear if nowadays FARC, the biggest guerrilla in Colombia, evolved form this group commanded by Aljure.

[2]The term *gamonal* refers to regional political leaders, whose position in society gives them influence upon rural voters.

clientelism? In this article we show how there's a two-way relation between clientelism and inequality and poverty. First, a poor society, in which income inequality is high, constitutes a natural environment for clientelism to emerge. Politicians will find it easier to establish patron-client relations when citizens lack of several material goods and services because of poverty. And second, if the political system becomes clientelistic, it's harder for democracy to work and it's easier for the economy to fall into a poverty trap.

This paper is divided into six sections, including this introduction. In section 2 we briefly introduce the first part of our model, explaining why social preferences theory is an interesting framework for studying clientelism. Section 3 relates income and poverty with clientelism. Using behavioral game theory, we show how this relation is mediated by strong reciprocity. Section 4 shows what the impact of clientelism is on the evolution of income inequality. As clientelism grows, it is more probable that non-egalitarian contracts regulate the division of surplus within a society. In section 5 we consider agents with bounded rationality, who learn and adapt their behavior over time, and who are exposed to stochastic shocks that may dislodge the incumbent political regime. Clientelism make non-egalitarian contracts both more persistent and accessible. Section 6 concludes the article.

2 Social Preferences and Clientelism: the role of Reciprocity

Two waves of study characterize academic work on clientelism [Stokes (2007)]. The first wave, inspired in anthropology and sociology, puts emphasis on moral sentiments different from self-interest as the basic explanation of clientelism.[3] For the second wave, mainly inspired by economics, agents respond to self interest when engaging in a clientelistic relation. In this article, we try to reconcile both approaches. For this purpose behavioral and evolutionary game theory constitute a rigorous and tractable framework.

For sociologist Gouldner (1960), "a norm of reciprocity, in it's universal form, makes two interrelated, minimal demands: (1) people should help those who have helped them, and (2) people should not injure those who have helped them." From this perspective, reciprocity is a universal norm, that structures social interaction. Many situations are better understood under the scope of reciprocity. In fact, he adds, "[g]iven significant power differences, egoistic motivations may seek to get benefits without returning them. [...] The norm of reciprocity, however, engenders motives for returning benefits even when power differences might invite exploitation". Perhaps, what Gouldner misses, is that reciprocity may engender exploitation that otherwise would not be engendered, as we show in the case of clientelism.

Adam Smith's *Wealth of the Nations* shows how self-interest might be the most important sentiment when analyzing people's behavior within market scenarios. Later, neoclassical economics based its analysis on the same tenet. For example, for

[3] See for example Lemarchand (1972) or Scott (1972).

Edgeworth (1881) "The first principle of economics is that every agent is actuated only by self-interest". But Smith's *Theory of Moral Sentiments* shows that human behavior is not only restricted to self-interest, and that other sentiments condition behavior in several non-market settings. In short, we will call *self-regarding preferences* situations in which an individual's satisfaction depends uniquely on his own material payoffs. In contrast, an agent exhibits *other-regarding* or *social preferences*, when his satisfaction not only depends on his payoffs, but also on the material revenues received by other players. Moral sentiments such as love, hate, envy, inequality aversion, reciprocity, shame, guilt or parochialism, explain social preferences.

The ultimatum game has become the recurrent example of how social preferences affect outcomes in non-market situations. In this two-player game, player 1 must decide how to split x dollars with player 2. He offers an amount $s \in [0, x]$ to the other player. If player 2 accepts, the money is split according to the offer, so that player 2 gets s while player 1 keeps $x - s$. But if player 2 rejects the offer, zero is the payoff for both players. Classical game theory, in which it is assumed that players exhibit self-regarding preferences, predicts that player 2 will accept any positive offer. Anticipating this behavior, player 1 offers the minimum amount possible. But experiments conducted all around the world, in a great variety of contexts and cultures, contradict this prediction.[4] In general, player 2 rejects low offers (below 30% of the pie). Strong reciprocity seems to explain this behavior. An individual exhibits strong reciprocity when he responds kindly to a kind action (even when there is an incentive to deviate), and unkindly to those who act rudely (even when punishment is costly and brings no material benefits). In the ultimatum game, a low offer is judged as an unkind action by player 2, so he rejects the offer, preferring zero to a positive payoff. Rejection is the mechanism for punishing the unkind action of player 1.

But why is reciprocity important when analyzing political clientelism? In his analysis of African integration and the relation between clientelism and ethnicity, Lemarchand (1972) states that "clientelism [...] extends these perceptions (mutual interest and cultural affinities) beyond the realm of primordial loyalties and establishes vertical links of reciprocity between ethnically or socially discrete entities". For Scott (1972)

> "The patron-client relationship, [...] may be defined as a special kind dyadic (two-person) ties involving a largely instrumental friendship in which an individual of higher socioeconomic status (patron) uses his own influence and resources to provide protection or benefits, or both, for a person of lower status (client) who, for his part, reciprocates by offering general support and assistance, including personal services, to the patron".

This is a general definition of clientelism, for which political clientelism is a special case. The important issue is that reciprocity links the unequal relation between

[4] See Gintis, Bowles, Boyd, and Fehr (2006), Henrich, Boyd, Bowles, Camerer, Fehr, and Gintis (2004), Bowles (2003), Gintis (2000), or Roth, Prasnikar, Okuno-Fujiwara, and Zamir (1991).

the patron and the client. When the politician gives protection or material benefits to the citizen, the latter can deviate from cooperation and abstain or give his political support to other candidate. Why does he behaves kindly with the clientelistic candidate? Reciprocity is an explanation. Self-interest could be another one. Afraid of loosing future benefits or of being punished, the client prefers to reciprocate the patron with his support. But both explanations, reciprocity and self-interest, are compatible with one another. In fact, Scott adds that "[a]lthough the balance of benefits may heavily favor the patron, some reciprocity is involved and it is this quality which [...] distinguishes patron-client dyads from relationships of pure coercion or formal authority that also may link individuals of different status." Then, political clientelism may emerge even in situations in which the candidate does not hold coercive mechanisms or credible threats of punishment against the citizen, as a consequence of reciprocity.

3 Poverty and Inequality Stimulate Clientelism

Consider a society in which different groups (classes) interact in an economic and political environment during several time periods. In this society, democracy is used for selecting governors and policymakers. This means that elections are held for deciding who forms the government. Economic relations are regulated by contracts, which determine how the surplus of economic activities is divided between its participants.

In a society with these characteristics social interactions may adopt various forms. We will consider two instances in our model. First, we will analyze the interaction between a politician and a citizen, in which the first is seeking political support (which includes votes), and the second needs public and private goods. Second, we will analyze the interaction between members of different groups when deciding how to divide production surplus. We assume that each group is interested in obtaining the largest part of the pie.

We consider a model of clientelism in which a candidate interacts with a citizen in a two-period sequential game. The politician is always tempted to use other means, besides ideology, to obtain votes. The provision of material goods or services, which in short we will call "gifts", is a feasible strategy for convincing a citizen and winning his support. We will consider the case of a politician who is not the favorite candidate of the voter. The voter prefers some other candidate whose proposals are closer to the citizen's preferences in the ideological spectrum.[5]

In the first stage of the game, the candidate decides whether to give a gift to the citizen. The citizen then decides whether or not to give political support to this candidate. Political support may take the simple form of a vote, or can include more complex features. Let V, $V > 0$, be the payoff for the politician when he

[5] In fact, this is the interesting case. If we consider the situation in which a person votes for a candidate who gives him a gift but is also his favorite candidate, it will be hard to establish the pervasive consequences of clientelism. It is more interesting to analyze a case in which a voter sacrifices his ideology because a candidate offers short-term material benefits.

receives political support from the citizen. In our case, V is the "value" of the vote for the candidate. The cost of giving a gift to the voter is $G_p > 0$, which may be a monetary or a psychological cost. Furthermore, let w be the citizen's wage (or income) and let's define a pair of functions $D(w)$ and $C(w)$, which represent the benefit for the citizen when voting for his favorite candidate and for the clientelistic politician, respectively. We assume that

$$D'(\cdot) > 0; \quad C'(\cdot) < 0 \tag{1}$$

and,

$$D(w) \geq C(w) \tag{2}$$

for every level of income $w > 0$. Here, (1) shows that income affects political preferences. Higher incomes imply more political participation. We model this by assuming that as income increases, the difference $D(w) - C(w)$ grows. The "ideological cost" of not voting for the favorite candidate is higher for more affluent voters. Meanwhile, (2) reflects the fact that the benefit of voting for the favorite candidate is at least as large as voting for the clientelistic politician. Finally, $G_c > 0$ is the benefit for the citizen when he receives a gift. Figure 1 shows the extensive form representation of the clientelism game. In the first stage, the politician (p) gives (g) or not ($\sim g$) the gift. In the second stage, the citizen (c) votes (v) or not ($\sim v$) for this candidate.

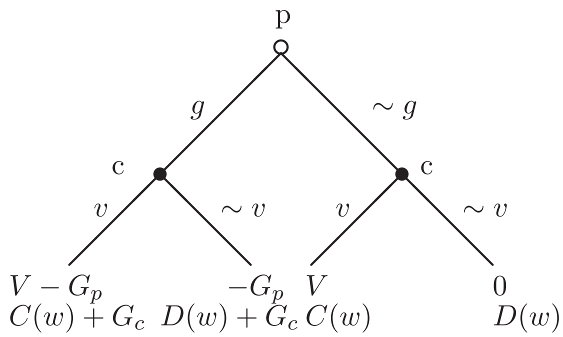

Figure 1: Clientelism Game

With these payoffs, it is straightforward to verify that not voting is a dominant strategy for the citizen. If the politician anticipates this, his best response is to not give the gift. Consequently, in the clientelism game with self-regarding preferences (i.e. where a player's satisfaction only depends on his own payoffs), in the subgame perfect Nash equilibrium there is no clientelism. But evidence and intuition contradict this conclusion. Something is missing in the argument.

In many bilateral interactions that are not regulated by contracts, self-regarding preferences are not the best description of moral sentiments, as we discussed in the preceding section From now on we will assume that the citizen exhibits social preferences. This means that his satisfaction not only depends on his own payoffs, but also on the payoffs of the other player (i.e. the candidate). In this clientelistic relationship, strong reciprocity seems to be fundamental. Following Falk and Fischbacher (2006) and Gallego (2007) we define the citizen's preferences as

$$u_2 = \Pi_2 + \rho_2 \varphi_1 \sigma_2$$

where u_2 is the citizen's satisfaction, Π_2 is his material payoff, ρ_2 measures the intensity of reciprocal preferences, φ_1 represents the kindness or unkindness perceived in the candidate's action, and σ_2 is the utility derived from the reciprocal act chosen by the voter. Let's explain in detail this representation of *Homo Reciprocans*.

In this representation of reciprocal preferences, the parameter $\rho_2 \geq 0$ represents the importance of reciprocity for the citizen. When $\rho_2 = 0$ preferences are totally self-regarding. As ρ_2 increases, the intensity of reciprocity grows for this voter. The candidate's actions, and his own reactions, become more important.

The kindness term, φ_1, is an indicator of whether the action chosen by the politician is judged as kind or unkind by the citizen. If s_1 is the action of the candidate,

$$\varphi_1(s_1) = \begin{cases} 1 & \text{if } s_1 = g \\ -1 & \text{if } s_1 =\sim g \end{cases}$$

Thus, the value of φ_1 is positive if the action is kind, and negative if it's judged as unkind. Now we will define the utility of the reciprocal act, σ_2. If s_2 is the action chosen by the citizen, the utility of this reciprocal act is given by

$$\sigma_2(s_2) = \begin{cases} \Pi_1(s_1, v) - \Pi_1(s_1, \sim v) & \text{if } s_2 = v \\ \Pi_1(s_1, \sim v) - \Pi_1(s_1, v) & \text{if } s_2 =\sim v \end{cases}$$

The intuition behind this definition is straightforward. The utility of the reciprocal act committed by the citizen is represented by how the payoff of the candidate changes because of this act. When the citizen reciprocates in a kind way, he votes for the politician, and his reciprocal satisfaction will be the difference between the candidate's material payoff when he receives the vote and when he doesn't receive it. Then, when the voter reciprocates kindly, the value of σ_2 is positive. When he responds unkindly, σ_2 is negative because the utility of the reciprocal act is the difference between the politician's payoff when he doesn't receive the vote and when he receives it.

Now we can make the distinction between the *material* payoffs of the game, as represented in Figure 1, and satisfaction payoffs, which include the citizen's moral sentiments (reciprocity). When the voter receives a gift and votes for the candidate, his utility is

$$u_2(g, v) = C(w) + G_c + \rho_2 V \tag{3}$$

When he receives the gift but doesn't vote for the clientelistic candidate, his utility is

$$u_2(g, \sim v) = D(w) + G_c - \rho_2 V \tag{4}$$

When the citizen votes for the candidate even though no gift was given, his utility is

$$u_2(\sim g, v) = C(w) - \rho_2 V. \tag{5}$$

Finally, when there's no gift and no vote, the utility for the citizen is

$$u_2(\sim g, \sim v) = D(w) + \rho_2 V. \tag{6}$$

In this model we assume that the politician's preferences are self-regarding when engaged in a clientelistic relationship. Then, his satisfaction payoffs are equal to his material payoffs. Considering this fact and using conditions (3), (4), (5), and (6), we are now able to represent the clientelism game with social preferences (Figure 2).

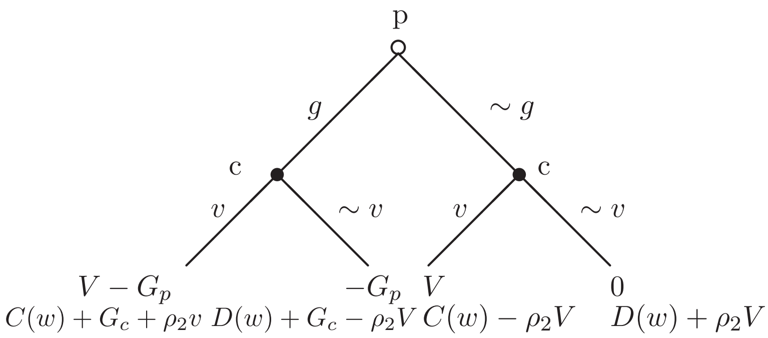

Figure 2: Clientelism Game With Reciprocal Preferences

Using backward induction we can solve for the reciprocal equilibrium (subgame perfect Nash equilibrium with reciprocal preferences[6]). When the candidate doesn't give a gift, it is always better for the citizen not to vote for him. The citizen will abstain or vote for his ideologically favorite candidate. Obviously, an interesting case arises when the politician offers a gift. In this case, for the citizen it is better to reciprocate by voting if

$$C(w) + G_c + \rho_2 V > D(w) + G_c - \rho_2 V$$

which turns into

[6]See Gallego (2007).

$$\rho_2 > \frac{D(w) - C(w)}{2V} \tag{7}$$

A careful analysis of condition (7) can help us understand some of the basic issues concerning clientelism. First, a dyadic relation such as clientelism, in which the patron offers materials goods and/or services to his client, while the latter gives, in exchange, political support (including the vote), is better understood as a consequence of strong reciprocity, rather than self-regarding preferences. After receiving a gift, the voter may be tempted to betray his patron by voting for his favorite candidate. But some material sentiment deters this attitude, and certainly we conclude it is reciprocity.

Some conditions make clientelism the most probable outcome. Condition (7) means that the intensity of reciprocal preferences should be greater than certain threshold so that the citizen prefers supporting the clientelistic candidate. This threshold is $\mu^* = \frac{D(w)-C(w)}{2V}$. When μ^* is small enough, it is easier for clientelism to emerge as an equilibrium in this game. But μ^* decreases if V increases or if the difference $D(w) - C(w)$ decreases. This last point is important. If ideological concerns are less important for the citizen, the expression $D(w) - C(w)$ gets smaller. But remember that both terms, which represent the benefits from voting for the preferred candidate or for the clientelistic candidate, depend on the citizen's level of income w. Besides, $D'(w) > 0$ while $C'(w) < 0$, because as income increases, political concerns grow and ideology becomes more important for the citizen, so it is better for him to vote for his preferred candidate than to support someone that is further from his ideal point on the ideological spectrum.

In sum, when incomes are low, ideological concerns are less important, so the threshold for clientelism to emerge reduces. Clientelism would be the result of a society with high levels of poverty and income inequality, in which a large part of its habitants live in poor conditions and whose incomes are not enough for satisfying basic needs. This simple model supports the first line of causality between clientelism and income inequality and poverty. Clientelism is more likely to emerge in a poor society with high income inequality, because in this context it is easier for the politician to establish a patron-client relationship.

From (7) it is also clear that as V grows, μ^* decreases, so that it is easier for clientelism to appear. But remember that V is the benefit for the politician of receiving *that* vote. This means that if office holding is highly valued, clientelism is a good mechanism for winning votes. Also, we expect that when elections are more competitive, or perhaps more tied, clientelism will be a useful strategy for politicians.

There's another interesting interpretation of this result. V is the value of that vote for the candidate. As V increases, the incentive of capturing that vote also grows, so clientelism might be a efficient strategy. Within a clientelistic network, politicians select carefully who their clients are. Perhaps, a citizen capable of convincing many others is better than an isolated person. Regional and local leaders serve as excellent brokers whose political support can represent lots of votes.

4 Clientelism Stimulates Income Inequality

In this section we consider the second part of the model. Economic activity is a consequence of cooperation between members of different groups or, what we will call, social classes. The benefit or surplus generated by economic activity must be divided between members of these groups. For example, landowners and sharecroppers have to decide how to split the benefit of agricultural activities, while capital owners and workers must decide how they divide a firm's revenues. We are interested in understanding the political-economic forces behind the struggle for these benefits, because its division determines directly how income is distributed within a society. Institutional arrangements determine how surplus is divided, and in many modern economic relations, contracts specify in detail how this process materializes. Contracts and institutions may be formal or informal. A formal contract specifies in detail the aspects that regulate a relationship, within a legal document. Informal contracts include habits and customs that determine people's behavior.

To model the distribution of income within a society, consider a group of people divided into two subgroups. Each subgroup is a social class such as tenants and landlords, or workers and capitalists. We will call the classes C and W, and we assume the number of members in each class is large. Each time period a member of each population is randomly paired to interact in a stage game Γ, with a member of the other class. For the sake of simplicity, we will model interactions as a coordination game as shown in Figure 3.

Class C		Class W	
		Contract 0	Contract 1
	Contract 0	π_0, w_0	0, 0
	Contract 1	0, 0	π_1, w_1

Figure 3: Contract game

Class C agents choose rows, while those of class W play columns. Players are randomly paired during $t = 1, 2, \ldots$ time periods, and each time period they must decide what type of contract they accept for dividing the gains of cooperation during the economic activity. Consequently, $\pi_k + w_k$ represents the total surplus to be divided, when contract k is selected, between the capitalist and the worker, or the landowner and the sharecropper. From the payoff matrix we can conclude that when players do not agree upon the same contract, their payoff is zero as no economic activity takes place if there is no previous agreement upon how the surplus is divided between participants. When there is an agreement, and both players coordinate on the same contract, each one gains a positive payoff. The following relation between payoffs is an important assumption of the model:

$$\pi_0 > \pi_1 = w_1 > w_0 \tag{8}$$

This contract game has two strict pure strategy Nash equilibria: Both players choosing contract 0, or both selecting contract 1. This is the key issue of contracts. Players adopt the same action they expect other players will adopt. Condition (8) characterize these contract conventions. Contract 1 is an egalitarian institution, in which income is distributed equally among players, while contract 0 is a non-egalitarian one, favoring members of Class C (landowners or capitalists, for example). If income distribution is a consequence of repeated interactions among members of social classes, with power and collective action as the forces behind the struggle, what type of contracts will be selected by evolutionary forces? In game-theoretic terms, which equilibrium will be selected in the medium and the long run?

The strategy sets for populations C and W are the same, and we call them $S_C = S_W = \{0, 1\}$, where 0 stands for contract 0, while 1 stands for contract 1. We will assume that players are "programmed" to follow some strategy $s \in S_i$, for $i = C, W$. In short, we say that a player is of "type s" when he is programmed to choose contract s. Consequently, members of each population are of type 0 or of type 1, and it is of our interest to understand what forces determine the evolution in the proportion of agents accepting or rejecting one contract or the other.

Let $x \in [0, 1]$ be the proportion of class C members of type 0. Then $1 - x$ is the proportion of type 1 agents in population C. In a similar way, y is the proportion of type 0 agents in class W, while $1-y$ is the proportion of players programmed to play contract 1 in this population. The expected payoff for a C-class player programmed to follow contract 0, given the frequency distribution $(y, 1-y)$ in class W, is $u_C(0, y)$, while $u_C(1, y)$ is the equivalent payoff for a type 1. Similarly, $u_W(x, 0)$ and $u_W(x, 1)$ are the expected payoffs, respectively, for types 0 and 1 within population W, when $(x, 1 - x)$ is the frequency distribution of types in population C. Then, the average payoffs in both populations are:

$$\begin{aligned} \bar{u}_C(x, y) =& x u_C(0, y) + (1 - x) u_C(1, y), \quad \text{and} \\ \bar{u}_W(x, y) =& y u_W(x, 0) + (1 - y) u_W(x, 1). \end{aligned}$$

We will use the replicator dynamics proposed originally by Taylor and Jonker (1978) to analyze the long run evolution [Gale, Binmore, and Samuleson (1995)] of the proportion of players following each strategy. This approach could be questioned because in the replicator dynamics it is assumed that players are programmed to follow some strategy. Perhaps, this makes sense in biological models, where the genotype of an organism determines traits and physical characteristics that cannot be modified. But in social systems, agents learn and adapt their behavior, so that a programmed player might not be the most accurate description in these settings. However, several works show how certain learning dynamics converge towards the replicator dynamics [Binmore and Samuelson (1997), Borgers and Sarin (1997), Cabrales (2000)]. In fact, for the results of this paper, we only need payoff monotonic dynamics, in which the growth rates of players following each strategy are strictly monotonic in their expected payoffs [Young (1998)].

Given these considerations, we can describe the dynamics of the system. If $\dot{x} = \frac{\partial x}{\partial t}$ and $\dot{y} = \frac{\partial y}{\partial t}$ express how the proportions of type 0 agents in each population evolve over time, the replicator equations are

$$\begin{aligned}\dot{x} =& x[u_C(0, y) - \bar{u}_C(x, y)], \qquad \text{and} \\ \dot{y} =& y[u_W(x, 0) - \bar{u}_W(x, y)].\end{aligned}$$

Then, it is clear that the proportion of agents of each population following contract 0 increases when their expected payoff is greater than the average payoff, and vice versa. This is why the replicator dynamics are a Darwinian-Malthusian description of a dynamical system. The "fittest" strategies survive, while weak strategies become extinct over time. Will non-egalitarian contracts prevail or will evolution transform society into a more egalitarian one? Before answering this important question, we must consider a key characteristic of human beings, inequality aversion.

A stylized fact recognized in several experiments is that people dislike unequal situations. Most human beings feel uncomfortable when they are below other people. In fact, evidence suggests that some people prefer not to have more than others. Inequality aversion is another variant of social preferences, because in this case people's satisfaction depend not only on their absolute payoffs, but also on their relative gains or losses. How could we model this type of preferences? First, we must make a distinction between *material* payoffs and *satisfaction*. Following Fehr and Schmidt (1999), preferences of a *Homo Equalis* (i.e. a player with inequality aversion) are given by

$$u_i(\Pi_i, \Pi_j) = \Pi_i - \alpha_i \max\{\Pi_j - \Pi_i, 0\} - \beta_i \max\{\Pi_i - \Pi_j, 0\} \tag{9}$$

where u_i is player i's satisfaction, Π_i is the material payoff for player i, $\alpha_i \geq 0$ measures the disutility provoked by disadvantageous inequality, and $\beta_i \geq 0$ measures how much dissatisfaction provokes advantageous inequality. For an agent with these preferences, final satisfaction not only depend on his own payoffs, but also on relative payoffs. Inequality reduces his utility, both if he is on top or below the other player. It's natural to assume that $\alpha_i \geq \beta_i$: for player i, a disadvantageous situation is worst than an advantageous one. Also, $\beta_i \leq 1$, otherwise, player i would punish himself at any advantageous situation, something that seems to make no sense for most human beings.

In this fashion, in our model we assume that players experiment inequality aversion, as the following assumption states.

Assumption 1.
Members of populations C and W exhibit inequality aversion, and their preferences

are described by (9). More precisely, the utility of a C-population member is of the form

$$u_C(\pi_k, w_k) = \pi_k - \alpha_C \max\{w_k - \pi_k, 0\} - \beta_C \max\{\pi_k - w_k, 0\} \qquad (10)$$

when contract k, $k = 0, 1$, is chosen. In a similar way, the utility of a W-population member is of the form

$$u_W(\pi_k, w_k) = w_k - \alpha_W \max\{\pi_k - w_k, 0\} - \beta_W \max\{w_k - \pi_k, 0\}. \qquad (11)$$

Then, the payoff matrix in Figure 3 represents material payoffs, but not satisfaction. From (10) and (11), the satisfaction of a C-player who plays contract 0 and is paired with a W-player who chooses the same contract is

$$u_C(0,0) = \pi_0 - \beta_C(\pi_0 - w_0)$$

because $\pi_0 > w_0$. Utility of a C-player decreases in the non-egalitarian contract, as his advantageous inequality aversion grows, because convention 0 favors these players. In this same situation, the payoff for the W-player is

$$u_W(0,0) = w_0 - \alpha_W(\pi_0 - w_0).$$

Contract 0 represents disadvantage for W-players. That's why, in this case, their utility diminishes as inequality $(\pi_0 - w_0)$ and aversion (α_W) grow.

But, what determines disadvantageous inequality aversion for these players? Now, it's time of linking this part of the model with the one developed in the last section. There, we constructed a theory of clientelism, arguing that low wages or incomes make people more vulnerable to gifts and offerings by politicians. Consequently, we assume that W-population members are benefited by gifts when engaged in a clientelistic relation. Evidence suggests that workers or tenants occupy the receiver role in clientelism. The reason is simple: contract 0, the non-egalitarian contract, represents a disadvantage for this class. We infer that clientelistic gifts have at least two effects on low income citizens: first, it stimulates them to vote for certain candidates. And second, as gifts may satisfy several needs, it attenuates inequality aversion. This argument justifies the following assumption:

Assumption 2.
The degree of disadvantageous inequality aversion experimented by W-population citizens depends on the magnitude of the gifts received by clientelistic politicians. This is,[7]

$$\alpha_W = \alpha_W(G_W)$$

Furthermore, higher gifts imply a less disadvantageous inequality aversion, which means that for any pair of gifts of magnitudes G_W and G'_W

[7]Note that we replaced G_c for G_W. This is because above we assumed that W-population members are the ones who receive gifts when a clientelistic relation is established.

$$G_W \geq G'_W \Rightarrow \alpha_W(G_W) \leq \alpha_W(G'_W)$$

In fact, for any $G_W > 0$, $\alpha_W(0) > \alpha_W(G_W)$, which means that the highest level of inequality aversion is felt when there's no clientelism and no gift.

Returning to the coordination game in Figure 3, when both players choose contract 0, this is the only case in which material payoffs differ from satisfaction, because in any other situation the payoffs are the same for both players. In particular, when both players select contract 1, inequality aversion has no consequence because this is an egalitarian contract.

Using these transformed payoffs, and after some simple calculations and a bit of algebra, we can state the replicator equations of our model. The evolution of the proportion of C-players following strategy 0 is given by

$$\dot{x} = x(1-x)\{y[\pi_0 - \beta_C(\pi_0 - w_0)] - (1-y)\pi_1\} \tag{12}$$

while in the case of W-players we have

$$\dot{y} = y(1-y)\{x[w_0 - \alpha_W(\pi_0 - w_0)] - (1-x)w_1\}. \tag{13}$$

The following theorem describes the dynamics of the system composed by equations (12) and (13). In particular, it shows how the proportion of players (workers and capitalists, or land owners and sharecroppers) programmed to propose/accept egalitarian or non-egalitarian contracts, evolves over time. This evolution depends on initial conditions, such as how large inequality is or how strong inequality aversion is for the players.

Theorem 1.
Suppose that (10) and (11) describe the preferences of members of social classes C and W, respectively. Then, for the contract game with material payoffs in Figure 3, whose dynamical system is described by the replicator equations (12) and (13), we have:

1. *Frequency distributions $(0,0)$ and $(1,1)$ are the only asymptotically stable states.*
2. *Frequency distribution (x^*, y^*) is a saddle point, where*

$$x^* = \frac{w_1}{w_0 + w_1 - \alpha_W(\pi_0 - w_0)}, \qquad \textit{and}$$
$$y^* = \frac{\pi_1}{\pi_0 + \pi_1 - \beta_C(\pi_0 - w_0)}.$$

Proof.

From (12), $\dot{x} = 0$ if $x = 0$, $x = 1$, or if

$$y^* = \frac{\pi_1}{\pi_0 + \pi_1 - \beta_C(\pi_0 - w_0)}$$

By assumption, $\beta_C \in [0,1]$. This implies that $y^* \in (0,1)$, as we should expect. On the other hand, from (13), $\dot{y} = 0$ if $y = 0$, $y = 1$, or if

$$x^* = \frac{w_1}{w_0 + w_1 - \alpha_W(\pi_0 - w_0)}$$

We assume that $w_0 \geq \alpha_W(\pi_0 - w_0)$ so that contract (0,0) is a Nash Equilibrium of the contract game with inequality aversion. Then, $x^* \in (0,1]$. Frequency distributions $(0,0), (0,1), (1,0), (1,1)$ and (x^*, y^*) are fixed points of the non-linear dynamical system described by the replicator equations (12) and (13). It's straightforward to show that $(0,1)$ and $(1,0)$ are unstable states. We will concentrate on the three remaining states.

1. The Jacobian matrix of the system is given by

$$J(x,y) = \begin{pmatrix} (1-2x)\{y[\pi_0 - \beta_C(\pi_0 - w_0)] - (1-y)\pi_1\} & x(1-x)[\pi_0 - \beta_C(\pi_0 - w_0) + \pi_1] \\ y(1-y)[w_0 - \alpha_W(\pi_0 - w_0) + w_1] & (1-2y)\{x[w_0 - \alpha_W(\pi_0 - w_0)] - (1-x)w_1\} \end{pmatrix}$$

   After evaluating state $(0,0)$, this matrix becomes

$$J(0,0) = \begin{pmatrix} -\pi_1 & 0 \\ 0 & -w_1 \end{pmatrix}$$

   whose determinant is $DetJ(0,0) = \pi_1 w_1 > 0$. Its trace is $trJ(0,0) = -(\pi_1 + w_1) < 0$. Then, frequency distribution $(0,0)$ is an asymptotically stable state of the dynamical system, which means that it is an evolutionary equilibrium.

   Evaluating state $(1,1)$ gives the Jacobian matrix

$$\begin{pmatrix} -[\pi_0 - \beta_C(\pi_0 - w_0)] & 0 \\ 0 & -[w_0 - \alpha_W(\pi_0 - w_0)] \end{pmatrix}$$

   whose determinant and trace are, respectively, $detJ(1,1) = [\pi_0 - \beta_C(\pi_0 - w_0)][w_0 - \alpha_W(\pi_0 - w_0)] > 0$ and $trJ(1,1) = -[\pi_0 - \beta_C(\pi_0 - w_0)] - [w_0 - \alpha_W(\pi_0 - w_0)] < 0$. This implies that frequency distribution $(1,1)$ is also an asymptotically stable state, or equivalently, an evolutionary equilibrium. This completes condition 1 of this theorem.

2. For the interior frequency (x^*, y^*) we have

$$J(x^*, y^*) = \begin{pmatrix} 0 & x^*(1-x^*)[\pi_0 - \beta_C(\pi_0 - w_0) + \pi_1] \\ y^*(1-y^*)[w_0 - \alpha_W(\pi_0 - w_0) + w_1] & 0 \end{pmatrix}$$

   for which

$$DetJ(x^*, y^*) = \\ -x^* y^* (1-x^*)(1-y^*)[\pi_0 - \beta_C(\pi_0 - w_0) + \pi_1][w_0 - \alpha_W(\pi_0 - w_0) + w_1] < 0$$

   This immediately implies that (x^*, y^*) is a saddle point, completing the proof.

□

According to this theorem, both the egalitarian and the non-egalitarian contracts are the evolutionary equilibria[8] of our contract game. Condition 1 states that in the long run, every agent will be playing one of the two contracts. This result should not be a surprise, because for any payoff monotonic dynamic, a strict Nash equilibrium is also an asymptotically stable state [Young (1998)]. Figure 4 presents the phase diagram of the dynamical system described by the replicator equations (12) and (13).

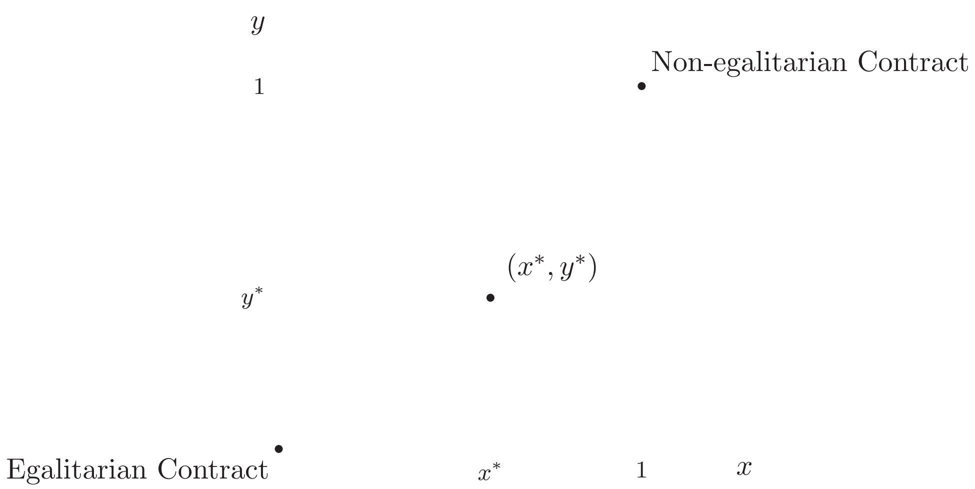

Figure 4: Phase diagram for the contract game

Initial conditions determine which equilibrium prevails, so history matters. The final outcome depends on the initial proportion of agents of each type. If a sufficient number of players propose/accept the non-egalitarian contract in the beginning of the game, the society will converge towards this equilibrium. As Figure 4 shows, the size each equilibrium's basin of attraction depends on the frequency distributions (x^*, y^*). But, as shown by condition 2 of theorem 1, these frequencies depend on the material payoffs for the players (π_k and w_k, for $k = 0, 1$), the degree of advantageous inequality aversion in class C (β_C), the degree of disadvantageous inequality aversion in class W (α_W), and the level of inequality implied by the non-egalitarian contract ($\pi_0 - w_0$).

When α_W decreases, the basin of attraction of the egalitarian contract shrinks because x^* becomes smaller. But earlier we assumed that for population W the degree of disadvantageous inequality aversion α_W depends on whether citizens received

[8]Remember that an evolutionary equilibrium is an asymptotically stable state of the replicator dynamics.

a gift or not. In other words, clientelism affects inequality aversion within population W. Also, we assumed that $\alpha'_W(G_c) < 0$, which means that more generous gifts imply lower inequality aversion. A comparison of a clientelistic society, in which $G_c > 0$, with a non-clientelistic one, suggests that the former has a lower α_W. Thus, the basin of attraction for the egalitarian society is smaller if clientelism exists or, in other words, *clientelism produces income inequality.*

5 Adaptive Learning, Stochastic Shocks, and Clientelism

Even though the model analyzed in the previous section is insightful on identifying the impact of clientelism on income inequality, it's *deterministic* flavor is perhaps a main problem. Besides, as we said before, the replicator dynamic is an extreme version of evolution, that many times is not the best way of describing social systems. In this section, we will move towards a more realistic conception of learning within human interaction.

It can be assumed that at choosing a strategy in a game, players determine their *best response* to what they expect other agents will play, and that expectations are full-filling. This is the main approach of *classical* game theory. On the other extreme, one may argue that agents inherit some strategy form their parents, and that over time fittest strategies prevail. *Conventional* evolutionary game theory, based on evolutionary stable states or the replicator dynamics, follows this path. Perhaps an intermediate approach, half way from the former two, is the one proposed by stochastic game theory, as developed by Young (1993, 1998) or Kandori, Mailath and Rob (1993). Recognizing that clientelism is an interesting feature of political and social systems, we now take this approach.

Lets consider again our two populations, C and W. Each period, a player of C-population is randomly paired with a player of W-population, to interact in the contract game. At any time period t, players select some strategy $s_i(t)$, with $s_i(t) \in \{0, 1\}$, for $i = C, W$. This is, each player chooses contract 0 or contract 1. The *play* at time t is a strategy profile $s(t) = (s_C(t), s_W(t))$, that specifies which strategy chose each player. In the last section we assumed that players were "programmed" to follow one of the two strategies, and that over time the frequency distributions of these evolved according to the replicator dynamics. Now we suppose that players update their strategies following an adaptive learning mechanism.

Players have a memory of m periods. This means that at any period $t + 1$, they are capable of looking the last m plays of the game, represented by the history profile $h = (s(t - m + 1), \ldots, s(t - 2), s(t - 1), s(t))$. The magnitude of m represents how far in the past the player is capable of looking back. From this memory profile the agent takes a sample of size $k \leq m$. These means that our player may not be able of studying all the profiles of h. At random, draws a sample of size s because "[e]ach player has access to information about what some of the previous players have done, which is relayed through established networks of friends, neighbors, co-workers, and so on" [Young (1998). For example, many times people deciding to accept a labor contract, use to ask around, or simply search, if the wage is competitive or if the number of working hours is fair. But people have limited cognitive capacities, so that $k \leq m$ bounds players' rationality.

Let's call $\varepsilon > 0$ the error rate of the learning process. Then, the updating mechanism is as follows. Each period t player i selects with probability $1 - \varepsilon$, his best response to the frequency distribution of strategies observed within the sample of size k. With probability ε selects randomly a strategy $s_i(t) \in \{0, 1\}$. We can interpret ε as the frequency at which the player chooses erroneously any strategy. It's a consequence of perturbations or shocks that affect people's behavior. As Bowles (2003) suggests, the non-best reply actions associated with ε may represent idiosyncratic plays related with experimentation, whim, error, or intentional mistakes. For example, some players could decide to reject non-egalitarian contacts even though these are the established condition, simply because they want to promote collective action against an unequal distribution of surplus.

If players use this updating mechanism, which convention will prevail? From theorem 4.1 of Young (1993), we know that when the process is unperturbed, that is, when $\varepsilon = 0$, and if information is sufficiently incomplete (if $k/m \leq 1/2$), from any initial state the process will converge with probability one either to the egalitarian contract or to the non-egalitarian one. This result is equivalent with the one we found in the last section assuming the replicator dynamics. But if $\varepsilon > 0$ any absorbing state is subject to perturbation that may dislodge one equilibrium or the other. A state is stochastically stable if in the long run, it is observed most of the time, as the error rate vanishes.

This concept is central for our analysis because it will tell us in which convention, egalitarian or non- egalitarian, social classes will spend most of the time. As we should expect, in this model this depends on clientelism.

Theorem 2.
Suppose that players of populations C and W exhibit inequality aversion, as represented by utility functions (10) and (11). Then, if information is sufficiently incomplete ($k/m \leq 1/2$) while k and m are large, the non-egalitarian convention (0,0) of the contract game is the unique stochastically stable state if

$$[\pi_0 - \beta_C(\pi_0 - w_0)][w_0 - \alpha_W(\pi_0 - w_0)] > \pi_1 w_1 \tag{14}$$

Proof.
Following Harsanyi and Selten (1988) we know that an equilibrium is risk-dominant if maximizes the expected payoff of each player when each one assumes that the others select any strategy with equal probability. For a C-class player contract 0 strictly risk-dominates contract 1 if

$$\frac{\pi_0 - \beta_C(\pi_0 - w_0)}{2} \geq \frac{\pi_1}{2} \tag{15}$$

For a W-class player contract 0 strictly risk dominates if

$$\frac{w_0 - \alpha_W(\pi_0 - w_0)}{2} \geq \frac{w_1}{2} \tag{16}$$

Then, multiplying (15) and (16), contract 0 is the unique risk-dominant equilibrium if

$$[\pi_0 - \beta_C(\pi_0 - w_0)][w_0 - \alpha_W(\pi_0 - w_0)] > \pi_1 w_1$$

From Young (1998), theorem 4.1, we know that the stochastically stable state is the risk dominant equilibrium.

□

The interpretation of this theorem is straightforward. Even though the Markov process generated by the adaptive learning mechanism introduced in this section is ergodic, i.e. we are not able to anticipate ex-ante where the system will be in the future, we can tell where it will be most of the time on the long run. The stochastically stable state is the most probable outcome. In our case, (14) determines when the non-egalitarian contract is the stochastically stable state. Two forces determine the outcome. First, as income inequality grows ($\pi_0 - w_0$), the left hand of (14) decreases. Higher inequality makes the non-egalitarian contract less sustainable on the long run, as a consequence of inequality aversion. In contrast , as α_W decreases, the left hand term increases, augmenting the probability of observing the non-egalitarian contract most of the time. But remember that disadvantageous inequality aversion among W-players α_W is a function of clientelism. As the gift given by the politician (G_W) grows, aversion decreases. Then, more clientelism implies greater chances of getting caught in the unequal equilibrium.

Now we can complete our argument of why clientelism is a poverty trap. In section 3 we showed that if w is low, it's easier for clientelism to emerge. Once it is established and a gift G_W is given from the patron to the client, inequality aversion of workers or tenants is attenuated. This increases the likelihood of the non-egalitarian division of surplus between capitalists and workers or landlords and sharecroppers. Then, patron incomes are higher, while client wages our lower. This, again, makes things easier for clientelism to emerge. *The society is caught in a poverty trap.*

6 Conclusions

In this article we studied the relation between political clientelism and income inequality and poverty. A first postwar wave of anthropological and sociological literature recognized that clientelism is an asymmetrical, dyadic relation, mediated mainly by reciprocity. We tried to reconcile this position with modern economic approaches, using behavioral game theory. Our major finding is that low incomes and poverty stimulate clientelism, mainly because the level of reciprocity needed for it to emerge is low when citizens lack of basic goods and services. The model of section 3 could be extended in order to include the effects of repeated interactions between politician, brokers, and voters. We infer that this extension would rescue the impact of self-regarding preferences as an explanation of clientelism. We take for granted that many citizens give political support the gifts they receive, not only because of reciprocity, but also because of the threat of loosing benefits in future interactions.

The second part of our model showed how clientelism affects the distribution of surplus within a society. Formal and informal contracts specify how the gains of cooperation between classes are to be divided. But this division may be more or less egalitarian, and it is of our interest to understand what are the underlying forces behind this division. We argued in sections 4 and 5 of this article that clientelism augments the probability that the non-egalitarian contract is the final outcome of this "class struggle". In fact, higher clientelism makes it harder for workers or tenants to use collective action as non-best response strategy, capable of dislodging an unequal situation. Clientelism makes the egalitarian contract both less accessible and less persistent. In this sense, it becomes an important strategy used by one class for the perpetuation of a favorable division of surplus.

Our model presented an argument of why clientelism is a poverty trap. In a poor and unequal society, clientelism is a natural outcome. Low incomes make things easier for clientelistic politicians, as shown in section 3, but also, as sections 4 and 5 show, clientelism increases the likelihood of non-egalitarian divisions of surplus. Then, wages will be lower for clients and higher for patrons, making, again, clientelism a natural outcome.

We suggest some important extensions of our model in order to correct some of its main flaws. First, it is necessary to extend the model presented in section 4, going beyond the dyadic relation presented there. The conjunction of several dyads conforms a *clientelistic* network. Urban and rural citizens relate themselves with local leaders, who act as brokers and link them with regional politicians. They connect the network with national candidates, whose power and influence make them important players in determining the level of public goods. Second, it is important to determine what the place of undercover organizations is in all this process. It is well known and documented that in some countries all sorts of *mafias*, drug traffickers, rebel groups, and other types if illegal organizations, penetrate political systems and contribute to the development of clientelism. A better understanding of clientelistic networks would contribute, for sure, to the formulation of policies for controlling this phenomenon.

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