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ENDOGENOUS INSTITUTIONS AND CONFLICT IN THE MODEL OF TRANSITION FROM STAGNATION TO GROWTH

We investigate[1] the impact of inequality in wealth distribution on the joint dynamics of conflict intensity and pro-growth institutions in the historical perspective. We build a two-sector endogenous growth model with political conflict between the traditional elite and the emerging class of capitalists during the transition from stagnation to growth. First, our model attempts to explain different moments of industrialization worldwide. Second, we capture various paths of conflict intensity: hump-shaped path, almost absent conflict, and other. We show that the distribution of wealth has a non-monotonous impact on the intensity of conflict and institutions supporting industrialization. Namely, higher inequality in land distribution may be detrimental to industrialization, but may lower conflict intensity. In contrast, higher inequality in capital holdings may be growth-enhancing.

Introduction and related literature

As suggested in [Galor et al., 2005; 2009], a significant part of cross-country variation in levels and growth rates of GDP per capita can be explained by differences in the moments of transition from the stage of stagnation with miniscule technological progress to modern growth regime. In [Acemoglu, Robinson, 2012] the authors state that the industrial revolution, which marked the transition to a new era, was accompanied by a social conflict between the traditional (landowning) elite and the embryonic class of manufacturers and capitalists. Moreover, not only the moment of transition matters. The historical evidence (see [Challier et al., 2010; Acemoglu, Robinson, 2012; Lagerlöf, 2013]) indicate that the intensity of conflict varied non-monotonously both over time and across countries. What can explain

[1] The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics in 2015.

these variations? We argue that the intensity of conflict[2] and the quality of economic institutions during the transition crucially depend on the distributions of land and capital both between and within social classes. Our study contributes to the current literature, showing that inequality not necessarily hampered industrialization and development [Boschini, 2006; Galor et al., 2009].

The institutional and political economy approach, to which we are related closest, considers institutional changes that favored the adoption of new technologies (and thus, industrialization and growth) as an outcome of a conflict between different groups with opposing interests (see [Bertocchi, 2006; Doepke, Zilibotti, 2008; Lagerlöf, 2009; Galor et al., 2009]). One of the main mechanisms behind the conflict is the following. Labor starts to migrate from the traditional sector (agrarian) to the modern sector (industrial), driven by higher wages due to technological progress. The traditional elite (landowners) starts to lose its rent from land and labor exploitation, and, hence, tries to block the technological progress (or education reforms). The incipient class of capitalists has the opposite incentives. This may result in a conflict over political power and ability to establish the preferred institutional framework.

The specificity of many (if not all) existing papers in this field is the assumption that institutions are determined by a simple political process: majority voting or directly by the elite (veto power) — see e.g. [Bertocchi, 2006; Galor et al., 2009; Lagerlöf, 2009]. Therefore, there is no actual "conflict": no efforts or struggle over the institutional framework, which in fact was a very important feature of the industrialization period [Acemoglu, Robinson, 2012]. Moreover, in the existing literature institutions change either due to steady capital and wealth accumulation (and, hence, less restrictive voting franchise), or due to a switch in preferences of the elite: when capital starts to play more important role in elite's assets than their land holdings [Galor et al., 2009]. However, Doepke and Zilibotti (2008) suggest that changes in the relative political power, and not in the preferences of the "old" elite, were often the key driver of changes in institutions. Hence, the incentives and ability to influence the institutional structure is what matters for the timing of take-off. When the economy accumulates capital and the distribution of assets between and within classes evolves, the incentives and abilities to alter institutions also change, thereby affecting political power, conflict intensity and institutional set-up.

We argue that taking into account the mechanisms of conflict over the institutional set-up will help us to explain different paths of technological and institutional

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[2] In some countries conflict was intensive and violent (France and Spain), and in other it was more peaceful (England); while in some cases the transition to modern growth regime still hasn't occurred (e.g. number of African countries) both with and without periods of conflict between traditional elite and emerging capitalists.

development. Quite a similar process of economic institutions determination was also presented in [Acemoglu, Robinson, 2008].

The present research complements the existing literature in two aspects. First, we contribute to the understanding of why the moments of transition from stagnation to growth vary so much between countries. We show that the inability (and lack of incentives) of emerging capitalists to oppose the elite in blocking technological development comes from the shape of capital distribution both within and between social classes. Second, we capture the historical patterns of changes in the intensity of conflict: it's (almost) absence in some periods, while rises and falls in other periods.

In order to answer the above questions we build a dynamic model of transition from stagnation to growth with endogenous institutions and political conflict.

The model

The economic structure of the model is similar to [Bertocchi, 2006; Cervellatti et al., 2008; Galor et al., 2009]. Political conflict is modelled in accordance with the literature on asymmetric public policy contests (see [Epstein, Nitzan, 2006; Cheikbossian, 2008; Baik, 2008]).

Production

The economy consists of two sectors: traditional, with "land" T and labor L_T as inputs, and the following Cobb-Douglas technology

$$Y_t = A_T T^{\alpha} L_T^{1-\alpha}, \tag{1}$$

where A_T is the sector productivity level. The modern sector employs physical capital K and labor L_M as inputs. The productivity level also differs and equals A_M. Therefore, with Cobb-Douglas technology we have

$$Y_M = A_M K^{\alpha} L_M^{1-\alpha}. \tag{2}$$

Technological progress in both sectors will be specified below. We also assume that labor is perfectly mobile. The aggregate product of the economy is $Y = Y_M + Y_T$, i.e. the two goods produced in the sectors are perfect substitutes. The final good can either be consumed or saved in the form of bequest to the offspring.

Population

We consider an OLG model with bequests where each generation lives for two periods. The total population is constant. Initially, households are divided into three classes: landowning elite ($\mathcal{L}$), which constitutes a share λ_L of population, landless capitalists ($\mathbb{C}$) with share λ_C (who own capital but not land), and workers (W) with share $1 - \lambda_L - \lambda_C$ (who own only their labor in the beginning). The initial amount of capital, K_0, is distributed according to some C.D.F. $G(K)$ among capitalists and the elite, while land, T, is distributed among the elite according to C.D.F. $H(T)$. Moreover, land is a non-tradable good; it is inherited from one generation to another without any changes in size, so that $T_t = T = const$, and $T_{i,t} = T_i = const$.

Incomes and preferences

In the first period of their lives, individuals receive their land and capital bequests. These production factors are in turn used in modern or traditional production processes. All agents also supply one unit of labor inelastically to the market. In the second period individuals receive their factor incomes and optimally allocate them between consumption and capital bequest to their offspring. Therefore, incomes of agents from different classes are: $I^i_{W,t+1} = w^i_{t+1} + k^i_{W,t+1} R_{t+1}$, $I^i_{C,t+1} = w^i_{t+1} + k^i_{C,t+1} R_{t+1}$, $I^i_{L,t+1} = w^i_{t+1} + k^i_{L,t+1} R_{t+1} + T^i \rho_{t+1}$, where w, R, ρ are the prices of labor, capital, and land. Capital holdings come from invested bequest, $k^i_{t+1} = b^i_t$, and T^i is the individual amount of land. Individual preferences over consumption and bequests are given by

$$U(c^i_{t+1}, b^i_{t+1}) = (1-\beta)\ln(c^i_{t+1}) + \beta \ln(b^i_{t+1}) - C(e^i_t), \tag{3}$$

where c^i_{t+1} stands for consumption, and b^i_{t+1} for bequest. Individuals maximize (3) with respect to the following budget constraint: $c^i_{t+1} + b^i_{t+1} \le I^i_{t+1}$. Moreover, agents may exert some effort e^i_t in political struggle in order to increase the probability of institutional outcome they prefer. Institutional set-up affects labor allocation, factor prices, and, hence, incomes.

Factor prices

We capture the historical feature of a non-competitive, exploitative nature of landowner-worker relations in a traditional sector by assuming that agricultural wages and land income are non-competitive, while factor prices are competitive in the modern sector. Specifically, following [Bertocchi, 2006; Acemoglu, Robinson, 2008], we set

$$w_{T,t} = (1-\tau)(1-\alpha)A_{T,t}\left(\frac{T}{L_{T,t}}\right)^{\alpha}, \tag{4}$$

where τ is a sort of a tax that a worker should pay to his landowner. The factor price of land is

$$\rho_t = \left(1 + \frac{\tau(1-\alpha)}{\alpha}\right)\alpha A_{T,t}\left(\frac{L_{T,t}}{T}\right)^{1-\alpha}. \tag{5}$$

Landowners here capture a certain fraction of the total agricultural output, while workers get an average of what is left; after some rearrangements, it is easy to get (4) and (5). In the modern sector all factor prices are competitive:

$$w_{M,t} = (1-\alpha)A_{M,t}\left(\frac{K_t}{L_{M,t}}\right)^{\alpha}. \quad (6)$$

$$R_t = \alpha A_{M,t}\left(\frac{L_{M,t}}{K_t}\right)^{1-\alpha}. \quad (7)$$

Political struggle and institutions

Institutions in our model determine the productivity of a modern sector. Those who are interested in development of the modern sector propose a certain economically feasible level of technological improvement in this sector. Those who oppose changes propose not to allow these improvements to occur. Opposing parties may invest some effort in order to increase the probability of winning a contest over the institutional set-up (block or non-block the technological development[3]).

We model conflict in accordance with the literature on asymmetric public policy contents (see e.g. [Nti, 1999; Epstein, Nitzan, 2006; Cheikbossian, 2008; Baik, 2008]). In our model players may vary by their prize valuation, since, e.g., capitalists and landowners may assess the consequences of institutional changes differently.

More formally, the outcome of the contest is a realization of a certain policy: Block (B) or Non-Block (NB). In case of (B), $A_{M,t+1} = A_{M,t}$, and in case of (NB), $A_{M,t+1} = g_M(A_{M,t})$. Agent i derives an indirect utility level of $V^i(B)$ from the Block policy and $V^i(NB)$ from the Non-Block policy. Those who are in favor of technological improvement may exert an effort e^i_{NB} in order to increase the probability of technological advance. Those who resist technological changes exert an effort e^j_B. The net benefit from winning a contest is $\Delta^i_{NB} = V^i_{NB}(NB) - V^i_{NB}(B)$, and $\Delta^j_B = V^j_B(B) - V^j_B(NB)$, respectively.

The probability of NB policy is determined by the standard logit contest success function (CSF):

$$p_{NB} = \frac{\sum e^i_{NB}}{\sum e^i_{NB} + \sum e^j_B} = \frac{E_{NB}}{E}, \quad (8)$$

Finally, the objectives of risk-neutral agents supporting/opposing the development of the modern sector are:

[3] It is important to note that, generally, it should not be only the technological progress. The contest is over the ease of operating in the new "business" environment, which includes property rights protection, infrastructure, education, etc.

$$W_{NB}^{i} = p_{NB}V_{NB}^{i}(NB) + (1 - p_{NB})V_{NB}^{i}(B) - C(e_{NB}^{i}) = \\ = V_{NB}^{i}(B) - p_{NB}\Delta_{NB}^{i} - C(e_{NB}^{i}), \tag{9}$$

$$W_{B}^{i} = p_{B}V_{B}^{j}(B) + (1 - p_{B})V_{B}^{j}(NB) - C(e_{B}^{i}) = \\ = V_{B}^{j}(NB) - p_{B}\Delta_{B}^{j} - C(e_{B}^{i}). \tag{10}$$

Timing

1. The generation is born and it receives capital and land bequests.
2. Agents make efforts in order to increase the probability of the desired institutional outcome.
3. After the institutional set-up is determined, agents supply their production factors to the market and receive their incomes in the following period.
4. Finally, agents optimally allocate their income between consumption and bequest to their offspring.

Equilibrium and results

We solve for the politico-economic equilibrium backwards, starting from the optimal allocation of income, given the dynamic variables from the previous period and given the outcome of the political struggle.

Step 4. Utility maximization and indirect utility

Each agent i maximizes utility from consumption and bequeathing given in (3) with respect to $c_{t+1}^{i} + b_{t+1}^{i} \leq I_{t+1}^{i}$. The optimal solution satisfies:

$$(c_{(t+1)}^{i})^{*} = (1 - \beta)I_{t+1}^{i}, \tag{11}$$

$$(b_{t+1}^{i})^{*} = \beta I_{t+1}^{i}. \tag{12}$$

Using (3), (11) and (12), we derive the indirect utility function:

$$V^{i}((c_{t+1}^{i})^{*}, (b_{t+1}^{i})^{*}, e_{t}^{i}, \ldots) = \ln(I_{t=1}^{i}) - C(e_{t}^{i}) + \xi(\beta). \tag{13}$$

Therefore, each agent's policy preferences are determined by his income. Next, we show how the incomes of agents from different classes depend on the distribution of capital and land wealth, its aggregate amounts, and the development of the modern sector.

Step 3. Labor market clearing and individual income

The labor market clears when, first, $w_{T,t} = w_{M,t}$, which comes from the fact that labor is perfectly mobile between two sectors, and, second, $L_{T,t} + L_{M,t} = L$, where L

is normalized to 1. Using (4) and (6) we get the equilibrium amount of workers employed in the modern sector:

$$\theta^*_{M,t} = \frac{1}{1+\left(\frac{T}{K_t}\right)\left(\frac{1-\tau}{A_t}\right)^{\frac{1}{\alpha}}} = L^*_{(M,t)}, \tag{14}$$

where $A_t = \frac{A_{M,t}}{A_{T,t}}$ is the productivity ratio after the conflict (higher in case of NB policy). Increased relative productivity of the modern sector pushes wages up and attracts more workers, until wages equalize at a new, higher level. Using (14) and (4)–(7), we get all the factor prices:

$$w_t(L^*_{M,t}) = (1-\alpha)A_{M,t}\left(\frac{K_t}{L^*_{M,t}}\right)^{\alpha},$$

$$R_t(L^*_{M,t}) = \alpha A_{M,t}\left(\frac{L^*_{M,t}}{K_t}\right)^{1-\alpha},$$

$$\rho_t(L^*_{M,t}) = \left(1+\frac{\tau(1-\alpha)}{\alpha}\right)\alpha A_{T,t}\left(\frac{L^*_{T,t}}{T}\right)^{1-\alpha}.$$

Hence, a higher $A_{M,t}$, by attracting labor and enhancing productivity, increases R_t and w_t, but lowers ρ_t (since land and labor are complements in the traditional sector). Now we can express individual incomes, which determine attitudes towards industrialization.

$$I^i_{W,t} = w_t(L^*_{M,t}) + k^i_{W,t}R_t(L^*_{M,t}), \tag{15}$$

$$I^i_{C,t} = w_t(L^*_{M,t}) + k^i_{C,t}R_t(L^*_{M,t}), \tag{16}$$

$$I^i_{L,t} = w_t(L^*_{M,t}) + k^i_{L,t}R_t(L^*_{M,t}) + T^i\rho_t(L^*_{M,t}). \tag{17}$$

It is clear from (15) and (16) that incomes of capitalists and workers positively depend on the level of modern sector development.

At the same time, landowner *i* may either support or oppose industrialization, depending on the amount of land and capital he owns. Using (17), we can solve for $\frac{dI^i_{L,t}}{dA_{M,t}} > 0$. We derive the following[4] (partly consistent with [Galor et al., 2009]).

[4] We do not provide proofs here in order to shorten the text. However, all proofs can be obtained from the authors upon request.

Proposition 1. For a given A_t and $\frac{K_t}{T}$ there exists a subset (probably empty) of agents from (L) with sufficiently high $\frac{k^i_{L,t}}{K_t}$ and low $\frac{T^i}{T}$, for which $\frac{dI^i_{L,t}}{dA_{M,t}} > 0$ holds, i.e. who support the modern sector development. The higher A_t and $\frac{K_t}{T}$, the larger this subset is.

Thus, the supporters of *NB* policy are all capitalists and workers, and (probably) a part of the landowners. The opponents of *NB* are the landowners with bigger landholdings and smaller capital. In the process of capital accumulation and productivity growth, the support of industrialization from landowners increases.

Step 2. Outcome of the political conflict

In this paper we provide the simplest possible version of the model with $C(e^i) = e^i$, and no upper constraints on e^i, which is enough to illustrate part of our ideas and results. Using (8)–(10) and (13), we get the following objective functions for the supporters and opponents of *NB* policy:

$$W^i_{NB} = \frac{E_{NB}}{E}\ln\left(\frac{I^i_{NB}}{I^i_B}\right) - e^i_{NB}, \tag{18}$$

$$W^j_B = \frac{E_B}{E}\ln\left(\frac{I^j_B}{I^j_{NB}}\right) - e^j_B, \tag{19}$$

which are then maximized with respect to e^i_{NB} and e^j_B.

We search for a pure strategy Nash equilibrium in this two-group asymmetric contest. Applying FOCs for problem (18), we get the following:

$$\frac{E_B}{E^2}\ln\left(\frac{I^i_{NB}}{I^i_B}\right) - 1 = 0, \quad \text{if } e^i_{NB} > 0,$$

$$\frac{E_B}{E^2}\ln\left(\frac{I^j_B}{I^j_{NB}}\right) - 1 \le 0, \quad \text{if } e^i_{NB} = 0.$$

The similar FOCs apply for each member of B-group. The only things that vary among agents in each group are $\Delta^i_{NB} = \ln\left(\frac{I^i_{NB}}{I^i_B}\right)$ and $\Delta^j_B = \ln\left(\frac{I^j_B}{I^j_{NB}}\right)$. Hence, only one player in each group will participate in the conflict. Namely, it is the player with highest valuation, i.e. the highest $\ln\left(\frac{I^i_{NB}}{I^i_B}\right)$ in NB-group, and the highest $\ln\left(\frac{I^j_B}{I^j_{NB}}\right)$ in B-group. This is true because if FOC holds with equality for a player with highest valuation (h), then for every player i with lower valuation marginal costs equal

$1 = \frac{E_B}{E^2}\ln\left(\frac{I_{NB}^h}{I_B^h}\right)$ and exceed marginal benefits $\frac{E_B}{E^2}\ln\left(\frac{I_{NB}^i}{I_B^i}\right)$ from participating in the conflict. See [Baik, 2008] for an in-depth discussion of such contests.

In a reduced two-player contest, using FOCs for participating agents (h) in both groups, we get the following Nash equilibrium:

$$\frac{E_{NB}^*}{E_B^*} = \frac{\Delta_{NB}^h}{\Delta_B^h}, \tag{20}$$

$$E_{NB}^* = \frac{\Delta_B^h}{(1+\Delta_B^h / \Delta_{NB}^h)^2}, \tag{21}$$

$$E = E_{NB}^* + E_B^* = E_{NB}^*\left(1+\frac{\Delta_B^h}{\Delta_{NB}^h}\right) = \frac{\Delta_{NB}^h \Delta_B^h}{\Delta_{NB}^h + \Delta_B^h}. \tag{22}$$

From (20) and (8), we derive the probability of NB policy, which represents institutional quality:

$$p_{NB} = \frac{1}{1+\Delta_B^h / \Delta_{NB}^h}. \tag{23}$$

Equation (23) states that institutional outcome is determined by the "stakes" ratio of the players with highest valuations in both groups. Equation (22) shows that the intensity of conflict increases with participants' stakes. Moreover, given a certain sum of $\Delta_{NB}^h + \Delta_B^h = \Delta$, conflict intensity is maximized when $\Delta_{NB}^h = \Delta_B^h$. These stakes change dynamically in response to productivity increases, capital accumulation, and labor movements.

Step 1. Capital accumulation and growth

Applying (12) and aggregating over individual incomes, we get the following capital accumulation equation:

$$K_{t+1} = \beta Y_t = \beta(A_{T,t} T^\alpha L_{T,t}^{1-\alpha} + A_{M,t} K_t^\alpha L_{M,t}^{1-\alpha}). \tag{24}$$

For simplicity we also assume that $A_{T,t} = A_T = const$, and $A_{M,t+1} = \begin{cases} \gamma A_{M,t}, & \text{if } NB \\ A_{M,t}, & \text{if } B \end{cases}$, $\gamma > 1$. The expected productivity growth is, therefore, $g_{M,t+1} = p_{NB}(\gamma - 1)$, increasing with institutional quality. Using (24), it is easy to verify that if $K_0 > \tilde{K}$, the sequence of K_t is monotonically increasing. Our prime interest next is to show how the distribution of capital and land between and within social classes affects the speed of industrialization and the intensity of conflict.