The Great Divergence revisited: industrialization, inequality and political conflict in the unified growth model

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Motivation

- Different timing of growth take-offs leads to the Great Divergence in income per capita across countries
- In many countries industrialization intensifies the social tensions between different social classes (landowners, emerging class of capitalists and workers)
- What explains the huge cross-country differences in the pace of industrialization and moments of transition from stagnation to growth?
- What explains differences in the intensity of political and social conflict between landowners and emerging class of capitalists?

Changes in the structure of wealth (France, 1700-2000)

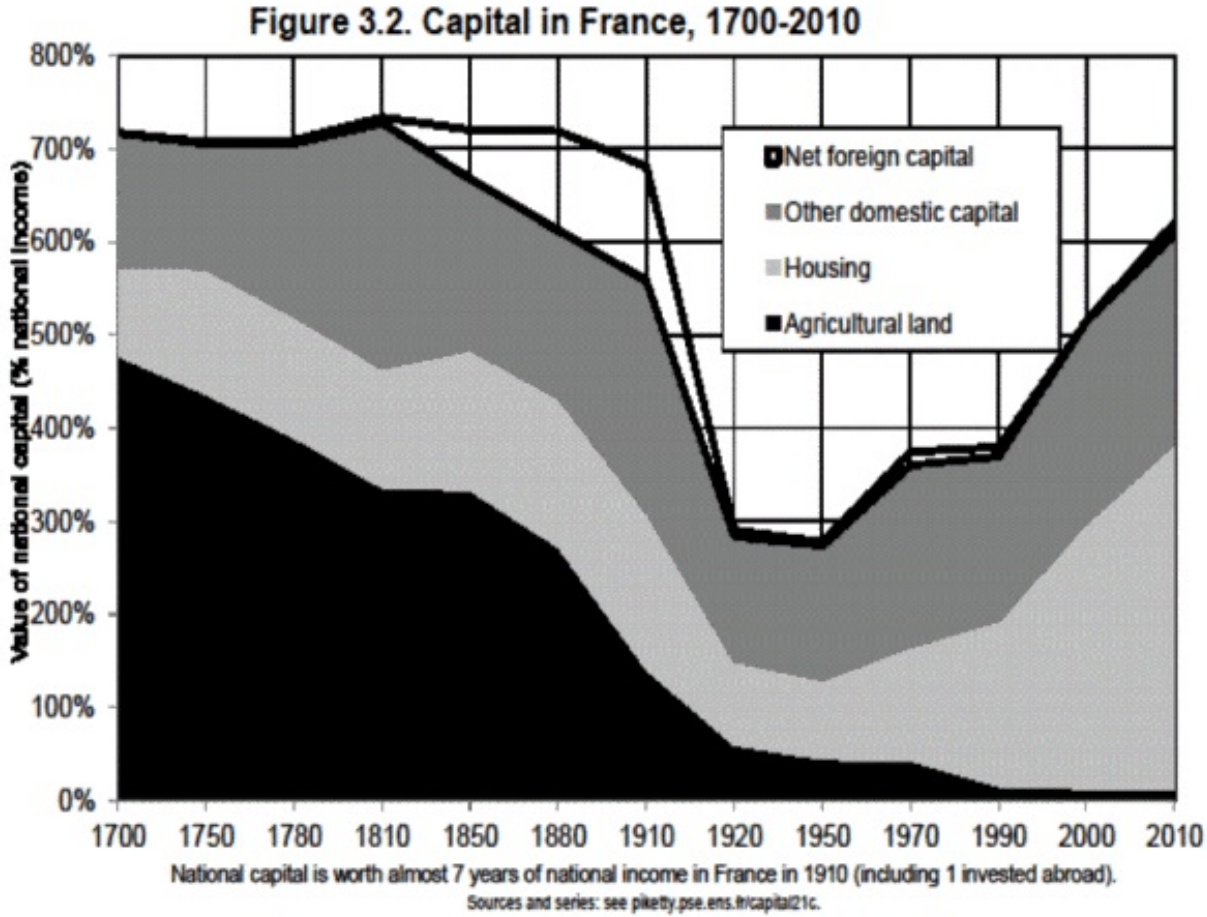

Рис. : T. Piketty. Le capital au XXI siécle. pp.27.

Political economy of industrialization

- In many countries the Industrial Revolution marked the transition to new era, when the old traditional elite was replaced by the new elite – emerging class of capitalists and entrepreneurs (Doepke and Zilibotti, 2005; Bertocchi, 2006)
- the political conflict over the institutional set-up was a very important feature of the Industrial Revolution era (Bertocchi (2006), Mokyr and Nye (2007), Acemoglu and Robinson (2012))
- Galor et al. (2009): higher inequality in the distribution of landownership adversely affected the emergence of human-capital promoting institutions
- Trew (2014) indicates that a more concentrated production in the pre-industrial districts of England was associated with a more rapid industrialization
- Purely economic mechanisms cannot provide the full picture of the relationship between assets ownership distribution and industrialization (Mokyr and Nye (2007)).

Methodology

How the inequality in landownership and in capital holdings affects the timing of take-offs and the intensity of contest between different social groups on different stages of development.

- Two-sector model of transition from stagnation to growth with heterogenous agents.
- Agents differ in the structure of their wealth holdings (land and capital)
- The possibility of adoption of new technologies as a public policy game
- Agents are capable to invest in the lobbying of their economic interests.
- The analysis of the joint dynamics of technology, the structure of wealth and the intensity of the contest.

Related literature

- The models of transition from stagnation to growth Galor,Weil (2000), Galor, Moav (2002), Hanssen, Prescott (2002), Jones (2002), Strulik, Weisdorf (2008)
- The models of the political economy of industrialization Galor et al. (2009), Bertocchi (2006), Boschini (2006)
- The models of public policy asymmetric contests Epstein and Nitzan (2006), Baik (2008), Nitzan and Ueda (2014)

Table of contents

Agents' types

- We consider an OLG model with bequests where each generation lives for two periods
- The size of the population is constant.
- Agents are divided into two classes: landowners, and landless citizens(capitalists)
- The amount of land is distributed within the group of elite with a known distribution function.
- Land is a non-tradable good; inside one family it is inherited from one generation to another without any changes in size,so

$$T_{i,t} = T_i = const$$

.

- The initial amount of capital, K_0, is distributed between the elite and citizens.

Agents' actions

- In the first period of their lives, agents do not take any economic or political decisions;
- At the end of the first period they only receive their capital and land bequests, b_t^i and T^i. Capital bequests are invested and become a productive capital in the next period, i.e. $k_{t+1}^i = b_t^i$.
- In the second period agents may participate in political struggle and invest some efforts e_{t+1}^i in order to increase the probability of institutional outcome they prefer
- After that the conflict is resolved, all agents inelastically supply one unit of labor to the market and production and consumption take place.

Agents' preferences

Agents maximize the following utility function

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

where c^i_{t+1} stands for consumption, b^i_{t+1} for bequest, e^i_{t+1} for the input in contest, given the budget constraint

$$I^i_{t+1} = w_{t+1} + k^i_{t+1} R_{t+1} + T^i \rho_{t+1}, \quad (2)$$

where $w_{t+1}, R_{t+1}, \rho_{t+1}$ are factor prices and capital equals to the bequest from the previous generation, $k^i_{t+1} = b^i_t$.

Production side

- The economy consists of two sectors, traditional (Tr) and modern (M). The production functions are Cobb-Douglas in both sectors

$$Y_{T,t} = A_{T,t} T^{\alpha} L_{T,t}^{1-\alpha}, \tag{3}$$

$$Y_{M,t} = A_{M,t} K_t^{\alpha} L_{M,t}^{1-\alpha}, \tag{4}$$

  - $L_{T,t}, L_{M,t}$ - is the employment in the traditional and in the modern sector,
  - $A_{M,t}, A_{T,t}$ - the level of technology in Tr and M sectors and
  - T_t, K_t - the size of the land and physical capital.
- Labor are perfectly mobile across sectors
- Goods in Tr and M sectors are perfect substitutes

$$Y_t = Y_{M,t} + Y_{T,t} \tag{5}$$

Factor incomes

- Landowners appropriate a fraction of the traditional sector output (Bertocchi (2006) and Acemoglu and Robinson (2008))
- Wage rate (w_T) and land rent ρ in traditional sector can be represented as

$$w_{T,t} = (1-\tau)(1-\alpha)A_{T,t}(T/L_{T,t})^{\alpha} \tag{6}$$

$$\rho_t = [(1+\tau(1-\alpha)/\alpha)]\alpha A_{T,t}(L_{T,t}/T)^{1-\alpha} \tag{7}$$

where τ measures the relative bargaining power of landowners versus their peasants

- In the modern sector we assume competitive market structure

$$w_{M,t} = (1-\alpha)A_{M,t}(K_t/L_{M,t})^{\alpha} \tag{8}$$

$$R_t = \alpha A_{M,t}(L_{M,t}/K_t)^{1-\alpha} \tag{9}$$

Technological progress

- Two type of policies:
  - reform policy (R).
  - status-quo policy (S).

$$A_{M,t} = \begin{cases} \gamma A_{M,t-1}, \textit{if } R \\ A_{M,t-1}, \textit{if } S \end{cases}, \tag{10}$$

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- The expected growth rate of technological progress is

$$g_t = p_{R,t}(\gamma - 1) \tag{11}$$

where $p_{R,t}$ - the probability that the reform policy will be implemented.

- There exists a spillover from the modern-sector productivity to the productivity in the traditional sector, such that $A_{T,t} = A_{M,t-1}$

Political contest

- Agents non-cooperatively choose the amount of efforts to put in contest
- The probability that the reform policy will be implemented is determined by the simple Tullock contest success function.

$$p_R = (\sum e_R^i)/(\sum e_R^i + \sum e_S^j) = E_R/E, \qquad (12)$$

where

  - e_R^i and e_S^j are efforts of supporters and opponents of the reform policy correspondingly.
  - E_R, E_S are the sum of efforts of groups R and S,
  - E is the total sum of efforts of all agents

- If the size of one of the group is zero, then p_R is determined by the agents' preferences.

The timing

1. The generation is born in period t and receives capital and land bequests at the end of that period. Capital bequest is invested in order to become a productive capital in period t+1.
2. In the beginning of period t+1 agents (may) participate in conflict over this period's institutional set-up, trying to increase the probability of the desired policy outcome, S or R.
3. Next, the institutional set-up is determined, and production in both sectors takes place using the supplied amounts of land, labor and productive capital.
4. Finally, agents receive their factor incomes, which depend on the outcome of the conflict, and optimally allocate them between consumption and bequest to their offspring.
5. The generation born in period t+1 receives capital and land bequests, and the game repeats.

Indirect utility function

$$V^i = ln(I^i_{t+1}) - e^i_{t+1} + \xi(\beta) \tag{13}$$

where $\xi(\beta) = (1-\beta)ln(1-\beta) + \beta ln\beta$ is constant
Therefore, each agent's policy preferences are determined by the effect of the policy on his/her income

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- The net gain from winning the political contest for the i-th supporter of industrialization (W_i) is

$$W^i = p_R V^i_R + (1-p_R) V^i_S \tag{14}$$

$$W^i = V^i_S + p_R(V^i_R - V^i_S) \tag{15}$$

where $V^i_R - V^i_S = ln(I^i_R/I^i_S) = \Delta_i$

- $\Delta_i(R)$ is the rate of return from the winning in the political conflict.

First-order conditions and equilibrium conflict outcome

$$\begin{cases} (E_S/E^2)\Delta^i - 1 = 0, \ if \ e_R^i > 0 \\ (E_S/E^2)\Delta^i - 1 \leq 0, \ if \ e_R^i = 0 \end{cases} \tag{16}$$

Only the agent with the highest valuation of the "prize"(h) spends positive efforts into the political conflict.

$$E_R^* = (\Delta_S^h)/(1 + \Delta_S^h/\Delta_R^h)^2 \tag{17}$$

$$p_R^* = 1/(1 + \Delta_S^h/\Delta_R^h) \tag{18}$$

where Δ_S^h, Δ_R^h - the rate of return from winning a political contest for agents with the highest valuation of the prize

Lemma 1: Outcome and intensity of political conflict

- The higher is the stake in conflict for the most eager supporter of industrialization relative to the stake of its most rampant opponent, the higher is the probability of reform
- The intensity of conflict increases with participants' stakes

$$E_R^* = (\Delta_S^h)/(1 + \Delta_S^h/\Delta_R^h)^2$$

$$p_R^* = 1/(1 + \Delta_S^h/\Delta_R^h)$$

Equilibrium employment, factor prices and incomes

- From labor market clearing condition

$$L^*_{M,t} = 1/(1 + (T/K_t)((1-\tau)/A_t)^{1/\alpha}), \tag{19}$$

where $A_t = \gamma$ for the reform policy and $A_t = 1$ for the status-quo policy.

- Individual incomes in the equilibrium are equal to
-

$$I^i_t = w^*_t + k^i_t R^*_t + T^i \rho^*_t \tag{20}$$

where w^*_t, R^*_t, ρ^*_t - equilibrium factor prices.

- Relative position in capital and land, as well as their factor prices, determines agents' attitudes towards industrialization
- Wages and interest on capital (w^*_t, R^*_t) increases if the reform policy is implemented, whereas the rent of landowners (ρ^*_t) declines.

Agents' political preferences

Proposition 1

- For the given K_t, $A_{M,t}$,$A_{T,t}$ there exists a subset (possibly empty) of landowners with sufficiently high k_t^i and sufficiently low T^i, such that they support the reform policy

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Proposition 1

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- The larger is k_t^i, the stronger is support for industrialization, the larger is T^i, the weaker is support for industrialization
- There exists a threshold level of aggregate capital $\overline{K}$ such that for all $K_t > \overline{K}$ all landowners support the reform policy and so $p_R = 1$.

Within group distribution of wealth

Proposition 2

- If the most eager supporter of industrialization (h_R) is inside the capitalist class, any strict Lorenz-worsening change of capital distribution within capitalists increases the expected gain from the reform policy for agent h and leads to higher p_R^*.
- This effect is larger for a larger level of the aggregated capital K.

$$p_R^* = 1/(1 + \Delta_S^h/\Delta_R^h)$$

Between-group distribution of wealth

Proposition 3

- For a low level of capital, redistribution of capital from capitalists to landowners lowers p_R^*,
- For a high level of capital, redistribution of capital from capitalists to landowners increases p_R^*.

$$p_R^* = 1/(1 + \Delta_S^h/\Delta_R^h)$$

Capital accumulation

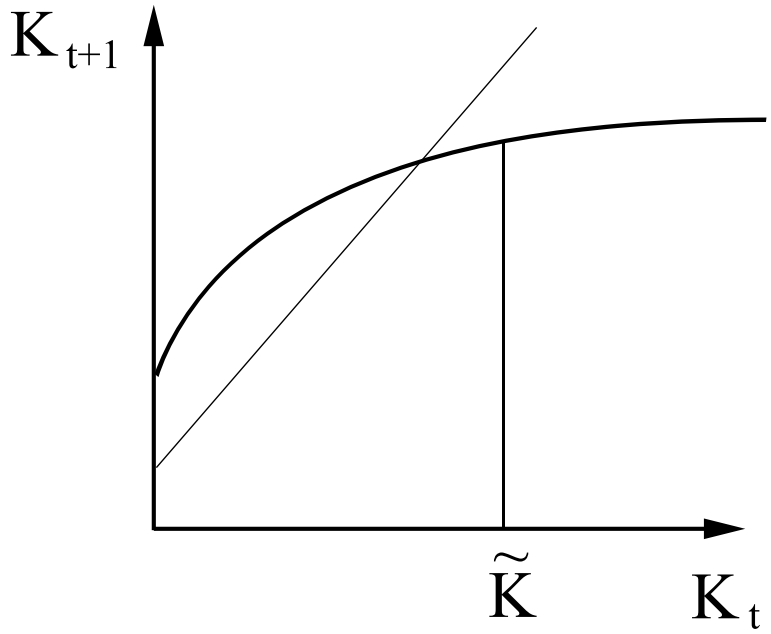
$$K_{t+1} = \beta Y_t = \beta(A_{T,t} T^{\alpha} L_{T,t}^{1-\alpha} + A_{M,t} K_t^{\alpha} L_{M,t}^{1-\alpha}), \qquad (21)$$

where,

$$A_{T,t} = A_{M,t-1},$$

$L_{T,t}$ and $L_{M,t}$ are determined from the market clearing condition and
$A_{M,t}$ is determined from the result of the political contest.

Dynamics for a constant level of technology ($A_M = A_T$)



- For a given level of technological progress $A_{T,t} = A_{M,t}$ capital assymptotically converge to the steady state level.
- When the new technology develops, the locus $K_{t+1}(K_t)$ shifts upwards, and the temporary steady state point moves to the right.

Conditional Steady state

For a given level of technological progress $A_{T,t} = A_{M,t}$ the main variables of the model $(\widetilde{K}, \widetilde{w}, \widetilde{\rho}, \widetilde{R}, \widetilde{I^i}, \widetilde{\Delta^i})$ are constant .

$$K^i_{t+1} = \beta(\widetilde{w} + \widetilde{\rho} T^i + \widetilde{R}^i_t) \tag{22}$$

$$\widetilde{K^i} = \beta(\widetilde{w} + \widetilde{\rho} T^i)/(1 - \beta\widetilde{R}) \tag{23}$$

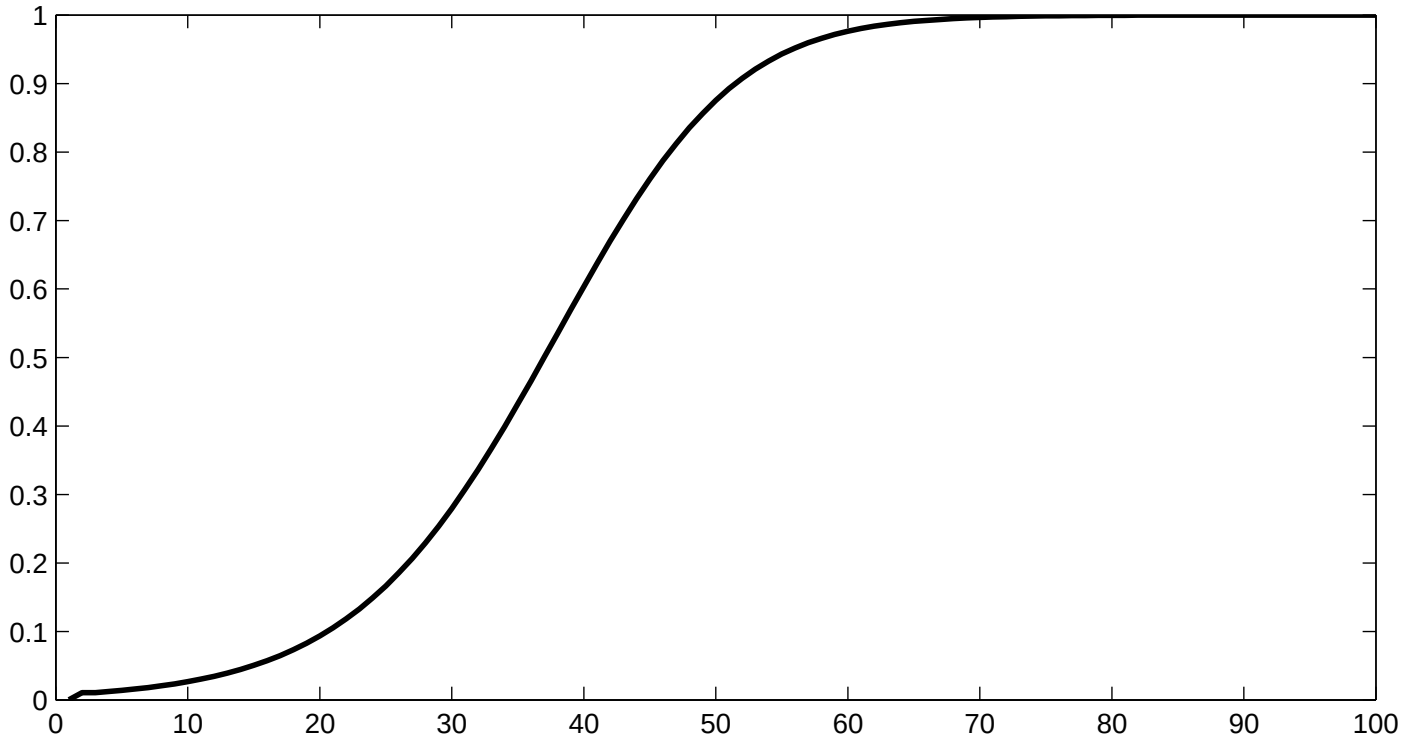
$$\widetilde{I^i} = (\widetilde{w} + \widetilde{\rho} T^i)/(1 - \beta\widetilde{R}) \tag{24}$$

- The distribution of capital in the steady state is determined by the distribution of land and the level of factor incomes.
- (Lemma 3) In the temporary steady state the order of expected gains from the reform policy does not change.

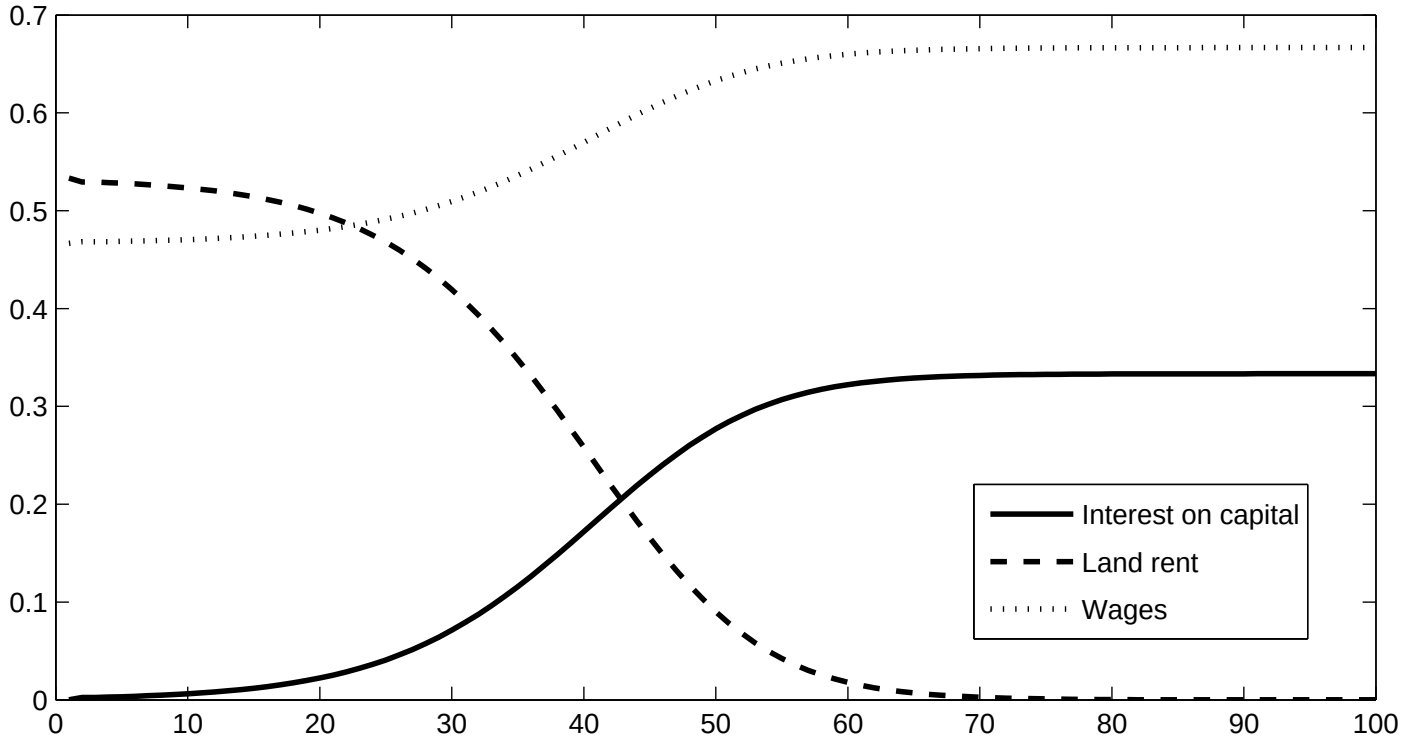
Numerical simulations

- Let us consider three groups of agents with a size $N_1 = 1, N_2 = 9999, N_3 = 90000$;
- The elite (landowners) constitutes 10% of the population;
- The land is distributed unequally between landowners, such that the Gini coefficient of the distribution of land within the elite equals 0.1

The share of employment in the modern sector



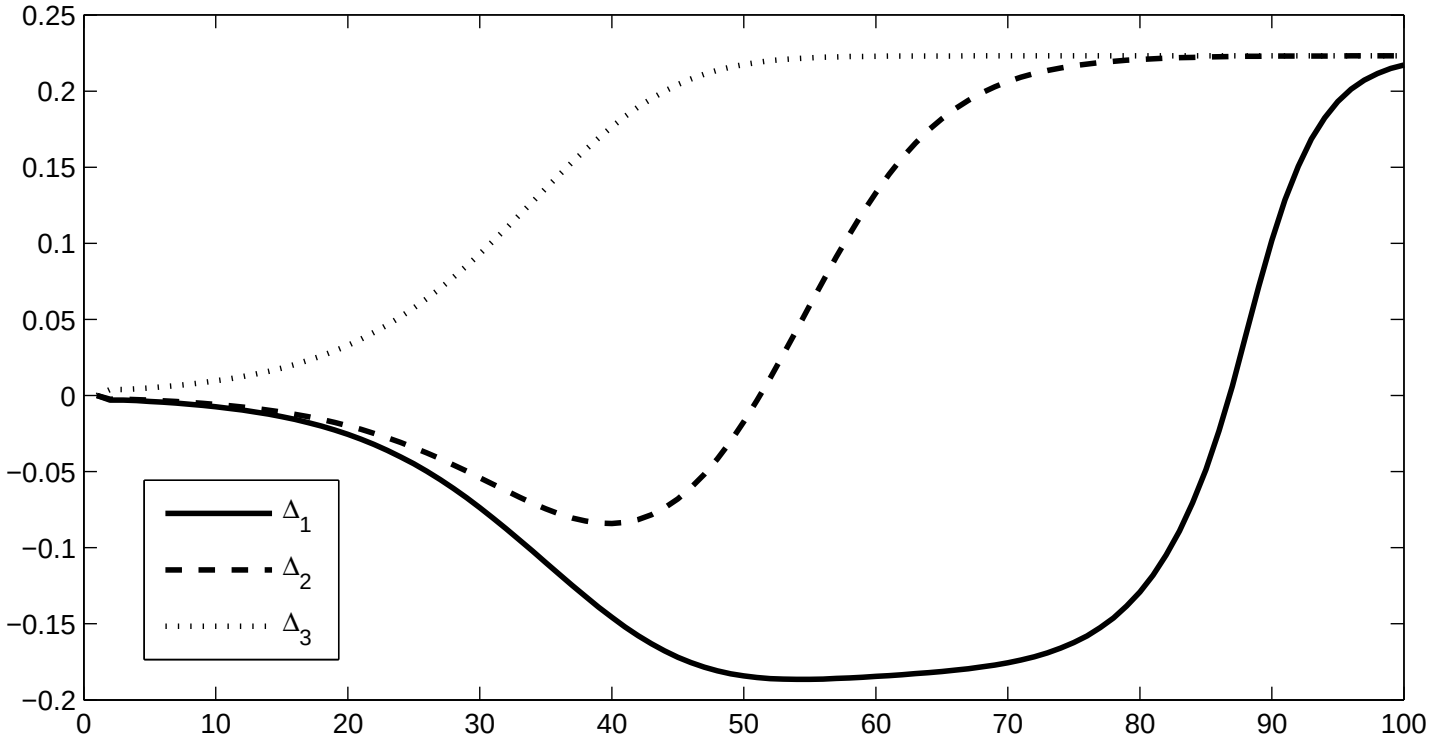
The share of factor incomes in GDP



Industrialization phases

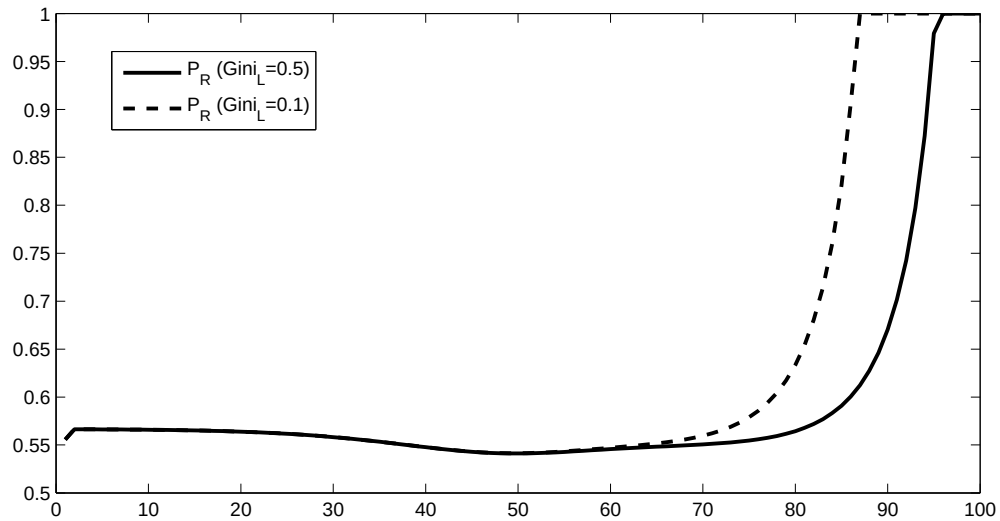
- Conflictual period of industrialization ($p_R < 1$)
- the first sub-period of increasing social tensions between supporters and opponents of industrialization;
- the second sub-period of decreasing social tensions between supporters and opponents of industialization;
- Peaceful (consensual) period of industrialization ($p_R = 1$)

The dynamics of the gains from the reform policy

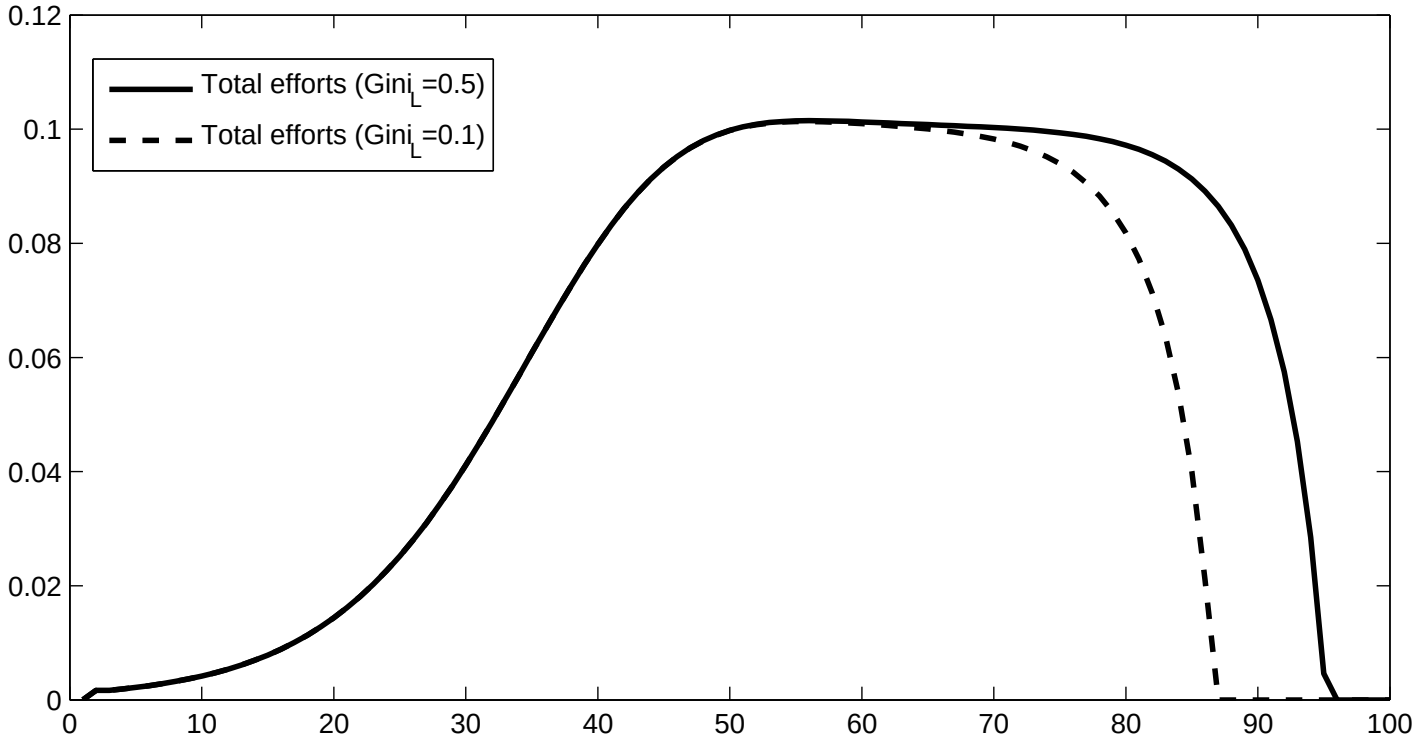


The probability that the reform policy is implemented

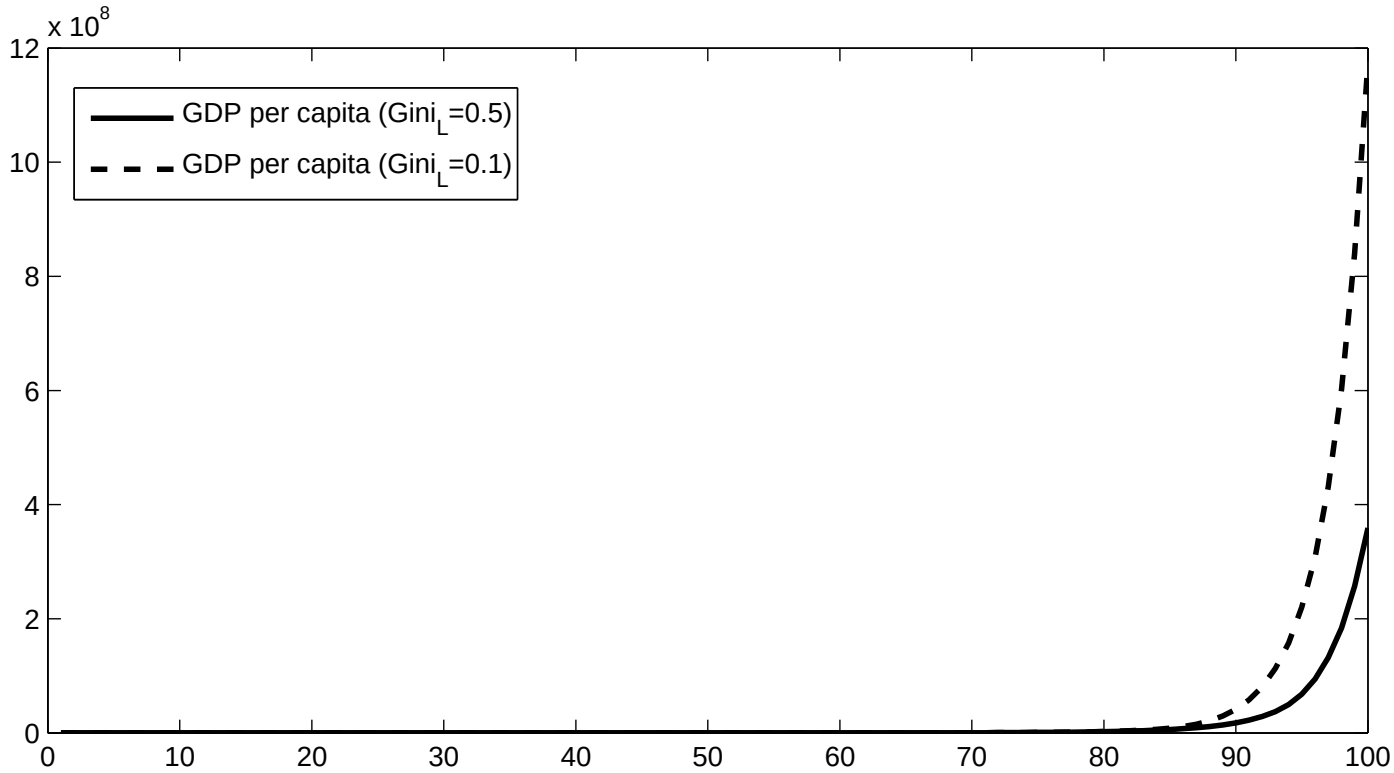
- Two cases
  - The inequality of land within the group of landowners is low (Gini=0.1)
  - The inequality of land within the group of landowners is high (Gini=0.5)



The intensity of the political contest in two cases



GDP per capita dynamics in two cases



Conclusion

- We analyse a new mechanism that explains the transition from stagnation to growth in a two-sector unified growth model.
- In the model technological progress is driven by the endogenous choice of institutions (policies), which are determined in the political contest between social classes.
- The concentration of capital within a class of capitalists during a conflictual period of industrialization leads to faster industrialization. This effect is increasing with a level of capital.
- An intensity of the conflict between the supporters and opponents of industrialization is non-monotonically related with a level of development

Possible extensions

- Another source of heterogeneity between agents (e.g. skills, entrepreneural skills)
- "Monetary"costs of the conflict.