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**ENDOGENOUS PROPERTY
RIGHTS, CONFLICT INTENSITY
AND INEQUALITY IN
ASYMMETRIC RENT-SEEKING
CONTEST**

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CONTEST^{2,3}**

Does less inequality in wealth distribution imply better property rights protection? In this paper we show that this impact is non monotonous and is conditional on a) equilibrium type: conflict (rent-seeking) or peace, b) the reasons of changes in wealth distribution, and c) the size of the ruling class, “elite”. In the conflict stage, institutional quality positively depends on the wealth of the elite, but negatively – on the size of the elite class. However, the transition from conflict to peace stage (with no rent-seeking and fast growth) requires the reduction of inequality. This generates an institutional trap. Moreover, the intensity of rent-seeking behavior increases both with progressive redistribution of wealth and with widening of the ruling class. Our results allow characterizing wealth distributions, wherein it is better to redistribute wealth or to expand the ruling class in order to improve institutions and limit rent-seeking incentives.

Keywords: property rights institutions, inequality, rent-seeking, wealth distribution, institutional traps, conflict, economic development

JEL Classification: D31, D72, D74, O17, P26

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1. Introduction

For some time past in development economics, political economy and related areas there is an increasing emphasis on institutional quality as one of the main factors explaining economic growth and differences in living standards between countries (Hall and Jones (1999), Acemoglu et al. (2001, 2002)). Particular attention is paid to property rights institutions (North (1990), Besley and Ghatak (2010)) and rent-seeking behavior, which is a result of insufficient property rights protection and presence of incentives and abilities to redistribute and extract rent, instead of to create it⁴.

Quite often in non-democratic countries the quality of property rights institutions becomes a political choice variable⁵. It is determined by narrow interest groups, which possess economic wealth and enough political power. This privileged position provides the elite with an opportunity to prey on the rest of population and extract rents. However, the elite has controversial incentives when choosing the level of property rights protection because of a well-understood logic (see, f.e., Olson (1993)). On the one hand, good property rights institutions increase productive investment in the economy and, thereby, the aggregate amount of rent, which can be extracted by the elite (famous “stationary bandit” phenomenon). On the other hand, when property rights are secure, it is more difficult for the elite to expropriate. It leads to the existence of a certain optimal level of institutional quality, preferred by the elite, which can be quite high. Moreover, under some circumstances the elite may prefer not to prey on masses and establish a “social contract” instead of a “state of nature” (we borrow these metaphors from Hobbes (1651) and Rousseau (1762)), where resources are wasted in conflict and rent-seeking.

In this paper we argue that the differences in institutional quality and the intensity of conflict can be explained by variations in the distribution of wealth between elite and masses. We propose a theory which studies the impact of wealth inequality on the elite’s preferences over the secured property rights and on agents’ “occupation” – rent-seeking or production. Present theoretical results (section 2.1) as well as empirical observations and some historical cases (section 2.2) are contradictory and force one to think of ambiguous dependence of property rights institutions on wealth inequality. We clarify this dependence, which we found to be non-

⁴ Economic literature provides a lot of mechanisms and channels through which rent-seeking hampers growth and leads to social losses. First, it is increasing risk of expropriation and a flow of resources from productive activities to unproductive in rent-seeking sector (Murphy et al., 1991, 1993). Second, the institutional weakness can lead to inefficiency of government investment (Mauro, 2004), foreign aid and transfers to developing countries (Svensson, 2000) due to inappropriate use of these funds and conflict intensification. In turn, intensive redistributive conflict over economic and political rents may result in worse institutional climate (Hodler, 2006). Finally, the main vehicle of growth, technological progress, can be retarded (Gonzales, 2005) because of the adverse effect of expropriation risks on the incentives to adopt superior technologies, which make business more attractive for rent-seekers.

⁵ See Glaeser et al. (2004) for an in depth discussion of this idea. Authors also consider alternative approaches of thinking about the relationship between property rights and both economic and political development.

monotonous and conditional. Namely, the response of property rights quality to the changes in wealth distribution depends on a) society's current stage, conflict (with intensive rent-seeking, weak institutions and limited growth potential) or peace, b) due to what the inequality changes: elite's share in total wealth or its share in population, c) how large is the ruling class (elite).

The importance of these specifics in relationship between inequality and property rights can hardly be overestimated. Many developing and less-developed countries today (as well as countries in their colonial and post-colonial periods of history) are trapped in equilibrium with low quality of institutions⁶, which hampers development. Implications of many existing theoretical papers are to some extent straightforward: they recommend to reduce inequality (by redistributing wealth, or by limiting the power of elite, or by expansion of the ruling class) in order to improve property rights protection and overcome underdevelopment. As we demonstrate in present paper, this argument is not universal and unconditional. For different wealth distributions we propose recommendations on how to improve institutions: whether it is better to concentrate on changes in wealth share of the ruling class or its size. We evaluate consequences of such measures in terms of institutional quality and conflict intensity. In order to do this, we construct the occupational choice model with rent-seeking behavior and endogenous property rights.

The structure and methodology of presented game-theoretic model are to some extent based on Konrad (2002), Sonin (2003), Polishchuk and Savvateev (2004), Nunn (2007) and Gradstein (2007). Our model is a three-stage game, in which agents from two classes, elite and masses, interact. These two classes differ from each other in terms of the share of aggregate wealth they own, size (share in population) and access to power and political decision making. On the first stage of the game elite chooses the level of property rights protection, which stands for the probability that a rent-seeker will be successful in expropriation of producer's output. On the second stage either a conflict equilibrium (where elite chooses rent-seeking and expropriates output from masses), or peace equilibrium (where both groups prefer not to conflict with each other, output is high, and property rights are well-defined) is realized. On the third stage agents optimally allocate their initial wealth between consumption, productive investment and expenditures on rent-seeking (expropriation or protection). After that the received product is consumed, and the game ends. Institutional quality in our model depends on both the choice of the elite (continuous changes), and the nature (conflict or peace) of the equilibrium (stepwise changes).

Our main findings indicate that if inequality rises because of the wealth share of the elite,

⁶ In particular, Nunn (2007) considers this phenomenon in the context of African countries, while Engerman and Sokoloff (2002) discuss the process of institutional formation and the stability of bad institutional framework in Central and South America, which are rooted in colonial past of these countries.

it leads to stronger property rights protection, while if it rises due to widening of the elite class, institutional strength declines. However, it is true only in the stage of conflict, when resources are allocated inefficiently due to rent-seeking activities. In order for transition to peace equilibrium to occur the inequality should be rather low. Hence, with lowering the inequality institutions first decrease (when elite loses its power) and then rapidly increase (when the incentives of the elite change from rent-seeking to production). The extent to which wealth should be redistributed (or elite class – widened) before the transition occurs depends on the initial size of the ruling class. The adverse effect of lowering inequality is strengthened since the amount of unproductive expenditures on rent-seeking rises when wealth distribution approaches the necessary level of equality.

It is important to note, why, in principle, higher inequality may lead to better institutions. For example, society may demand stronger redistribution, when inequality is high, which makes the elite to carry more about secured property rights (see Cervellati et al. (2008), Leonard and Long (2012)). Also, if the elite class is narrower, the problem of collective action among them may be reduced, which means better public goods (including secured property rights) provision. However, our logic is different.

When the elite becomes relatively more wealthy it means a) elite being more effective in rent-seeking; b) higher risks of expropriation for producers, which as a result shifts elite's preferences towards more secured property. Strong elite may extract rent well even under good institutions, while the combination of powerful elite and weak institutions deters masses from production, thereby reducing the amount of rent. Moreover, the reduction of output of relatively poorer producers is sharp (due to concavity of technology), which also means that marginal losses from worsening institutions is higher for rich elites. At the same time, narrowing of the ruling class deters the incentives of masses to defend their output and increases production, which both increases the benefits of weaker property rights for the elite. Thereby, in a sense, elite's wealth and weak institutions are substitutes, while the size of the elite class and weak property rights complement each other from the elite's point of view.

The results we obtain also allow us to build an approximate classification of countries in accordance with the tightness of the ruling class. In countries with extremely narrow elite it is useless to redistribute wealth, since it will not change the elite's incentives from rent-seeking to production. The only way to improve institutions is to expand elite class, but it will be associated with a dramatic increase in conflict intensity. In countries with (still small) larger ruling class the redistribution of wealth can lead to peace equilibrium with good institutions. However, first institutional strength falls with lowering inequality, but then rapidly increases, when the nature of equilibrium changes. In such countries good institutions may correspond to both high and low

elite's share in total wealth, while intermediate cases correspond to weaker institutions. In societies where ruling class is even wider, peaceful equilibrium emerges if wealth is distributed not very unequally. But if inequality is very high, such countries end up in conflict, which is even more intense than in purely autocratic regimes, but at the same time they enjoy moderate level of property rights protection. Only established democracies with wide ruling class can destroy the incentives for rent-seeking and agree on secured property rights irrespective of the elite's wealth share. These results clarify the ambiguous relationship between inequality, institutions and economic growth.

The rest of the paper is organized as follows. Section 2 presents empirical evidence, which motivates our research, and existing theoretical arguments and results. In section 3 we describe the assumptions and structure of the model. Section 4 gives the characterization and properties of equilibrium, and presents the main results of the paper. We discuss our results in the context of controversial empirical evidence and some historical cases of institutional formation and change in section 5. Finally, section 6 concludes.

2. Empirical evidence and theoretical results

2.1 Empirics of inequality and property rights institutions

It is widely believed that higher inequality (in particular, higher income share of the richest people) corresponds to a lower level of property rights institutions. Gradstein (2007) investigates the data from World Bank (Kaufmann et al., 2003) and ICRG⁷, and points on the negative relationship between the quality of property rights (indexes Rule of Law, Control of Corruption) and the measures of inequality (Gini index, the ratio of 1st income quintile to the 5th). Author finds significant negative correlation from -0.2 to -0.45. In Keefer and Knack (2002) the impact of inequality on property rights is tested econometrically and found to be negative and significant (an increase in Gini index on 5 percentage points leads to a reduction of average property rights index on 1 point of 50).

However, there are reasons to doubt that the impact of inequality on property rights is necessarily negative. Davies et al. (2011) present data on in-country wealth (not income) distribution. In countries with strong property rights, for example, Switzerland, Denmark, USA, UK, the wealthiest 1% (5%, 10%) of population owns a higher share in the aggregate wealth, than in, for example, China, India, Italy and Spain – countries with not so well-protected property rights. Further, Amendola et al. (2013) provides data on 47 developing countries,

⁷ International Country Risk Guide - <https://www.prsgroup.com/about-us/our-two-methodologies/icrg>

according to which there exists a positive relationship between average quality of property rights (Fraser index) and average inequality (Gini index). Moreover, in countries with relatively low democracy measures (Vanhanen's democracy index) the relationship between inequality and institutions is positive, while in more established democracies it is negative.

We also can provide some historical cases that stress the ambiguity of the impact of inequality on institutions. In Acemoglu et al. (2002) it is shown that weak property rights institutions developed in countries where native population was rich and its density was high in the time of European colonization ("Reversal of fortune"). If, on the other hand, the inequality between European colonizers and local population in terms of wealth and strength was high (if native population was not numerous and not developed economically), it was a fertile ground for good property rights institutions. This example points on the positive impact of the elite's wealth on property rights protection.

Another example is discussed in Khan and Jomo (2000). It highlights the positive dependence of institutional quality on elite's wealth, but negative – on the elite's class tightness. In particular, authors analyze the historical evidence from India and South Korea in their colonial periods and after independence. The rule of not numerous and not wealthy Britain colonizes in India led to the establishment of weak property rights. At the same time, Japanese colonizers in South Korea constituted higher share of population and owned far more power and wealth than the British in India. The dominance of subsequently emerged wealthy industrial elites in Korea led to development and formation of stronger property rights, than in India, where interest groups, comparable to each other in terms of power and wealth, were engaged in rent-seeking and conflict.

These and other observations (which we will discuss in more detail later) highlight the necessity for more careful examination of conditions, under which wealth and power inequality affects institutions and the intensity of rent-seeking positively/negatively. The fact that draws particular attention is that positive relationship between inequality and property rights emerges in countries that can be characterized as resting in the stage of conflict. These are both countries in (post)colonial periods of their history and part of today's developing and underdeveloped economies. Usually these countries are also autocracies or not established democracies.

However, as Glaeser et al. (2004) notes, pro-growth institutions were established both in democratic and autocratic societies throughout the history. In our paper we argue that political elite may prefer good institutions if some conditions on wealth distribution hold. In the next subsection we review the existing theoretical results on the relationship between inequality, institutions and rent-seeking intensity.

2.2 Theoretical results

Our paper contributes to the literature on endogenous property rights institutions. In many such models the level of property rights protection was found to depend negatively on the level of inequality. In Sonin (2003) and Gradstein (2007) it is shown that richer agents prefer lower level of property rights protection. This result partly rests on the assumption of complementarity between productive and unproductive investment. More capital investment results in the advantage in contest. Hence, rich agents are not interested in public protection of property rights. They can protect their own product privately and expropriate other's. However, the data provided in the previous subsection stresses the possibility of an inverse effect.

We also link our research to the literature that studies the impact of strength asymmetry between contenders on the outcome of conflict and preferable level of property rights protection. Konrad (2002) considers a contest between the incumbent and the challenger and studies the impact of productive and fighting effectiveness asymmetry on the investment incentives. In Muthoo (2004) it is shown that in asymmetric rent-seeking contest the strengthening of initially more powerful agent shifts his preferences towards increasing property rights protection, while if a weaker player strengthens it leads to worse property rights. If one of the agents becomes too strong, the other agent will not have incentives to produce and create rent. However, author does not link the strength in contest to wealth inequality, and considers a two-player contest (missing effect of group size asymmetry on the security of property rights). Besley and Ghatak (2010) also note that the concentration of power in the hands of one agent is more effective in terms of institutional quality and production, than the distribution of power between several agents.

Our work also has a lot in common with Cervellati et al. (2008), who build a taxonomy of politico-economic equilibria depending on the level of income inequality in a model of conflict between elite and masses. Authors stress the non-monotonic relationship between inequality and institutional strength. In particular, they note that oligarchies can be efficient if elite is rich and powerful. Authors also show that a transition from oligarchy to democracy involves a period of intensive conflict, which coincide with Acemoglu (2008).

When evaluating the consequences of changes in wealth distribution we also give particular attention to the intensity of conflict between elite and masses. Wealth inequality affects the incentives to invest in rent-seeking both directly and indirectly, through its effect on the quality of property rights. Therefore, our work refers to the literature on rent-seeking intensity in the models of production and conflict (Nitzan (1994) and Garfinkel and Skaperdas (2006) provide an overview). More specifically, we separate two dimensions of inequality, wealth inequality and group size inequality, which together characterize between-group wealth distribution, and study how these variables affect rent-seeking intensity.

In our model wealth inequality affects the intensity of conflict through agents' effectiveness in conflict. Gradstein (1991), Kohli and Singh (1999) study the influence of ex-ante fighting effectiveness inequality between contenders on rent-seeking expenditures and social optimum. The known result is that lower asymmetry between contenders leads to higher rent-seeking expenditures. At the same time, if agents are equal in their strength, it can be better for both of them not to engage in a conflict – such a case is analyzed in Skaperdas (1992). Hence, the relationship between conflict intensity and strength asymmetry becomes ambiguous.

Regarding the effect of inequality in group sizes, in Cheikbossian (2008) author accounts for the fact that larger (other things equal, wealthier) group is more influential and, hence, *ceteris paribus*, can lower the expenditures on rent-seeking. As a result, greater asymmetry in group sizes leads to lower conflict intensity. Recent contribution by Nupia (2013) states that the impact of wealth (and group size) asymmetry on the intensity of conflict is non-monotonic. We complement this literature by considering endogenous institutions and their impact on the intensity of conflict.

3. The model: assumptions and structure

In this section we describe the timing of events, and the way agents interact with each other. We introduce their optimization problems on each stage of the game, describe the distribution of wealth, and specify technologies of production and conflict.

3.1 Wealth distribution and inequality

The economy is populated by a unit continuum of agents. All agents are divided into two groups: ruling or privileged class (“elite”, E), who has an access to power and political decision making, and unprivileged class (“masses”, M). We assume wealth distribution to be discrete. Elite and masses constitute a fraction n and $1-n$ in total population, correspondingly, and $n < 0.5$ holds. The total amount of wealth in the economy, W , is distributed between these two groups, and elite owns a fraction θ of the total wealth, while masses own a fraction $1-\theta$. All agents inside their groups have the same wealth, $w_E = \frac{\theta W}{n}$ and $w_M = \frac{(1-\theta)W}{(1-n)}$. Moreover, agents from the elite are richer than agents from masses, which implies $\theta > n$. We can derive the measure of inequality in wealth distribution, known as Gini index.

Lemma 1. *The Gini index for the described discrete wealth distribution is:*

$$Gini = \theta - n \quad (1.1)$$

Proof. Lemma 1 can be proved by simply using the definition of Gini coefficient as a ratio of square between the Lorenz curve and the 45-degree line to the square of the whole triangle in (θ, n) coordinates. After a few algebraic manipulations it is easy to derive (1.1).

It is important to note that an increase in, for example, share of the elite class in population should result in an increase in total wealth share of the elite (if the individual wealth in this group does not change). This means that $\theta = \theta(n)$, $\theta'_n > 0$. However, wealth shares could well change without any variations in groups' sizes (f.e. due to redistribution of wealth). Moreover, we will consider θ and n changing independently ("ceteris paribus"). Thus, it is the same as if we compare wealth distributions, in which the same wealth share belongs to different population shares. We will discuss possible extensions in section 5.

3.2 Production, rent-seeking and consumption

Below we describe the rent-seeking game with endogenous property rights institutions. It is a three-stage game with complete and perfect information.

Timing

1st stage. On the first stage of the game the representative member of the privileged class chooses the level of property rights protection in accordance with his political preferences (indirect utility function). This agent rationally anticipates the reaction of the society (occupational choices, production/expropriation/consumption decisions and so forth) on his choice and takes it into account. Moreover, we consider the choice on this stage as credible commitment of the elite.

2nd stage. On the second stage the representative agent (say, leader) in each group, $\{E, M\}$, decides what will be the occupation of all the agents from his group⁸. There are two possible occupations: productive entrepreneur, (*PR*), or unproductive entrepreneur (rent-seeker), (*RS*). In this article we will focus on the situation in which elite is a potential predator, while masses could become victims or do not produce at all and free themselves of expropriation risks⁹.

⁸ Since all agents inside their groups are identical this only means that agents managed to resolve the collective action problem. We also consider the case when agents from one group can not expropriate from each other.

⁹ It is also possible that masses have an ability and desire to expropriate elite's property, while the elite has to protect itself. However, such a scenario is behind the scope of this paper. In Cervellati et al. (2008) authors consider a game of a similar structure, and masses can (through expropriation or progressive taxation) equalize their wealth with wealth of the elite group members. The elite can disagree and prefer a wasteful conflict to such peace. Mejia and Posada (2007) consider a conflict over the privileged position and power of the elite. The group in power can protect its positions either using military force, or through populist transfers to the masses.

<i>E/M</i>	<i>PR</i>	<i>Not PR</i>
<i>PR</i>	V_1, V_2	V_3, V_4
<i>RS</i>	V_5, V_6	V_7, V_8

Table 1. Pay-off matrix of the “producer-expropriator” game

Here $V_{1,\dots,8}$ are the pay-offs, which are taken into account by agents when they choose their occupation. There could be only two pure-strategy Nash equilibria in this game as it would become clear soon. Nash equilibrium is either (PR, PR) or (RS, PR) . The first one is optimal from the societal point of view, since there are no unproductive expenditures and expropriation risks in that case, and, hence, no distortions in the investment incentives. The second equilibrium is a conflict one, where society bears losses from the unproductive expenditures on extortion and protection, while output is low due to expropriation risks and lower number of producers.

3rd stage. After choosing an occupation each agent optimally distributes his wealth between production and different types of investment in order to maximize utility function and taking other agents’ actions as given. Thus, we analyze a sort of Nash-Cournot equilibrium at this stage. The results of interactions between players are the production of a certain amount of final output, which is then redistributed in rent-seeking contest. Further, all agents consume the product they get, and the game ends. On the third stage of the game all the pay-offs, $V_{1,\dots,8}$, are formed, which are taken into account on the second stage.

This game can be solved by backward induction. Let’s consider each stage of the game in more detail.

3rd stage of the game

Each agent maximizes quasi-linear utility function¹⁰:

$$U_i = C_i + E\pi_k \quad (1.2)$$

where $\pi_k = \pi_k(K, D, R)$ is a return on agent’s investment (both productive and unproductive) given his opponents investment, and $k = \{PR, RS\}$. It is going to be specified in more details further. The expected returns from investment depend on agent’s occupation and 2nd stage equilibrium type. We will start with considering a conflict equilibrium, (RS, PR) , in which elite expropriates masses, while masses produce and try to protect their output from expropriation.

¹⁰ We assume quasi-linear utility in order to put aside the standard income effect and stress the mechanisms that are of interest to us, through which wealth distribution affects production, conflict and institutions.

For each producer from masses in (RS, PR) equilibrium the following budget constraint should hold:

$$w_M = C_M + K_M + D_M, \quad (1.3)$$

where w_M is the initial wealth of producer from masses, K_M is the amount of invested capital, D_M is investment in protection of one's output, and C_M is consumption. The production technology takes a simple Cobb-Douglas form, $Y_s = AK_s^\alpha$, where A is a productivity level, and $s = \{M, E\}$.

Further, following the tradition of occupational choice models of rent-seeking, we assume that there is a certain probability, p^{PR} , that a producer will meet a rent-seeker in the process of random matching. Next, if producer is unlucky to meet a rent-seeker, a fraction τ_{EM} of producer's output is transferred to rent-seeker. Both τ_{EM} and p^{PR} are endogenous variables and will be specified later. Now we can express the expected return on producer's investment if he belongs to masses:

$$E\pi_{PR,M} = Y_M \cdot (1 - p^{PR}) + Y_M \cdot (1 - \tau_{EM}) p^{PR} = Y_M \cdot (1 - \tau_{EM} p^{PR}) \quad (1.4)$$

Likewise, for each agent from the elite in (RS, PR) equilibrium the following budget constraint should hold:

$$w_E = C_E + R_E, \quad (1.5)$$

where R_E is the expenditure on expropriation. Each rent-seeker meets a victim from producers with a probability p^{RS} and a share τ_{EM} from producer's output Y_M . However, there are barriers for rent-seekers to prey on producers, which represent the quality of property rights institutions. Namely, only a share q of all rent-seekers will be successful in expropriation, while a share $(1 - q)$ will fail. Here q is a measure of property rights institutions strength¹¹ and is a political choice variable. The expropriator gets zero pay-off if he is unsuccessful. Hence, the expected payoff to rent-seeker equals:

$$E\pi_{RS,E} = Y_M \cdot q \cdot \tau_{EM} p^{RS} \quad (1.6)$$

The share of output, τ_{EM} , that an expropriator receives in conflict with producer, is determined in accordance with contest success function¹² (CSF):

¹¹ The higher are the quality and intensity of the work of police, the more honest and transparent are the courts, the less corrupted is the government, the higher will be the risks for rent-seekers and, hence, lower will be q . Here the approximation for q could be, for example, Rule of Law or Control of Corruption indexes.

¹² The literature on CSF starts with seminal paper of Tullock (1980). Further, CSFs were axiomatized and intensively studied in Hirshleifer (1989) and Skaperdas (1996).

$$\tau_{EM} = \frac{\gamma \cdot R_E}{\gamma \cdot R_E + D_M}, \quad (1.7)$$

where γ stands for rent-seeker's relative fighting effectiveness in conflict. One of the main assumptions of our model is that agent's effectiveness in conflict is determined by his wealth. Thus, if the member of elite wants to expropriate producer from masses, then we have

$$\gamma = \frac{w_E}{w_M} = \frac{\theta W/n}{(1-\theta)W/(1-n)} = \frac{\theta(1-n)}{(1-\theta)n}. \text{ In other words, the strength in conflict is higher, ceteris$$

paribus, for agents from wealthier and less numerous groups. Here it is important to note, why we assume such a form of CSF, which is modified it in a similar way to Gradstein (1991) and Kohli and Singh (1999). We want to take into account that wealth inequality impacts rent-seeking and production incentives, as well as preferences towards the level of property rights protection, through the distribution of relative power, ability to win the contest. This idea has both theoretical and empirical underpinning¹³. Moreover, in the meaning of Olson (1965), the more narrow in the interest group the more efficient it is in fighting for one's own hand, which also is captured by such form of CSF.

As we have already mentioned above, there is a process of random matching between producers and rent-seekers. If x is a share of rent-seekers in population and $1-x$ is a share of producers, then only xq of rent-seekers are successful in their attempts to expropriate, while others get nothing. So, we have xq "active" rent-seekers, $1-x$ producers. Since each rent-seeker can rob only one producer, and each producer can be robbed only once, we have

$$p^{PR} = \min\left\{1, \frac{xq}{1-x}\right\}, p^{RS} = \min\left\{1, \frac{1-x}{xq}\right\}. \text{ Since in the } (RS, PR) \text{ equilibrium members of the elite}$$

group choose rent-seeking, while masses choose production, x equals n and it follows that¹⁴

$$p^{PR} = \min\left\{1, \frac{xq}{1-x}\right\} = \frac{nq}{1-n}, p^{RS} = \min\left\{1, \frac{1-x}{xq}\right\} = 1. \text{ Here we borrow from famous articles of}$$

Murphy et al. (1993), Mehlum et al. (2003) and Nunn (2007). The main idea of this assumption is "crowding out" of rent-seekers when their number grows, since each rent-seeker can expropriate only one producer, and each producer can be attacked only once. Apart from other advantages, this assumption stresses the importance of group sizes (and, hence, inequality) in the

¹³ For example, Hellman et al. (2003) and Chong and Gradstein (2010) provide evidence that bigger and more wealthy firms are more influential and effective in building political connections and "state capture". Thus, they can influence the government's decisions on redistribution, granting different privileges and so on. Small firms don't possess such power and connections, and, hence, are ex-ante less efficient in lobbying and pressure on other firms. In theoretical papers of Sonin (2003), Gradstein (2007), Leonard and Long (2012) partly similar idea is used. When agents increase their capital investment, the effectiveness of their rent-seeking investment also rises (a kind of complementarity between productive and unproductive investment).

¹⁴ If $1-n$ is a share of producers, n is a share of rent-seekers, of which only q are successful, then, since $n < 0.5$ and $q < 1$, it always holds that $p^{PR} = \frac{nq}{1-n} < 1$, while $p^{RS} = 1$.

process of rent-seeking. Small group has an advantage, because agents within this group do not compete with other and have a high probability of success, while their victims assess the probability of being robbed as small, which also creates a fertile ground for rent-seeking behavior. Thus, inequality affects the risks of expropriation through both the probability of expropriation and the share of output, which is stolen. Moreover, this occupational choice structure allows modeling institutional change as a process of switching between the “regimes”, conflict or peace, when one or another group prefers rent-seeking or peaceful production.

Finally, we can rewrite the utility function of producer in the following way:

$$U_M^{PR} = C_M + E\pi_{M,PR} = C_M + AK_M^\alpha \left(1 - \frac{nq}{1-n} \cdot \frac{\gamma R_E}{\gamma R_E + D_M} \right) \quad (1.8)$$

And the utility of rent-seeker is:

$$U_E^{RS} = C_E + E\pi_{E,RS} = C_E + AK_M^\alpha \cdot q \cdot \frac{\gamma R_E}{\gamma R_E + D_M} \quad (1.9)$$

In (RS, PR) equilibrium all agents from the elite maximize (1.9) subject to (1.5), and all agents from masses maximize (1.8) subject to (1.3). For the sake of simplicity we will consider only interior optimal solutions for these problems¹⁵. We denote the optimal values of endogenous variables on the third stage of the game as $\{C_E^*(\alpha, A, \theta, n, q, W), R_E^*(\alpha, A, \theta, n, q)\}$ and $\{C_M^*(\alpha, A, \theta, n, q, W), K_M^*(\alpha, A, \theta, n, q), D_M^*(\alpha, A, \theta, n, q)\}$. Then the expected pay-off of the representative agent from the elite group, which is taken into account on the second stage of the game, is $V_5 = U_E^{RS}(C_E^*, R_E^*, K_M^*, D_M^*)$. Similarly, the expected pay-off of the representative agent from masses is $V_6 = U_M^{PR}(C_M^*, K_M^*, D_M^*, R_E^*)$.

Now we switch our attention to the peaceful (PR, PR) equilibrium, where both masses and elite produce, there are no unproductive expenditures, and property rights are secured. Each agent allocates his initial wealth between consumption and capital investment. Hence, we have $E\pi_E = E\pi_M = Y_s$. As a result, the utility function of a producer on the 3rd stage of the game in (PR, PR) regime will take the following form:

$$U_s^{PR} = C_s + E\pi_{s,PR} = C_s + AK_s^\alpha, \text{ where } s = \{E, M\}. \quad (1.10)$$

Budget constraints are:

$$w_{s,PR} = C_s + K_s, \text{ where } s = \{E, M\}. \quad (1.11)$$

It is clear that maximizing (1.10) subject to (1.11) all agents choose the same level of capital investment, $K_M^{**} = K_E^{**} = K^{**}(A, \alpha)$, and consume the residual part of their wealth:

¹⁵ Because of the quasilinear utility function it is sufficient to set w_E and w_M high enough in order to guarantee that the optimum will be interior.

$C_M^{**}(A, \alpha, \theta, n, W)$ и $C_E^{**}(A, \alpha, \theta, n, W)$. The expected pay-offs of the representative agents from elite and masses are, respectively, $V_1 = U_E^{PR}(C_E^{**}, K^{**})$ and $V_2 = U_M^{PR}(C_M^{**}, K^{**})$.

Finally, agents from masses may prefer not to produce at all in order to secure themselves from expropriation risks. In that case elite has nothing to expropriate if it chooses rent-seeking and, hence, $V_8 = C_M^{NP} = w_M$ and $V_7 = C_E^{NP} = w_E$. If the elite chooses production, it is optimal to invest K^{**} and get $V_3 = V_1$, while $V_4 = V_8$. Now we have all the necessary values to proceed to the second stage of the game, where agents choose their occupations.

Second stage of the game

It is clear that (see table 1 and definitions of $V_{1, \dots, 8}$ above) if masses choose strategy “no production”, the optimal response for the elite is to choose “production”, since $V_3 > V_7$ (the net return on investment is strictly positive when there is no rent-seeking). Similarly, if elite chooses “production”, masses response by choosing “production” as well, since $V_2 > V_4$. Therefore, there could be only two possible pure-strategy Nash equilibria, (RS, PR) or (PR, PR) . There is also a possibility on no pure-strategy Nash equilibrium on the second stage of the game. For (RS, PR) to be Nash equilibrium two following conditions should hold simultaneously:

$$\begin{cases} V_5 > V_1 \\ V_6 > V_8 \end{cases}, \quad (1.12)$$

which means that elite should expect high returns from expropriation, and masses should assess the risks of expropriation as not too high, while both groups have to anticipate reasonable expenditures on rent-seeking on reasonable.

If, on the other hand, expected returns on rent-seeking become too low, elite may prefer not to engage in a conflict. If the following condition holds, the equilibrium on the second stage of the game would be (PR, PR) .

$$V_1 > V_5 \quad (1.13)$$

It is important to note that (1.13) is both necessary and sufficient condition for (PR, PR) equilibrium. We do not care of the sign of $(V_6 - V_8)$. However, there also could be a set of parameters, for which there is no pure-strategy Nash equilibrium:

$$\begin{cases} V_5 > V_1 \\ V_8 > V_6 \end{cases} \quad (1.14)$$

Since $V_{1,\dots,8}$ are functions of model parameters, inequalities (1.12), (1.13) and (1.14) impose conditions on $(A, \alpha, \theta, n, q, W)$. In particular, we can derive conditions on wealth distribution, (θ, n) , given which the equilibrium will be conflict or peace.

First stage of the game

We model endogenous property rights in somewhat similar way to Sonin (2003), Gradstein (2007) and Leonard and Long (2012). Each agent has his own preferences towards the strength of property rights protection according to the indirect utility function. The resulting political equilibrium is determined by part of the society, which has political power (elite). In Sonin (2003) the decisive agent belongs to certain percentile of wealth distribution, which value depends on the degree of political bias. Property rights protection is a continuous variable defined on the interval from 0 to 1. In Gradstein (2007) elite group consists of people whose wealth is above a certain threshold level, which is higher for more autocratic societies. The median agent inside this ruling class determines the “regime”: either a conflict over the aggregate investment, when property rights are insecure, or peace, when there is no rent-seeking and property is absolutely secured. We partly follow the modeling methodology of both these papers.

In our model in the 1st and 2nd stages of the game agents take institutions as given. However, on the 1st stage of the game the quality of property rights protection is an endogenous variable and is determined by representative member of the elite. This “ruler” considers his possible pay-offs from $V_{1,\dots,8}$ and chooses the level of institutional quality q_E^* that gives him the highest possible pay-off. Note that in (PR, PR) equilibrium there is no rent-seeking and, hence, V_1 is independent on q . In (RS, PR) equilibrium V_5 depends on q . Thus, when choosing the optimal level of q elite takes into account its impact on V_5 . The ruler maximized his indirect utility function in (RS, PR) :

$$V_5 = U_E^{RS} \left(C_E^*(q, \dots), R_E^*(q, \dots), K_M^*(q, \dots), D_M^*(q, \dots), q \dots \right) \quad (1.15)$$

with respect to q . Subject to $0 < q \leq 1$. Let us denote the optimal solution by $q_E^*(\alpha, A, \theta, n, W)$.

Then $V_5^* = V_5(q_E^*)$ is the highest possible pay-off that a member of elite can get in conflict equilibrium. Masses in this case get $V_6^* = V_6(q_E^*)$. Thus, we can modify the conditions for (RS, PR) conflict to be Nash equilibrium on the second stage:

$$\begin{cases} V_5^* > V_1 \\ V_6^* > V_8 \end{cases} \quad (1.16)$$

Representative member of the ruling class rationally predicts, where he can get higher pay-off, in conflict equilibrium or in peace, and chooses the level of property rights protection that leads to his preferred equilibrium.

Summing up, the resulting institutional quality depends on both the type of equilibrium (or “regime”) and the value of $q_E^*(\alpha, A, \theta, n, W)$ if conflict regime is in place. If (PR, PR) is the equilibrium, then we assume that property rights are absolutely secured¹⁶, which means that $q^{**} = 0$. As a result institutional quality changes both continuously, inside one regime, and step-wise, when the transition from one regime to another takes place. This structure allows distinguishing between the impact of inequality on institutions a) through the incentives to engage in rent-seeking or production, or b) through the preferences towards the strength of property rights.

3.3 Economic growth

We provide a highly simplified variant of economic growth structure in our two-period model. We borrow the following modeling from Aghion et al. (1999). In accordance with well-known effects of learning-by-doing and capital externalities we define the next period productivity level as $A_{t+1} = Y_t = \int Y_{i,t} di = \int A_t K_{i,t}^\alpha di$. The standard way to find the economy’s

growth rates is to calculate $g_t = \ln\left(\frac{Y_t}{Y_{t-1}}\right)$, and, hence, we get $g_t = \ln\left(\frac{\int A_t K_{i,t}^\alpha di}{A_t}\right) = \ln\left(\int K_{i,t}^\alpha di\right)$.

Then, using the last equation in the context of our model, we see that economy’s growth rates depend on the number of agents that engage in productive activities, and on the intensity of their capital investment. In (RS, PR) equilibrium we get:

$$g_Y^* = \ln\left((1-n) \cdot (K_M^*)^\alpha\right), \quad (1.17)$$

and in (PR, PR) equilibrium growth rates are equal to:

$$g_Y^{**} = \ln\left((K^{**})^\alpha\right). \quad (1.18)$$

Now we have finished with the assumptions and methodology. In the following section we proceed to the analysis of equilibrium and its properties. We state our main results regarding the endogenous determination of property rights strength and conflict intensity depending on the distribution of wealth and power in the society.

¹⁶ The logics of this assumption may be based on well-known idea: when all agents produce and nobody expropriates, property rights are highly secured, because if somebody deviates to rent-seeking he will immediately get caught and punished. This is a famous “strength in numbers” argument.

4. The results: endogenous property rights, regime switches and conflict intensity

We start with (RS, PR) as Nash equilibrium on the second stage of the game. We derive optimal values of endogenous variables and explain how production and conflict intensity depend on wealth distribution and institutional quality parameters. Further we proceed to the explanation of endogenous institutional change: firstly, we describe the elite's choice of property rights' strength in (RS, PR) equilibrium, and, secondly, we add regime switches when wealth distribution changes. Finally, we provide an approximate classification of countries, based on the tightness of the ruling class, which allows to see, how institutional measures responds to changes in wealth distribution, depending on the country's current position.

4.1 Economic equilibrium: productive and unproductive expenditures

In this subsection we treat institutional quality as exogenously given. Below we give a definition of a (RS, PR) equilibrium (conflict) and derive optimal values of all endogenous variables on the 3rd stage of the game. Further, we study how productive and unproductive investments are affected by changes in wealth distribution if institutional quality is exogenous.

Definition 1

For a given value of q (which is going to be specified further), if (1.12) holds, and all $(1-n)$ agents from masses maximize (1.8) subject to (1.3), while all n agents from the elite maximize (1.9) subject to (1.5), the resulting set of variables' optimal values $(K_M^, D_M^*, C_M^*, R_E^*, C_E^*)$, which we get by intersecting the reaction curves of producer and expropriator, constitute (RS, PR) equilibrium.*

Moreover, we can provide a closed form representation of this equilibrium:

$$\frac{D_M^*}{R_E^*} = \frac{n}{1-n} \quad (1.19)$$

$$K_M^* = \left(A\alpha \left(1 - p^{PR} \frac{1}{1 + \frac{D_M^*}{\gamma R_E^*}} \right) \right)^{\frac{1}{1-\alpha}} = \left(A\alpha \left(1 - \frac{q}{\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1} \right) \right)^{\frac{1}{1-\alpha}} \quad (1.20)$$

$$Y_M^* = A \left(A\alpha \left(1 - \frac{q}{\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1} \right) \right)^{\frac{\alpha}{1-\alpha}} \quad (1.21)$$

$$R_E^* = \frac{Y_M^* \cdot q \cdot \frac{\theta}{1-\theta}}{\left(\frac{n}{1-n} + \frac{\theta(1-n)}{(1-\theta)n} \right)^2} \quad (1.22)$$

$$C_M^* = w_M - K_M^* - D_M^*, \quad C_E^* = w_E - R_E^* \quad (1.23)$$

Comparative statics of production and rent-seeking expenditures

Let us first consider how wealth distribution and institutional quality affect the incentives of masses for productive investment. As we can easily see from (1.19), each member of the elite group puts more effort in expropriation, than each member of masses puts into protection of his output. This is because the elite group is rather narrow and each member of the elite will benefit from investing in conflict with a higher probability than a member of masses. When the share of elite in population grows, the risks of expropriation for each producer also increase, and producers start to invest relatively more in protection. Since with higher n masses protect themselves more intensively, the share of output that goes to expropriator falls¹⁷. We also see from $\tau_{EM} = \frac{1}{1 + \frac{1}{\gamma} \cdot \frac{D_M^*}{R_E^*}}$ that τ_{EM} increases with γ . But if we recall that $\gamma = \frac{\theta(1-n)}{(1-\theta)n}$, it appears

that inequality has an ambiguous impact on the expected risks of expropriation. Below we consider it in more details.

From (1.20) it is clear that productive investment of one agent from masses decreases with higher risks of expropriation, which can be expressed as the expected share of output, transferred to rent-seeker, $p^{PR} \cdot \tau_{EM}$. These risks definitely increase if the elite become wealthier, which makes the elite more powerful combatant. The decline of institutional quality also increases the risks of expropriation through higher probability of encounter with rent-seeker. As a result both higher θ and q decrease expected returns on productive investment and lower K_M^* .

However, the impact of widening/narrowing the ruling class on the expropriation risks is more difficult. Firstly, an increase in elite's share in population leads to higher probability of

¹⁷ It is also worth mentioning that the ratio of investment in protection and expropriation does not depend on the size of the rent, Y_M^* , since it changes the incentives to expropriate and protect the output in the same way. This ratio also does not depend on the agents' relative fighting effectiveness, γ , since function $\tau_{EM} = \frac{1}{1 + \frac{1}{\gamma} \cdot \frac{D_M^*}{R_E^*}}$ is homogeneous of degree zero.

encounter with rent-seeker ($p^{PR} \uparrow$), which lowers the expected return on capital. Secondly, higher n means that wealth and power are dispersed among more agents, which makes them less efficient in conflict ($\gamma \downarrow$) and increases the expected return on capital (alternatively, according to Olson (1965), bigger group is less efficient in lobbying their interests). Finally, as we have already mentioned above, masses increase their expenditures on protection if there are more rent-seekers, $\left(\frac{D_M^*}{R_E^*} = \frac{n}{1-n} \uparrow \right)$, which also means lower risks and higher investment. The first effect decreases K_M^* , while the second and the third – increase, hence, the overall effect is ambiguous. However, for sufficiently low levels of n (recall that in our model $n < 0.5$ and $\theta > n$) the effect on K_M^* from changes in p^{PR} prevails over the effect from changes in τ_{EM} (through γ or $\frac{D_M^*}{R_E^*}$), and, eventually, an increase in the size of the ruling class (larger n) leads to lower K_M^* .

Proposition 1. Productive investment, inequality and property rights

In (RS, PR) equilibrium, $\forall n < 0.5, n < \theta$ the following holds:

$$1) \frac{\partial K_M^*}{\partial q} < 0 ; 2) \frac{\partial K_M^*}{\partial \theta} < 0 ; 3) \frac{\partial K_M^*}{\partial n} < 0 .$$

Proof – see appendix 1.1

Thus, better property rights protection increases productive investment and, thereby, accelerates economic growth (from (1.17)), which is consistent with famous arguments and observations of Hall and Jones (1999). The impact of inequality on productive investment is ambiguous and depends on the reasons of changes in wealth distribution. If the level of wealth inequality, measured as in (1.1), increases due to higher θ (for example, redistribution of wealth from rich to the poor), then capital investment decreases. If, on the other hand, inequality increases because of lower n (narrowing of the elite group), productive expenditures rise.

It is important to clarify the reasons of the overall negative relationship between n and K_M^* . When the number of rent-seekers rises, producers start to increase their protection, which reduces the risks. But the magnitude of this effect is positively related to the strength the masses, $1/\gamma$ (see (1.20)), which is rather low given $\theta > n$ and $n < 0.5$. In the same way, the effect of lower political power of larger rent-seeking group also becomes really important only if n is high, while in our model n is low. Finally, when the share of the elite in population is small,

masses lose rather big share τ_{EM} of their output ($\gamma \uparrow, \frac{D_M^*}{R_E^*} \downarrow$). Hence, the marginal effect that changes in p^{PR} have on K_M^* is rather strong. At the same time, the probability of meeting a rent-seeker, p^{PR} , is small, and, hence, the marginal effect that changes in τ_{EM} have on K_M^* is small as well.

One important implication of this result is that there is no monotonous impact of inequality on economic growth. In (RS, PR) equilibrium (even with exogenous, for now, property rights) economic growth rates (see (1.17)) decrease with higher n (lower inequality) due to lower number of producers and lower productive investment of each producer (which is in line with seminal papers of Murphy et al. (1991, 1993)). At the same time, growth accelerates with lower θ , which also means a decrease of inequality level.

Below we continue with the impact of wealth distribution parameters on the intensity of rent-seeking behavior. We introduce a RSE (rent-seeking expenditures) variable that stands for the aggregate expenditures on both expropriation and protection:

$$RSE = nR_E^* + (1-n)D_M^* = 2nR_E^*, \quad (1.24)$$

where the second equality follows from (1.19).

Proposition 2. Conflict intensity and inequality

In (RS, PR) equilibrium $\forall \theta > n, n < 0.5$ the following holds:

1) $\frac{\partial RSE}{\partial \theta} < 0;$

2) If $q > \tilde{q}(\theta)$, then $\begin{cases} \frac{\partial RSE}{\partial n} \geq 0, & \text{if } n \leq \tilde{n}(q) \\ \frac{\partial RSE}{\partial n} < 0, & \text{if } n > \tilde{n}(q) \end{cases}$

If $q \leq \tilde{q}(\theta)$, then $\frac{\partial RSE}{\partial n} > 0$. Moreover, $\frac{\partial \tilde{n}}{\partial q} < 0$ and $\frac{\partial \tilde{q}}{\partial \theta} < 0$.

Proof – see appendix 1.2.

Consequently, the intensity of rent-seeking behavior decreases if elite becomes more wealthy, because a) masses recognize that risks of expropriation increase, since elite can extract more, *ceteris paribus*, and, hence, productive investment decrease, which lowers the size of the rent; b) higher efficiency of investment in conflict allows the elite to invest less in order to get the same amount of rent. In other words, the fighting efforts of masses should be rather high if we expect the rising effectiveness of the elite to result in higher returns from expropriation and,

hence, more funds put in it. If the investment in protection is small, while the elite is quite effective in conflict, there is no incentives for the members of the elite to increase their expenditures. This result partly supports the logic of Cheikbossian (2008). Thereby, the progressive redistribution of wealth leads to higher rent-seeking intensity.

The consequences of the ruling class expansion are ambiguous and depend on the current tightness of the elite, wealth share of the elite, and institutional quality. On the one hand, growing number of rent-seekers lowers production incentives (see proposition 1), $\frac{\partial Y_M^*}{\partial n} < 0$, which means less rents to extract and, hence, lower incentives to invest in expropriation. On the other hand, higher n lowers fighting effectiveness of the elite, and increases the intensity of protection by masses. These changes lead to the following two effects: a) lower output share that a rent-seeker can extort from producer ($\tau_{EM} \downarrow$), which decreases the incentives to invest in expropriation; b) In order to get the same share of output as before, the rent-seeker has to invest more in expropriation¹⁸. The first of the last two effects dominates if the effectiveness of the elite lowers greatly, or if the intensity of protection increases sharply. However, both these things happen if n is sufficiently large, namely, if $n > \hat{n} = \frac{1}{1 + \sqrt{1/\theta - 1}}$. If n is not that large (which is true in our case) the second effect dominates, and it is profitable for the elite to increase rent-seeking efforts. Overall, it leads to non-monotonous dependence of RSE on n (namely, “inverted-U” shape).

However, if the effect of $\frac{\partial Y_M^*}{\partial n} < 0$ is not strong enough, RSE will start to decrease only for very high values of n , which do not belong to the set of $n < 0.5, n < \theta$. This happens if property rights are strong and masses are wealthy, which relaxes the adverse effect that increased number of rent-seekers has on production. Thus, the redistribution of funds from elite to masses may lead to worse consequences of the ruling class expansion. Unproductive investment may increase monotonically with higher n . Stronger property rights protection may cause the same effect.

In what follows we consider the endogenous property rights formation, and study how changes in wealth distribution affect institutional quality. Moreover, we consider how the dependence between property rights and inequality alters the results that we have discussed up to this point.

¹⁸ These two effects are somewhat similar to the standard income and substitution effects in consumer choice theory.

4.2 Endogenous property rights institutions in conflict equilibrium

As we have noticed in subsection 3.2, in order to determine the conditions for the second stage equilibrium to be (RS, PR) or (PR, PR) we first have to find the optimal level of property rights protection for the elite in (RS, PR) case.

The preferences of the elite towards the level of property rights protection are driven by three effects. On the one hand, weaker property rights make it easier to expropriate and increase the probability of success for a rent-seeker. On the other hand, it discourages producers from productive investment (since risks of expropriation increase), which lowers the amount of rent to be extracted. Finally, the level of property rights protection affects the expenditures that the elite has to make in order to get the desired amount of rent. The relative strength of these effects depends on wealth and group size inequality between elite and masses and determines the preferences of the elite towards the level of property rights protection. As we demonstrate below these preferences are single peaked.

Proposition 3. Endogenous property rights institutions

1. In (RS, PR) equilibrium there exists a unique level of property rights protection, q_E^* , which is optimal for the elite (maximizes (1.15) subject to q), such that

$$q_E^* = \min \left\{ 1, (1-\alpha) \left(\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1 \right) \right\}. \quad (1.25)$$

Moreover, if $q_E^* < 1$, i.e. while

$$\theta > \bar{\theta}(n, \alpha) = \frac{1}{1 + \frac{1-n}{n} \left(\phi(\alpha) - \frac{1}{n} \right)}, \quad (1.26)$$

the following holds: $\frac{\partial q_E^*}{\partial \theta} < 0$, $\frac{\partial q_E^*}{\partial n} < 0 \quad \forall \alpha, \theta, n \in \begin{cases} \theta > n \\ n < 0.5 \end{cases}$. Here we have $\phi(\alpha) = \frac{2-\alpha}{1-\alpha}$ and

$$\frac{\partial \bar{\theta}}{\partial n} < 0.$$

2. $q_E^* = \arg \max RSE$.

Proof – see appendix 1.3.

Thus, if inequality rises and members of the ruling class become richer because of the higher wealth share of the whole group (through legal or illegal redistribution of wealth, or through capital accumulation), the level of property rights protection improves. However, if members of the elite become richer due to narrowing of the ruling class (limiting access to power, less democratic political system), institutional quality falls. As reflected by (1.26), the more

narrow is the elite class the higher wealth share should belong to the elite for them to have incentives to set $q_E^* < 1$, i.e. to improve institutions when they become richer. This result disagrees with common opinion that higher inequality implies worse property rights institutions. Let us explain the intuition behind this result.

The main idea is that the wealth and power of the elite on the one hand, and weak property rights, on the other hand, are in some sense substitutes. If rent-seekers from elite are wealthy, they are effective in expropriation and can extort a large fraction of output even if institutions are rather strong. Moreover, a decline in the strength of property rights protection provides excessively large losses in the size of the rent and elite's utility, since a) the reduction in capital investment of masses is high since the risks of expropriation is high; b) the reduction in producers' output decreases rent-seekers' pay-offs heavily, because the share of this output the elite could have got is high. The tightness of the ruling class, in contrast, increases benefits and decreases costs of weak institutions: 1) the elite gets higher share (because of more effectiveness in conflict and less intensive protection by masses) of larger output (because of lower expropriation risks from producers' point of view); 2) the contraction of capital investment when institutions weaken is not as severe, if there are fewer rent-seekers. As a result, the tightness of the ruling class "compliments" weak property rights institutions. Below we demonstrate the logics of this result step-by-step.

Let us consider the equation that determines q_E^* :

$$\left. \frac{\partial V_5}{\partial q} = \frac{\partial U_E^{RS}}{\partial q} \right|_* = \frac{\partial U_E^{RS}}{\partial K_M^*} \cdot \frac{\partial K_M^*}{\partial q} + \frac{\partial U_E^{RS}}{\partial D_M^*} \cdot \frac{\partial D_M^*}{\partial q} + \frac{\partial U_E^{RS}}{\partial R_E^*} \cdot \frac{\partial R_E^*}{\partial q} + \frac{\partial U_E^{RS}}{\partial q} = 0 \quad (1.27)$$

First, when choosing the level of property rights protection, elite considers expenditures on rent-seeking, their own and of masses. However, $\frac{\partial U_E^{RS}}{\partial R_E^*} \cdot \frac{\partial R_E^*}{\partial q} = 0$, given that R_E^* максимизирует

U_E^{RS} , and $\frac{\partial U_E^{RS}}{\partial D_M^*} \cdot \frac{\partial D_M^*}{\partial q} = 0$, given that q_E^* максимизирует D_M^* (see proposition 2, part 2). That

is why we can ignore the 2nd and the 3rd terms in (1.27).

Further, using (1.27), we write down what is the marginal benefits of increasing q :

$MB_q = \frac{\partial U_E^{RS}}{\partial q} = Y_M^* \cdot \tau_{EM}^*$ (4th term in (1.27)), which decrease with q . While marginal costs of q

are: $MC_q = \frac{\partial U_E^{RS}}{\partial K_M^*} \cdot \frac{\partial K_M^*}{\partial q} = (Y_M^*)'_K \cdot q \cdot \tau_{EM}^* \cdot (K_M^*)'_q$ (the 1st term in (1.27)) and increase with q .

Let us consider the impact of wealth and tightness of the ruling class on MB_q and MC_q . We start with the impact of θ on MB_q and MC_q .

The marginal costs of weaker institutions consist of lower rent available for rent-seekers, Y_M^* , since producers decrease their capital investment. These costs are substantial if the utility gains from higher rent are big ($(Y_M^*)_K \cdot q \cdot \tau_{EM}^* \uparrow$), and if masses decrease their investment sharply ($(K_M^*)_q \uparrow$) when institutions decline. Rich elite gets high share of the output, τ_{EM}^* , while the output of poor masses reacts sharply on changes in K_M^* . That is why the richer is the elite, higher are utility losses from weakening property rights. Moreover, masses decrease capital investment the stronger, the richer is the elite, because higher probability of expropriation is supplemented by higher lost share of output. As a result, we have $(MC_q)'_\theta > 0$.

Marginal benefits from weakening property rights protection come from higher probability of successful expropriation. And the higher is the size of extracted rent, $Y_M^* \cdot \tau_{EM}^*$, the higher is MB_q . Rich elite gets bigger share of output, which increases MB_q , but, at the same time, higher wealth and power of the elite increases risks and, therefore, decreases Y_M^* and MB_q . However, the last effect is dominated by the previous effects (both on MB_q and MC_q). Summing up, the richer is the elite, the stronger are the property rights institutions, other things being equal, in (RS, PR) regime.

The rise in inequality through narrowing of the elite class has an opposite effect. Firstly, lower n means higher MB_q , because masses invest more in production ($Y_M^* \uparrow$) and less – in protection ($D_M^* / R_E^* \downarrow$), while the elite becomes more effective in rent-seeking. It leads to higher rent, extracted by the elite, and $MB_q = Y_M^* \cdot \tau_{EM}^*$ increases. The impact of the elite group size on MC_q is more difficult, but almost always we have $(MC_q)'_n > 0$. There are two main reasons for that: 1) the decrease in capital investment in response to weaker institutions is not severe, if risks of expropriation is rather low; 2) when number of rent-seekers is low, K_M^* is high, and, hence, changes in output, $(Y_M^*)_K$, are small. In total, narrowing of the ruling class makes its representative member to prefer worse institutions, higher q_E^* in (RS, PR) regime.

Corollary 1. Inequality and economic growth

The endogenous determination of property rights makes the impact of inequality on productive expenditures and growth more complicated. Inequality affects capital investment both

directly (see proposition 1) and indirectly – through the strength of institutions. The higher wealth share of the elite decreases output and growth directly, but it also increases institutional quality and, hence, fosters growth. Likewise, the narrowing of the ruling class means lower number of rent-seekers, which increases returns on capital investment, but it also worsens institutions, which hampers growth. This ambiguity stresses the impossibility of any linear dependence between inequality and growth. In present version of the model the mentioned effects neutralize each other in such a way that $K_M^*(q_E^*)'_\theta = 0$, $K_M^*(q_E^*)'_n = 0$ ¹⁹, if (1.26) holds, while if (1.26) is violated, the dependence between growth and wealth distribution is characterized by proposition 1. Hence, if $\theta < \bar{\theta}$ (i.e. if the elite is not very wealthy), an increase in θ decreases growth, while a decrease in n increases growth. If $\theta > \bar{\theta}$ (rich elite) then there is no effect of elite's wealth share on growth, but there still is a negative impact of higher n on growth (see (1.17)).

Corollary 2. Inequality and conflict intensity

In proposition 3 we also state (part 2) that when elite choose the level of property rights protection, driven by their pay-off maximization, they maximize the intensity of conflict (aggregate rent-seeking expenditures). The resulting impact that inequality has on rent-seeking intensity now consists of direct influence (see proposition 2) and indirect – via institutional

strength. Since $\frac{\partial R_E^*}{\partial q_E^*} = 0$, the effect of θ and n on RSE with endogenous institutions is the same,

as with exogenous property rights. To see this, we simply consider the derivative of $RSE = 2nR_E^* = RSE\left(n, R_E^*(\theta, n, q_E^*(\theta, n))\right)$ with respect to θ and n . Obviously,

$$\frac{\partial RSE}{\partial \theta} = \frac{\partial RSE}{\partial R_E^*} \cdot \left[\left(R_E^*\right)'_\theta + \frac{\partial R_E^*}{\partial q_E^*} \cdot \left(q_E^*\right)'_\theta \right],$$

where the second term in brackets equals zero. Hence,

we have the same dependence, as in the exogenous institutions case. In a similar way we can show that the form of relationship between conflict intensity and size of the elite group stays the same. However, with endogenous institutions there is an exact equilibrium value of institutional quality. It can be shown that $q_E^*(\theta, n) < \tilde{q}(\theta)$, which means (see proposition 2) that conflict intensity monotonically increases with the expansion of the ruling class.

¹⁹ This special case is a consequence of simplifying assumptions we have made. In particular, this result will no longer hold if in the process of endogenous institutional formation the preferences of masses are taken into account with non-zero weight. Analogously, this result will be violated if the utility function is, for example, logarithmic instead of quasi-linear.

Institutional quality may change not only because elite changes its preferences towards the security of property, but also because the nature of the equilibrium, conflict or peace, switches. Below we consider the impact of wealth distribution parameters on the Nash equilibrium on the 2nd stage of the game.

4.3 Regime switches: conflict or peace

We can express the pay-offs of masses and elite in different equilibria on the second stage of the game. In definition 1 we have all the optimal values for the conflict, (RS, PR) , equilibrium. Inserting (1.19) – (1.23) into (1.8) and (1.9), after some algebraic manipulations we get, correspondingly:

$$\begin{aligned} V_6 &= U_M^{PR}(C_M^*, K_M^*, D_M^*, R_E^*) = w_M - K_M^* - D_M^* + Y_M^* \left(1 - \frac{nq}{1-n} \tau_{EM}^*\right) = \\ &= \frac{(1-\theta)W}{(1-n)} + K_M^* \cdot \mu(\theta, n, q, \alpha) \end{aligned} \quad (1.28)$$

$$V_5 = U_E^{RS}(C_E^*, R_E^*, K_M^*, D_M^*) = w_E - R_E^* + qY_M^* \tau_{EM}^* = \frac{\theta W}{n} + Y_M^* \cdot \nu(\theta, n, q) \quad (1.29)$$

Further we can use (1.25) to modify (1.28) and (1.29) in order to get the maximum possible pay-off of the elite in (RS, PR) equilibrium, which is $V_5(q_E^*) = V_5^*$, and the pay-off of masses, which is $V_6(q_E^*) = V_6^*$. It is also easy to derive the expressions for V_1 and V_2 , which correspond to the optimal investment decisions of the elite and masses in (PR, PR) equilibrium:

$$V_1 = U_E^{PR}(C_E^{**}, K^{**}) = w_E - K^{**} + Y^{**} = \frac{\theta W}{n} + (A\alpha)^{\frac{1}{1-\alpha}} \left(\frac{1}{\alpha} - 1\right) \quad (1.30)$$

$$V_2 = U_M^{PR}(C_M^{**}, K^{**}) = w_M - K^{**} + Y^{**} = \frac{(1-\theta)W}{(1-n)} + (A\alpha)^{\frac{1}{1-\alpha}} \left(\frac{1}{\alpha} - 1\right) \quad (1.31)$$

Next we consider conditions, under which the conflict (RS, PR) equilibrium is realized as Nash equilibrium on the second stage of the game, namely (1.16). If $V_5^* > V_1$ holds, then the representative agent of the ruling class prefers to become a rent-seeker, not producer. The second condition, $V_6^* > V_8$, turns out to be nonbinding²¹, which means that if $V_5^* > V_1$ then $V_6^* > V_8$. If, on the other hand, $V_5^* < V_1$ holds, then Nash equilibrium is (PR, PR) .

²⁰ $\mu(\theta, n, q, \alpha) = \frac{1}{\alpha} - \frac{1}{\alpha} \left[\frac{1}{q} - \frac{1}{\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1} \right]^{-1} \cdot \frac{\theta(1-n)}{(1-\theta)n} \cdot \left(1 + \frac{\theta(1-n)^2}{(1-\theta)n^2}\right)^{-2} - 1$, $\nu(\theta, n, q) = q \left(1 + \frac{(1-\theta)n^2}{\theta(1-n)^2}\right)^{-2}$

²¹ The more detailed explanation of this is quite extensive and is available upon request from the author.

Proposition 4. Endogenous regime switches

The conflict (RS, PR) regime constitutes Nash equilibrium if $V_5^* > V_1$ holds, which is equivalent to:

$$\theta > \bar{\bar{\theta}}(n, \alpha) = \frac{1}{1 + \left(\varphi(\alpha) \cdot \frac{1-n}{n} - 1 \right) \cdot \left(\frac{1-n}{n} \right)^2}, \quad (1.32)$$

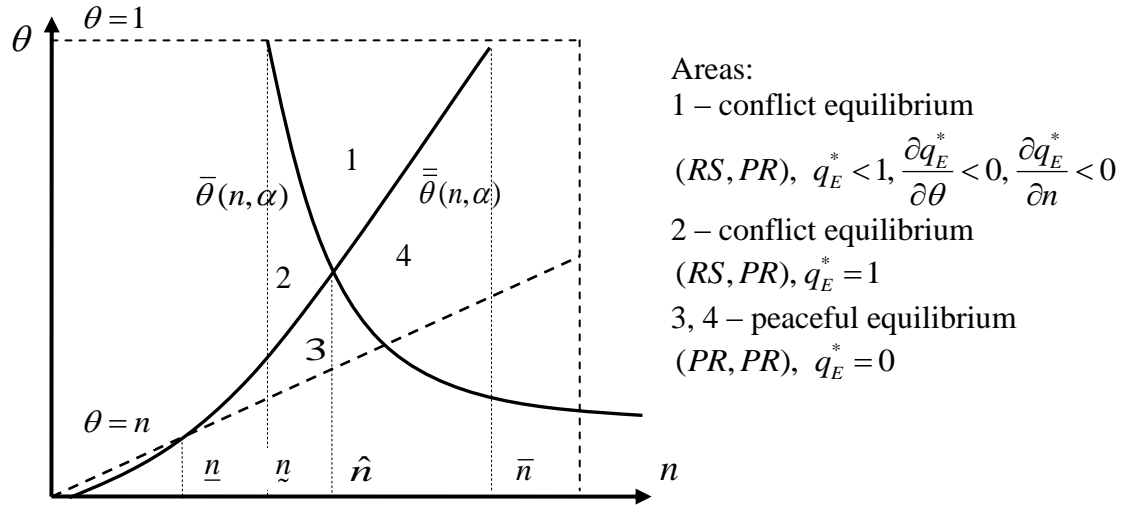
where $\frac{\partial \bar{\bar{\theta}}}{\partial n} > 0 \quad \forall n, \alpha \in \begin{cases} \theta > n \\ n < 0.5 \end{cases}$ and $\varphi(\alpha) = \alpha^{\frac{\alpha}{1-\alpha}}$. Otherwise, if $\theta < \bar{\bar{\theta}}(n, \alpha)$, a peaceful

(PR, PR) constitutes Nash equilibrium.

Proof – see appendix 1.4.

Thus, high inequality creates a fertile ground for conflict equilibrium to emerge, which corresponds with the ideas of Gradstein (2007). Indeed, the richer is rent-seeker the higher output share he can extract in conflict. Moreover, higher fighting effectiveness allows wasting less wealth in expropriation (see proposition 2), which leaves more for consumption (see (1.23)). There is also a reduction of capital investment by masses due to higher risks of expropriation, but this effect is offset by better property rights protection. Overall, higher θ increases the attractiveness of rent-seeking for the elite. The similar effect comes from the narrowing of ruling class: the relative defensive spendings of masses decrease, the effectiveness of the elite increases, while expenditures on expropriation falls. Consequently, lower n makes rent-seeker occupation more favorable for the elite. As a result, the more narrow is the ruling class the less wealthy it should be in order for conflict regime to be an equilibrium (see (1.32)).

If the economy rests in conflict equilibrium, its property rights strength and changes are determined by proposition 3. If, on the other hand, the economy is in the peaceful stage, property rights are perfectly secured. Figure 1 below depicts functions $\bar{\theta}(n, \alpha)$ and $\bar{\bar{\theta}}(n, \alpha)$, as well as the areas corresponding to different institutional regimes. Thereby, we put together our results on endogenous institutions from previous propositions.



Picture 1. Wealth distribution and institutional regime

As it follows from proposition 4 (and it can be seen on the graph), for transition to equilibrium with no rent-seeking, secured property rights and fast growth (areas 3 and 4) to occur, it is necessary to reduce inequality: redistribute wealth from elite to masses or to expand the ruling class. However, in conflict equilibrium (areas 1 and 2) progressive redistribution of wealth lowers institutional strength (proposition 3). Institutional quality continues to decrease with lower θ , until the incentives of the elite change from rent-seeking to production, and the transition to peace stage takes place. Moreover, the narrower is the ruling class in the beginning of transition process, the larger wealth redistribution is needed for the transition to happen, and the lower will the institutional quality fall before the elite switches to production. The conflict equilibrium appears to be a kind of institutional trap: lower wealth share of the elite first leads to worse property rights protection, while the expansion of the ruling class will not be supported by the population (it is unfavorable in terms of the pay-offs for both elite and masses)²².

Another argument that points on the negative consequences of lowering inequality for improving institutional framework lies in conflict intensity. The reduction of inequality, which is necessary for peaceful equilibrium, leads to an increase in conflict intensity (see corollary 2). The closer the distribution of wealth becomes to one that enables transition to peaceful stage, the higher is the intensity of rent-seeking.

Now we can evaluate the institutional consequences of changes in wealth distribution for countries with different tightness of the ruling class.

Proposition 5. Taxonomy of institutional regimes and changes

²² This statement can be proved formally and is available upon request from the author.

- (a) $\exists \underline{n}(\alpha)$: $\underline{n}(\alpha) = \bar{\bar{\theta}}(\underline{n}(\alpha), \alpha)$, for which the following holds: if $n \leq \underline{n}(\alpha)$, then $\forall \theta \in [n, 1]$: $q_E^* = 1$.
- (b) $\exists \underline{\bar{n}}(\alpha)$: $\bar{\theta}(\underline{\bar{n}}(\alpha), \alpha) = 1$, for which the following holds: if $\underline{n}(\alpha) < n \leq \underline{\bar{n}}(\alpha)$, then, and $\forall \theta \in [n, \bar{\theta}]$: $q_E^* = 0$.
- (c) $\exists \hat{n}(\alpha)$: $\bar{\theta}(\hat{n}(\alpha), \alpha) = \bar{\bar{\theta}}(\hat{n}(\alpha), \alpha)$, for which the following holds: if $\underline{\bar{n}}(\alpha) < n \leq \hat{n}(\alpha)$, then $\forall \theta \in (\bar{\theta}, 1]$: $q_E^* < 1$, $\frac{\partial q_E^*}{\partial \theta} < 0$ and $\forall \theta \in (\bar{\bar{\theta}}, \bar{\theta}]$: $q_E^* = 1$, $\frac{\partial q_E^*}{\partial \theta} = 0$ and $\forall \theta \in [n, \bar{\bar{\theta}}]$: $q_E^* = 0$.
- (d) $\exists \bar{n}(\alpha)$: $\bar{\theta}(\bar{n}(\alpha), \alpha) = 1$, for which the following holds: if $\hat{n}(\alpha) < n \leq \bar{n}(\alpha)$, then $\forall \theta \in (\bar{\bar{\theta}}, 1]$: $q_E^* < 1$, $\frac{\partial q_E^*}{\partial \theta} < 0$, and $\forall \theta \in [n, \bar{\theta}]$: $q_E^* = 0$. If, finally, $\bar{n}(\alpha) < n < 0.5$, then $\forall \theta \in [n, 1]$: $q_E^* = 0$.

Proof. It is sufficient to use the definitions of $\bar{\theta}(n, \alpha)$ and $\bar{\bar{\theta}}(n, \alpha)$.

In accordance with proposition 6 we can divide countries into 5 types, depending on the tightness of the ruling class, and characterize the impact that changes in wealth distribution will have in each country type.

1. Countries with extremely narrow ruling class ($n \leq \underline{n}(\alpha)$) rest in the stage of conflict with very weak institutions, and the redistribution of wealth from elite to masses will not result in regime switch and institutional development. Moreover, such policy increases unproductive expenditures on rent-seeking. In contrary, if wealth is concentrated in the hands of the elite, conflict intensity is almost zero (high θ , low n). Only the expansion of the ruling class may give such countries a chance to escape institutional trap.
2. Countries with slightly wider elite ($\underline{n}(\alpha) < n \leq \underline{\bar{n}}(\alpha)$) can get out of institutional trap only through very intensive and severe redistribution of wealth and power. This process is accompanied by sharp conflict intensification, while institutions do not improve before the regime changes. When the regime switches, property rights protection drastically increases, while conflict vanishes.
3. If the ruling class is even wider ($\underline{\bar{n}}(\alpha) < n \leq \hat{n}(\alpha)$), good institutions may exist either when elite is extremely rich or when inequality is low. In intermediate cases property rights are weak and worsen if elite loses wealth. If such countries fail to establish peace regime, the intensity of conflict is even higher than in pure autocracies described above.

4. Further, there are countries that can be named democracies ($\hat{n}(\alpha) < n \leq \bar{n}(\alpha)$). However, if wealth is highly concentrated in the hands of elite, such countries find oneself in a conflict equilibrium with very intensive rent-seeking (even higher than in previous non-democratic regimes – “captured democracy” (Acemoglu and Robinson (2008))). Intensive conflict may coexist with rather good level of property rights protection. Redistribution of wealth first decreases institutional quality, but this fall does not last for a long time – regime switch takes place soon.
5. Finally, only countries with really wide access to power and political decision making ($\bar{n}(\alpha) < n < 0.5$, established democracies) can be characterized by strong property rights protection and no rent-seeking between masses and elite, irrespective of the wealth share owned by the elite.

In the next section we briefly discuss our results and interpret them in the context of ambiguous empirics and historical cases.

5. Discussion and possible extensions

Our results indicate that in extremely authoritarian countries ($n \leq \underline{n}$) lowering inequality can only intensify conflict. In countries with intermediate tightness of the ruling class ($\underline{n} < n \leq \hat{n}$) a rise in inequality level also more often results in “not worse” institutions than in more democratic countries ($n > \hat{n}$). These results and the logic of our model can be a possible explanation for the empirical evidence of Amendola et al. (2013). Authors find that in less democratic countries the relationship between inequality and property rights is positive, while in more democratic – negative. Hence, in nondemocratic regimes the expansion of the ruling class and not the redistribution of wealth should be the goal. At the same time, the fact that institutional improvement in many cases is accompanied with conflict intensification should be taken into account.

The cases we mention in section 2.1 can be interpreted in the framework we propose. In such a way, Japanese colonizers in South Korea constituted a substantial share of population and were wealthy and powerful (area 1, $\underline{n} < n \leq \hat{n}$). After the independence the ruling class was represented by chebols (big companies) and slightly expanded (area 1, $\hat{n}(\alpha) < n \leq \bar{n}(\alpha)$). Overall, the distribution of wealth in (post)colonial time was favorable for good property rights protection (with quite high rent-seeking and corruption (Khan and Jomo, 2000) due to conflict equilibrium and high n). The case of India is a contrast: British colonizers (the elite) were very few in

numbers and not wealthy enough to control the local population (area 2, $n < \hat{n}$, low θ). Hence, British colonizers established weak institutions – only that way they could extract rent from local producers (and the latter had some incentives to invest). After the independence India was characterized by widespread rent-seeking (Khan and Jomo, 2000), since there were no powerful elite, but many sources of power to influence on policymaking.

Other historical case from Acemoglu et al. (2002) also confirms our logics. European colonizers in Americas were disposed to establishing strong property rights if the local population did not offer substantial resistance. It was the case of not thickly settled and not economically (and military) strong local population, who did not create sufficient rent for expropriation. Otherwise, if European colonizers constituted only a little share in population, while locals were strong and wealthy, then the equilibrium with weak institutions and intensive conflict emerged. It is important to note that we only use the data and cases of Acemoglu et al. (2002), while the explanation is different.

The case of Russia also fits the model. In the 90th Russia was characterized by the absence of strong centralized power, given that the wealthy group of oligarchs was very narrow. The result was the conflict equilibrium with widespread corruption and rent-seeking, and weak property rights (Sonin, 2003) – area 1, $\hat{n} < n \leq \hat{n}$. However, eventually, when wealth and power consolidated in the hands of the ruling class, the quality of institutions started to improve. At the same time, the situation is now even farther from “no-rent-seeking – high growth” equilibrium, as, to some extent, is indicated by Yakovlev et al. (2014).

It also worth noting that our model predicts a “U-shaped” relationship between the tightness of the ruling class and economic growth: in conflict equilibrium higher number of rent-seekers hampers growth (see corollary 1), while in the “long run” increase in n leads to the switch towards high growth equilibrium. At the same time, we get an “inverted-U” relationship between the tightness of the ruling class and rent-seeking intensity: in a conflict stage higher n increases rent-seeking intensity, while after a switch to peaceful stage rent-seeking vanishes. Both these predictions of our model provide an explanation for the empirical observations on democracy – growth and democracy – corruption relationships (see Mohtadi and Roe (2003)).

As a prospect for further research we can offer several theoretical hypotheses to be tested empirically: 1) the sign of the impact of inequality on property rights in developing countries depends on how we measure inequality (“a share of wealth of a given percentile” – positive sign, or “which share of population owns a given wealth share” – negative sign); 2) in nondemocratic countries good institutions occur either under very wealthy elite or under rather low level of inequality (intermediate cases – worse institutions). Moreover, the model can be enriched by considering the case, when masses can expropriate the elite’s wealth. It also worth modeling the

similar structure, but with common wealth effects (f.e. log utility), as well as the situation, where agents from one class can choose different occupations.

6. Conclusion

In this paper we have analyzed the impact of inequality in wealth distribution on the strength of property rights institutions and the intensity of conflict. The model of asymmetric rent-seeking with endogenous institutions is constructed. The results we got imply that the negative impact of inequality on institutions is only a special case, while generally the relationship is conditional on the tightness of the ruling class, reasons of changes in wealth distribution, and current equilibrium type – conflict or peace.

Firstly, the reason of changes in wealth distribution matters. Reducing inequality through progressive redistribution of wealth and power, which lowers wealth share of the elite, leads to a decline of institutional strength. However, this result holds for countries in the stage of conflict. And since the transition to peaceful stage requires lowering inequality, there emerges a non-monotonous dependence of property rights quality on elite's wealth. Reducing inequality through the expansion of the ruling class improves institutional quality, but it also increases rent-seeking intensity.

Secondly, initial tightness of the ruling class matters. Thus, for the most autocratic countries the consequences of lowering inequality are expected to be negative: institutional quality will not notably improve, while conflict intensity increases sharply both with redistribution and ruling class expansion. Countries with wider ruling class may establish strong property rights either with very rich and powerful elite or with wealth distribution close to uniform. Intermediate cases correspond to worse institutions. For more democratic countries the positive effect of wealth inequality on institutions almost vanishes.

Finally, our results help to explain some empirical evidence and historical cases, and give additional reasoning of why there is no linear relationship between inequality and economic growth.

Appendix 1. Proofs

A.1.1 Proof of proposition 1

It is clear from (1.20) that $\frac{\partial K_M^*}{\partial q} < 0$ и $\frac{\partial K_M^*}{\partial \theta} < 0$. Let us explore the sign of the first derivative $\frac{\partial K_M^*}{\partial n}$. It is easy to show that $\frac{\partial K_M^*}{\partial n} > 0$ if $n > \hat{n} = \frac{1}{1 + \sqrt{1/\theta - 1}}$. However, the set of

$$n: \begin{cases} n > \hat{n} \\ \theta > n \\ n < 0.5 \end{cases} \text{ is empty, since } \hat{n} < 0.5 \text{ is equivalent to } \theta < 0.5, \text{ while } \hat{n} < \theta \text{ is equivalent to } \theta > 0.5,$$

which leads us to a contradiction. Hence, $\frac{\partial K_M^*}{\partial n} < 0$ on the admissible set of n . **Q.E.D.**

A. 1.2 Proof of proposition 2

The incentives of the elite to invest in expropriation are determined by the equality of marginal benefits, $MB_{R_E} = Y_M \cdot q \cdot \frac{\partial \tau_{EM}}{\partial R_E}$, and marginal costs, $MC_{R_E} = 1$, of expropriation.

Because of the properties of CSF, τ_{EM} , we have $\frac{\partial^2 \tau_{EM}}{\partial R_E^2} < 0$, i.e. MB_{R_E} decreases with R_E .

1) From proposition 1 and (1.21) it is clear that $\frac{\partial Y_M^*}{\partial \theta} < 0$, which lowers the marginal benefits of

expropriation. Moreover, $\frac{\partial^2 \tau_{EM}}{\partial R_E \partial \theta} < 0$ if $\frac{D_M}{R_E} < \frac{\theta(1-n)}{(1-\theta)n}$. In (RS, PR) equilibrium the holds:

$$\frac{D_M}{R_E} = \frac{D_M^*}{R_E^*} = \frac{n}{1-n}, \text{ and hence, } \frac{\partial^2 \tau_{EM}}{\partial R_E \partial \theta} < 0 \text{ if } \frac{n}{1-n} < \frac{\theta(1-n)}{(1-\theta)n}, \text{ i.e. if } n < \frac{1}{1 + \sqrt{1/\theta - 1}} = \hat{n}, \text{ which}$$

is true $\forall \theta > n, n < 0.5$ (see proof of proposition 1). Thus, in (RS, PR) equilibrium it is always

true that $\frac{\partial^2 \tau_{EM}}{\partial R_E \partial \theta} < 0$. As a result, $\frac{\partial MB_{R_E}}{\partial \theta} < 0$, which guarantees $\frac{\partial R_E^*}{\partial \theta} < 0$ (since MB_{R_E}

decreases with R_E). Finally, it follows (see (1.24)) that $\frac{\partial RSE}{\partial \theta} < 0, \forall \theta > n, n < 0.5$. **Q.E.D.**

2) From proposition 1 and (1.21) it is clear that $\frac{\partial Y_M^*}{\partial n} < 0$, which lowers the marginal benefits of

expropriation. Moreover, doing the same calculation as in the previous proof, we get that in

(RS, PR) equilibrium it always holds that $\frac{\partial^2 \tau_{EM}}{\partial R_E \partial n} > 0$, which increases marginal benefits from

expropriation. Together these two effects generate non-monotonous "Inverted-U" relationship between RSE and n .

Farther proof is not difficult but tedious, and we do not provide it here. It is available upon request from the author.

Q.E.D.

A.1.3. Proof of proposition 3

1. Consider (1.29). Note that the following holds: a) $\frac{\partial Y_M^*}{\partial q} < 0$ and $\frac{\partial v}{\partial q} > 0$, b) $\lim_{q \rightarrow 0} \frac{\partial V_5}{\partial q} > 0$, and c) equation $\frac{\partial V_5}{\partial q} = 0$ has a unique solution, $q_E^* = (1-\alpha) \left(\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1 \right)$.

Hence, the dependence of V_5 on q is non-monotonous and has an “Inverted-U” shape. Since $V_5(q)$ is a strictly concave function, while the set of admissible values of q is convex, the argmax of $V_5(q)$ is unique. However, it can lie to the right of 1 – in this case we have a boundary optimum, $q_E^* = 1$. Further, from $(1-\alpha) \left(\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1 \right) < 1$ it is straightforward to get

$\theta > \frac{1}{1 + \frac{1-n}{n} \left(\phi(\alpha) - \frac{1}{n} \right)} = \bar{\theta}$. Noting the proof of proposition 1, it is easy to show that

$\frac{\partial q_E^*}{\partial \theta} < 0$, $\frac{\partial q_E^*}{\partial n} < 0$. It is easy to verify that $\frac{\partial \bar{\theta}}{\partial n} < 0$. **Q.E.D.**

2. Consider the derivative of RSE with respect to q and equate it to zero. Then we simply solve for $q = (1-\alpha) \left(\frac{(1-\theta)n}{\theta(1-n)} + \frac{1}{n} - 1 \right) = q_E^*$. **Q.E.D.**

A.1.4. Proof of proposition 4

Let us insert (1.25) into (1.29), and then subtract (1.30) from what we get. Then ask for $V_5^* > V_1$. Simple algebraic manipulations result in $\phi(\alpha) > \frac{n}{1-n} \left(1 + \left(\frac{1}{\theta} - 1 \right) \left(\frac{n}{1-n} \right)^2 \right)$, from where

we get $\theta > \frac{1}{1 + \left(\phi(\alpha) \cdot \frac{1-n}{n} - 1 \right) \cdot \left(\frac{1-n}{n} \right)^2} = \bar{\theta}(n, \alpha)$. Finally, verify that $\frac{\partial \bar{\theta}}{\partial n} > 0$. **Q.E.D.**

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