

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

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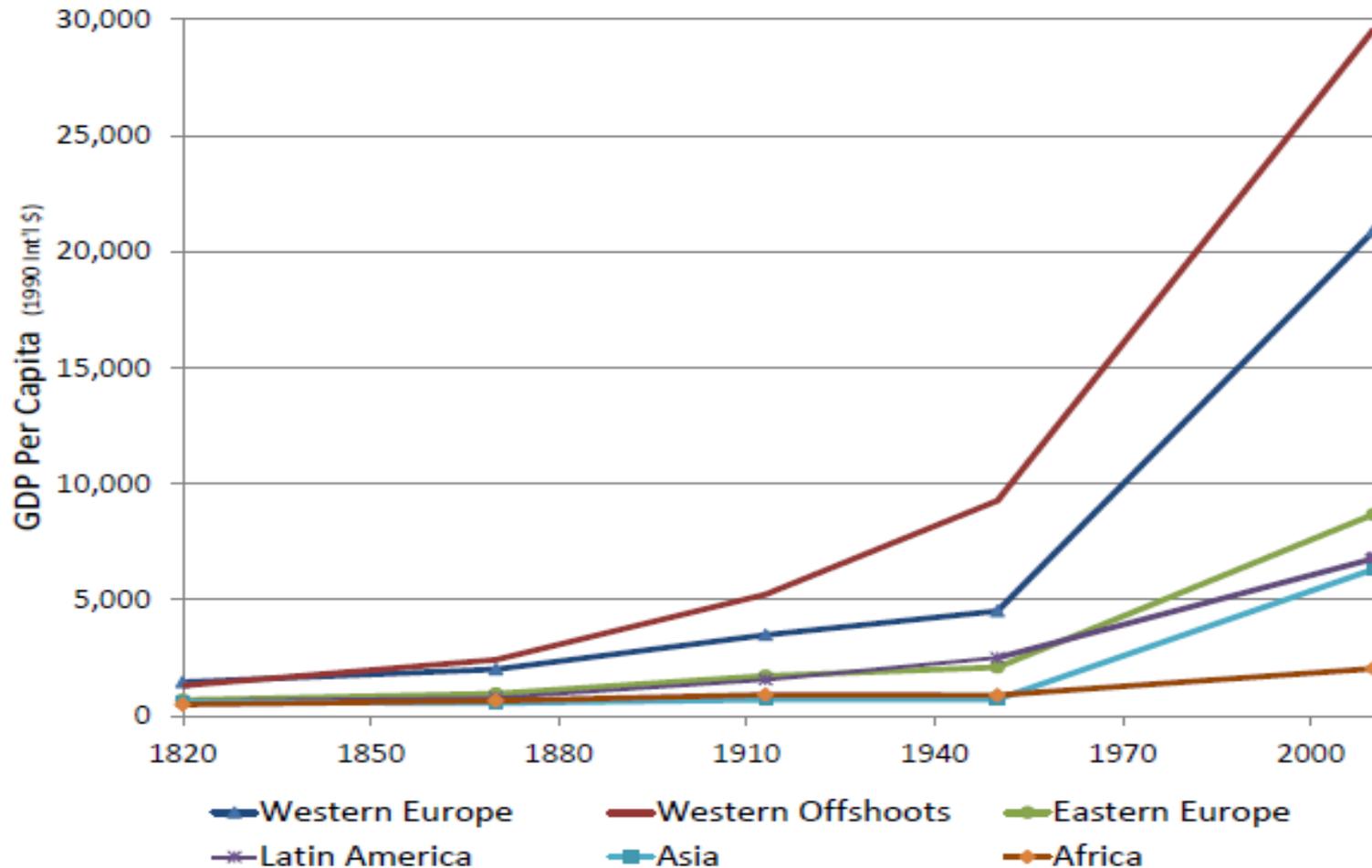
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Motivation-1

Rich-to-poor countries ratio in terms of GDP per capita is now around 20:1, while it was 3:1 before the Industrial Revolution. What can explain these huge and increasing differences in cross-country living standards?

- The variation in moments of take-off from stagnation to growth, and the pace of this process: Galor et al. (2005, 2009), Jones (2002), Hansen and Prescott (2002) – **the Great Divergence phenomenon**

The Great Divergence



Source: O. Galor, Lecture 1: Growth and Comparative Development

Motivation-2

The transition to modern growth regime was accompanied by:

- The political conflict between the supporters and opponents of modern sector development
- The endogenous change in institutional set-up as the outcome of this political conflict: adoption of new technologies, education reforms, property rights protection

But why countries differ in the outcomes and intensity of this this conflict?

What determines whether the pro-growth policies accumulate sufficient support or not?

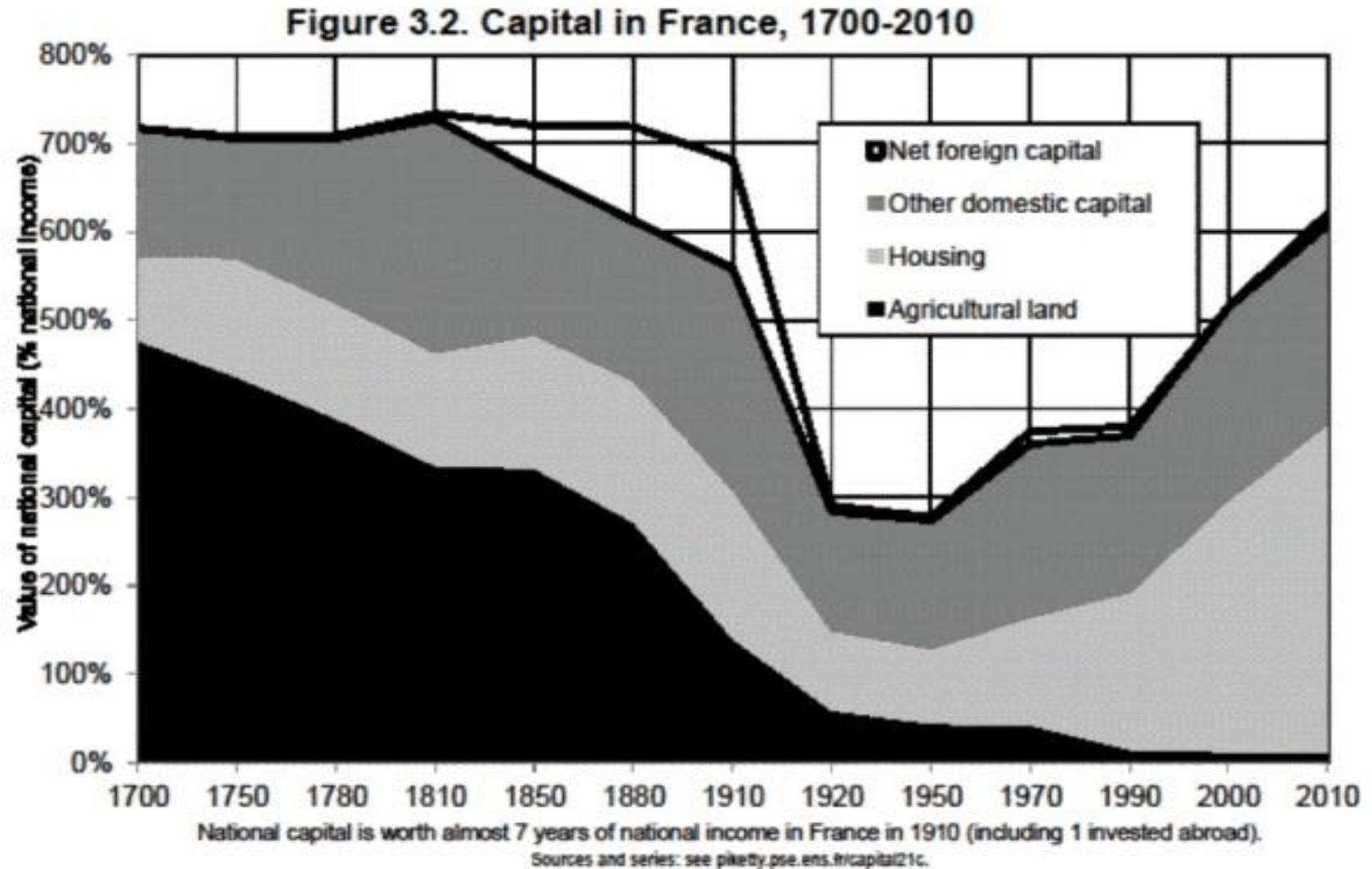
Motivation-3

We study the impact of **inequality in wealth distribution** on the outcomes and intensity of political conflict during the stage of transition from stagnation to growth

Why inequality is important for the pace of transition and political conflict?

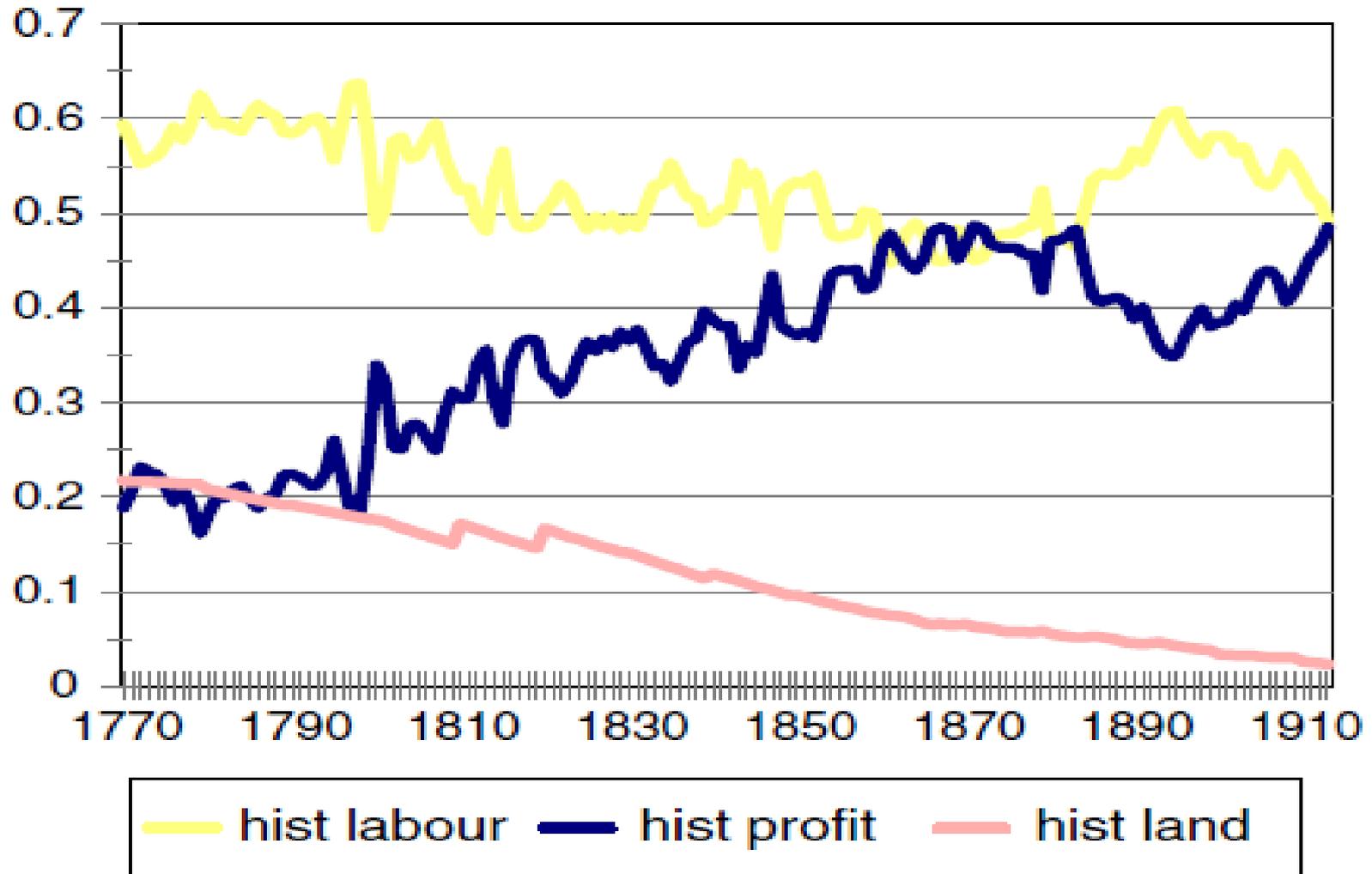
- It affects the preferred level of institutional strength of each agent
- It shapes the incentives and abilities of agents to participate in political conflict

Changes in the structure of wealth



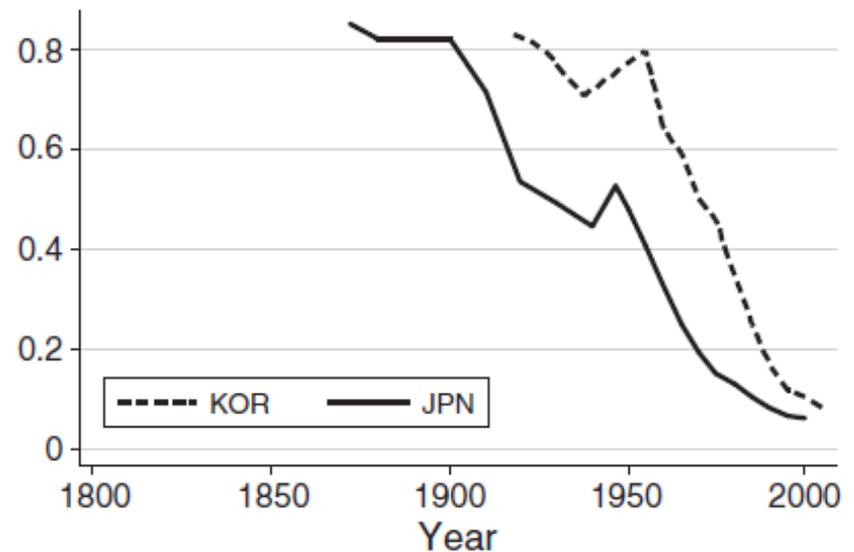
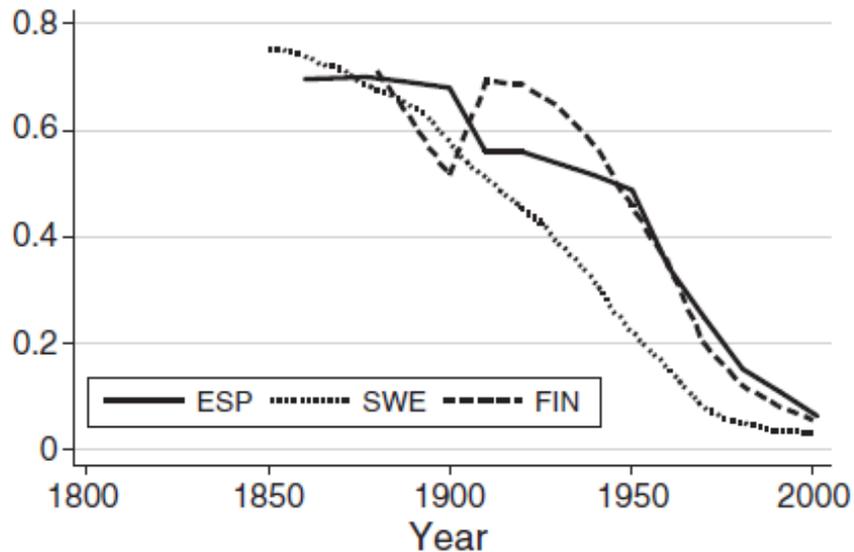
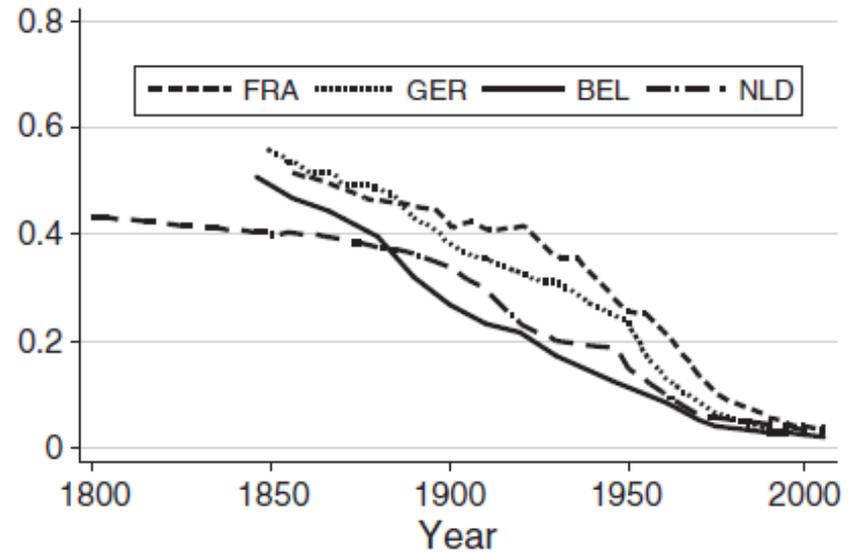
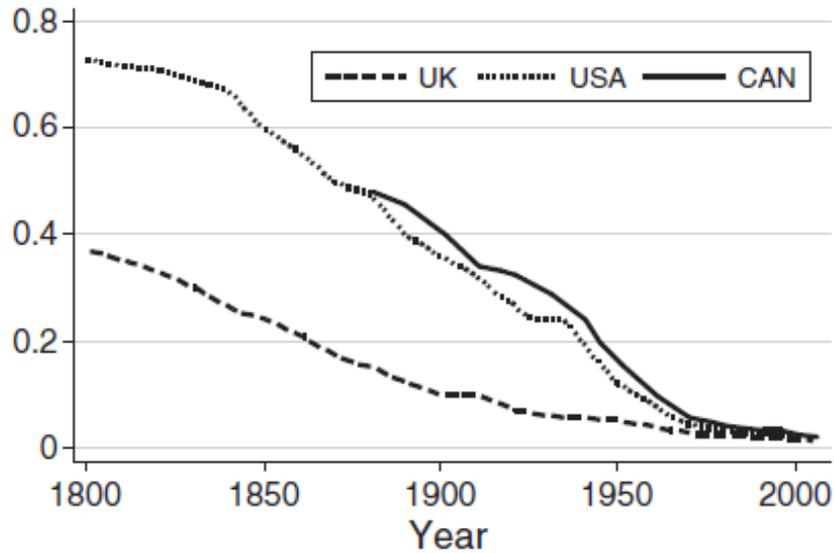
Source: Piketty, 2014, Capital in the 21st century

Changes in the structure of wealth



Source: Allen, 2009, “Engel’s pause, technical change...”

Reallocation of labor (Alvarez-Cuadrado and Poschke, 2011, “Structural change out of agriculture...”)



Our contribution-1

1. We build a two-sector unified growth model of the transition from stagnation to growth, in which the outcome of public policy contests between heterogeneous agents determines the pace of industrialization and growth.
2. The model captures several key features of the industrialization period:
 - Gradual structural change (reallocation of labor from traditional to the modern sector)
 - Rising share of capital gains, while declining share of land rents in the overall incomes
 - The political conflict between the old elite and the new emerging capitalist elite; an “inverted-U” dynamics of conflict intensity

Our contribution-2

The shape of wealth distribution within and between the opposing groups affects the agents' incentives and abilities to invest in political conflict. Hence, it affects the pace of development

- Higher concentration of landownership hampers institutional development and growth during industrialization period
- The impact of inequality in capital distribution is stage-dependent; moreover the between- and within-group dimension matters

Our contribution-3

- Higher concentration of capital inside the landless agents is growth-enhancing; the effect is stronger for later stages of industrialization
- The effect of between-group inequality in capital ownership
 - May lead to an adverse effect of capital concentration (if big landowners are also big capital owners)
 - Depends on the stage of industrialization (in the early stages higher share of traditional elite in the modern sector hampers development, and vice versa)

Related Literature

- The models of transition from stagnation to growth: Galor, Weil (2000), Hanssen, Prescott (2002), Jones (2002), Strulik, Weisdorf (2008)
- The political economy of industrialization: Llavador and Oxoby (2005), Bertocchi (2006), Boschini (2006), Galor et al. (2009), Desmet and Parente (2014)
- Public policy asymmetric contests: Epstein and Nitzan (2006), Baik (2008), Nitzan and Ueda (2014)
- Inequality, institutions and growth: Sonin (2003), Gradstein (2007), Mokyr and Nye (2007), Galor et al. (2009), Amendola et al. (2013)

The Model

Timing

- 1) The generation is born and it receives capital and land bequests, which are used in production processes and generate incomes next period
- 2) Agents may invest part of their income in conflict in order to increase the probability of the desired institutional outcome
- 3) After the institutional set-up is determined, agents receive their post-conflict incomes, where factor prices are affected by the conflict outcome
- 4) Finally, agents optimally allocate their post-conflict income between consumption and bequest to their offspring, and the game repeats

Production

Two-sector unified growth model (Hansen and Prescott, 2002; Galor et al., 2009)

➤ Traditional sector (land and labor): $Y_T = A_T T^\alpha L_T^{1-\alpha}$

➤ Modern sector (capital and labor): $Y_M = A_M K^\alpha L_M^{1-\alpha}$

➤ Technological progress is stochastic in the M-sector:

$$A_{M,t+1} = \begin{cases} gA_{M,t}, & \text{if } R \\ A_{M,t}, & \text{if } S \end{cases}, g > 1$$

➤ A spillover to the traditional sector: $A_{T,t+1} = A_{M,t}$

➤ Goods are perfect substitutes: $Y = Y_M + Y_T$

➤ Labor is absolutely mobile between sectors.

Population

OLG model with bequests where each generation lives for two periods

- Total population is constant
- Three initial classes: landowning elite (E), share λ_E of population, landless capitalists (C), share λ_C (who own capital but not land), and workers (W), share $1 - \lambda_E - \lambda_C$

Both within- and between-group inequality:

- K_0 is distributed according to C.D.F. $G(K)$ among capitalists and the elite
- T is distributed among the elite according to C.D.F. $H(T)$.
- Land is fixed and non-tradable, hence $T_t = T = \text{const}$ and $T_t^i = T^i = \text{const}$

Incomes

- All agents receive capital and (if in an agent is a landowner) land bequests in the first period, and invest these bequests in production process
- The second period is divided into two parts, pre-conflict and post-conflict; agents get their incomes before conflict and after the conflict
- All agents work (inelastic labor supply) and receive wage income

Therefore, income of agent i is the following:

$$I_t^i = w_t^i + k_t^i R_t + T^i \rho_t$$

Factor Prices

Wages and land income are non-competitive in traditional sector:

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

while factor prices are competitive in the modern sector:

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

Preferences and optimization

- Individual preferences over consumption and bequests are given by

$$U^i = (1 - \beta) \ln(c_{t+1,1}^i) + \beta (\ln(c_{t+1,2}^i) + \ln(b_{t+1}^i))$$

- Two budget constraints:

$$c_{t+1,1}^i + e_{t+1}^i \leq I_{t+1,1}^i - \text{pre-conflict income allocation}$$

$$c_{t+1,2}^i + b_{t+1}^i \leq I_{t+1,2}^i - \text{post-conflict incomes allocation}$$

Second stage optimization

$$U_2^i = \ln(c_{t+1,2}^i) + \ln(b_{t+1}^i)$$

$c_{t+1,2}^i + b_{t+1}^i \leq I_{t+1,2}^i$ - post-conflict income allocation

Solution:

$$(c_{t+1,2}^i)^* = \frac{1}{2} \cdot I_{t+1,2}^i, \quad (b_{t+1}^i)^* = \frac{1}{2} \cdot I_{t+1,2}^i$$

$$V^i = \ln(I_{t+1}^i)$$

First stage optimization

Pre-conflict utility:

$$V^i = (1 - \beta) \ln(c_{t+1,1}^i) + \beta \ln(I_{t+1,2}^i)$$

$$c_{t+1,1}^i + e_{t+1}^i \leq I_{t+1,1}^i$$

where e_{t+1}^i is the money-input in conflict.

- Therefore, political preferences are driven by post-conflict incomes
- Post-conflict incomes depend on the outcome of political conflict, since conflict outcome affects relative productivity of sectors, labor reallocation, and hence, factor prices

Political Conflict

We model conflict over the institutional set-up in accordance with literature on asymmetric public policy contest games, see e.g. (Nti, 1999; Epstein and Nitzan, 2007; Baik, 2008; Nitzan and Ueda, 2014)

- The outcome of a contest is a realization of a certain policy, Reform (R) or Status-quo (S), which advances (R) or holds the same (S) the productivity level $A_{M,t}$
- The benefit from winning a contest is a utility gain due to higher income:

$$\Delta_R^i = V_R^i(R) - V_R^i(S), \text{ and } \Delta_S^j = V_S^j(S) - V_S^j(R)$$

- The probability of reform policy is given by the following Tullock-type CSF:

$$p_R = \frac{\sum e_R^i}{\sum e_R^i + \sum e_S^j} = \frac{E_R}{E}$$

Political preferences

Proposition 1. (Political preferences)

- **Landowners' capital and land holdings.** For a given $K_t, T, g,$ and $\tau,$ there exists a (possibly empty) subset \mathcal{L}_R of landowners, who have sufficiently high k^i and low $T^i,$ such that they support reform policy (industrialization)
- **Strength of support.** For a given $K_t, T, g,$ and $\tau,$ the larger k^i is; the stronger the support for industrialization is, i.e. $(\Delta_R^i)'_{k^i} > 0,$ and the larger T^i is; the weaker the support for industrialization is, i.e. $(\Delta_R^i)'_{T^i} < 0.$
- **The end of conflict.** There exists a threshold level of aggregate capital $\bar{K},$ such that for all $K_t \geq \bar{K}$ even the most eager supporter of status-quo policy switches his preferences towards industrialization; therefore, there is no conflict, and $p_R = 1$ when $K_t \geq \bar{K}.$

Individual Contributions to the Conflict

Expected gains from participation in conflict for the supporter of reform policy:

$$\begin{aligned} \max_{e_R^i, c^i} \quad & p_R \cdot \ln \beta \left(\frac{I_R}{I_S} \right) + (1 - \beta) \ln(c^i) \\ \text{s.t.} \quad & c^i + e^i \leq I^i \end{aligned}$$

$$\text{Solution (best response): } (e_R^i)^* = I_{t+1,1}^i - \frac{1-\beta}{\frac{E-E_R}{E} \Delta_R^i}$$

Expenditures increase with own income and stake in conflict, but decrease with other group members aggregate expenditures (free-riding) and overall expenditures (lower ability to influence)

Public policy contest equilibrium

Share functions approach (Cornes and Hartley, 2000, 2005; Nitzan and Ueda, 2014)

$$E_R^* = \sum (e_R^i)^* = \sum \left(I_{t+1,1}^i - \frac{1-\beta}{E-E_R} \Delta_R^i \right)_+ \rightarrow \text{unique equilibrium}$$

group effort (applying monotonicity and continuity arguments)

$$E: \frac{E_R}{E} + \frac{E_S}{E} = 1 \rightarrow \text{unique aggregate effort equilibrium}$$

Within-group inequality in capital distribution

Proposition 2 (within-group distribution of capital)

- If $E_S > \overline{E_S}$, then any strict Lorenz-worsening redistribution of capital within the landless group of agents increases the probability of reform policy. The effect is larger for the larger values of the aggregate capital.
- The opposite holds for land distribution inside the landowners

Reasoning:

- Conflict vs Consumption channel
- Gains from winning in a conflict channel
- Free-riding channel (contributors and non-contributors)

Between-group inequality in capital distribution

- Denote by η a share of K_t that belongs to capitalists, while $(1 - \eta)K_t$ belongs to landowners.

Proposition 3 (between-group distribution of capital)

- If $\frac{T}{K_t} \geq \kappa$ then a lower η results in lower p_R , i.e. lower pace of industrialization
- if $\frac{T}{K_t} < \kappa$ then a lower η leads to higher p_R and faster industrialization.
- Here κ is a function of inequality in land distribution and within-groups' capital distribution.

Model Dynamics

Dynamic equations

➤ Capital accumulation

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

➤ Employment in the traditional sector

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

➤ The expected rate of productivity growth in the modern sector

$$\mathbb{E} \left(\frac{A_{M,t}}{A_{M,t-1}} \right) = p_{R,t} (\gamma - 1),$$

➤ Technological progress in the traditional sector

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

Conditional steady-state

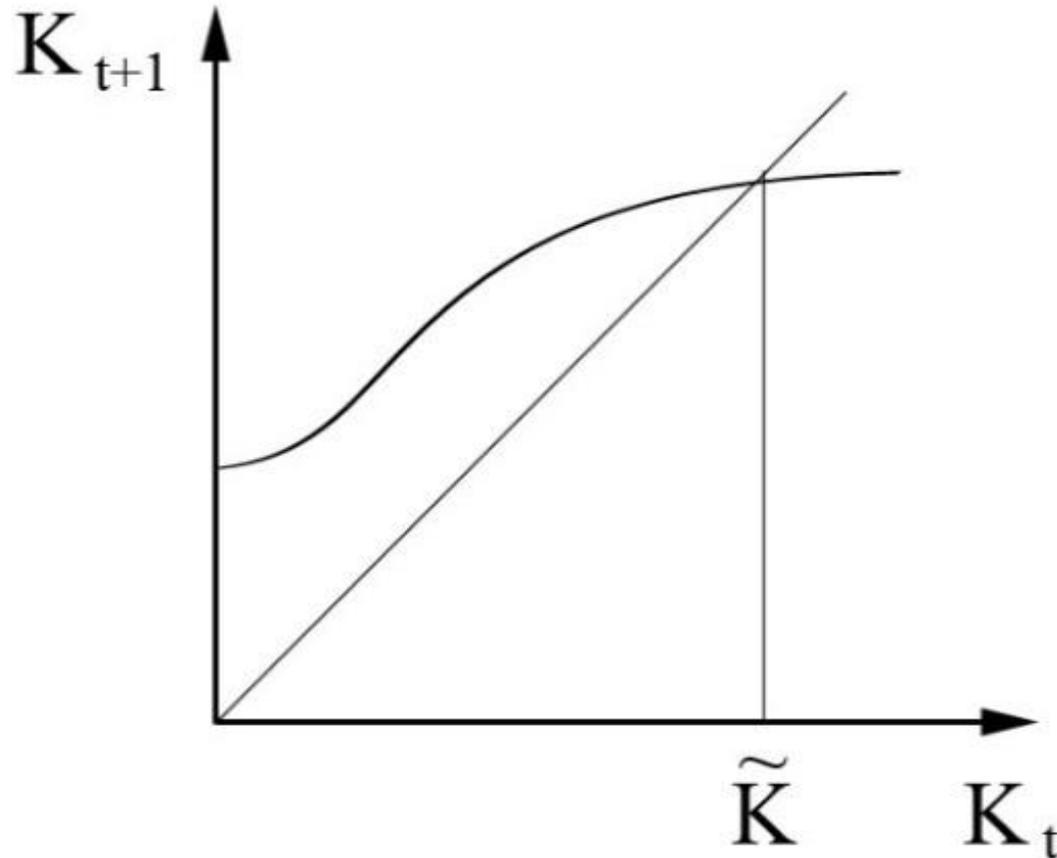


Figure 1. The dynamics of aggregate capital for a given level of AM, AT

The share of employment in the modern sector

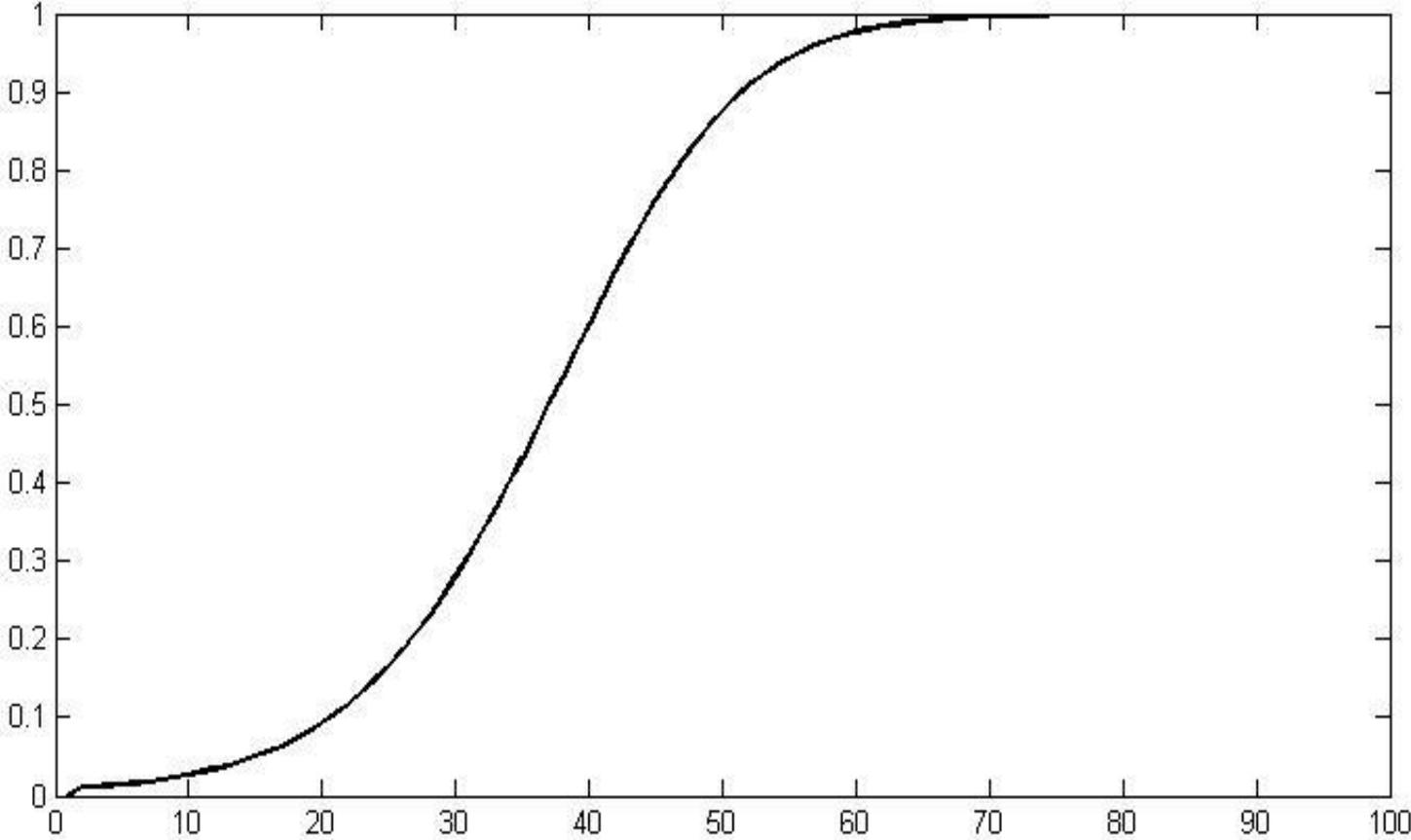


Figure 3. The dynamics of employment in the modern sector

The shares of factor incomes in GDP

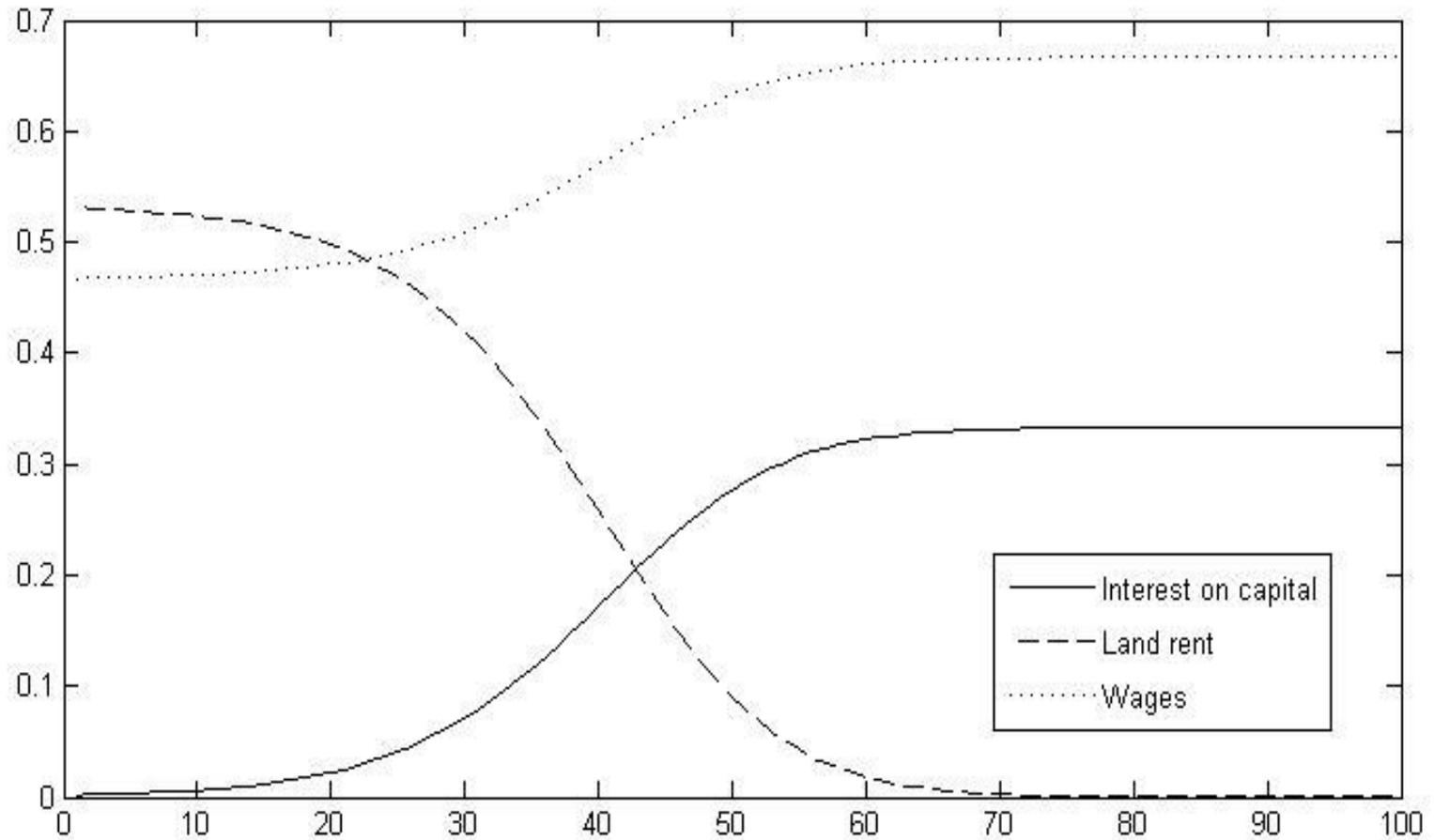


Figure 4. The dynamics of factor incomes shares in total value added

Gains from the reform policy

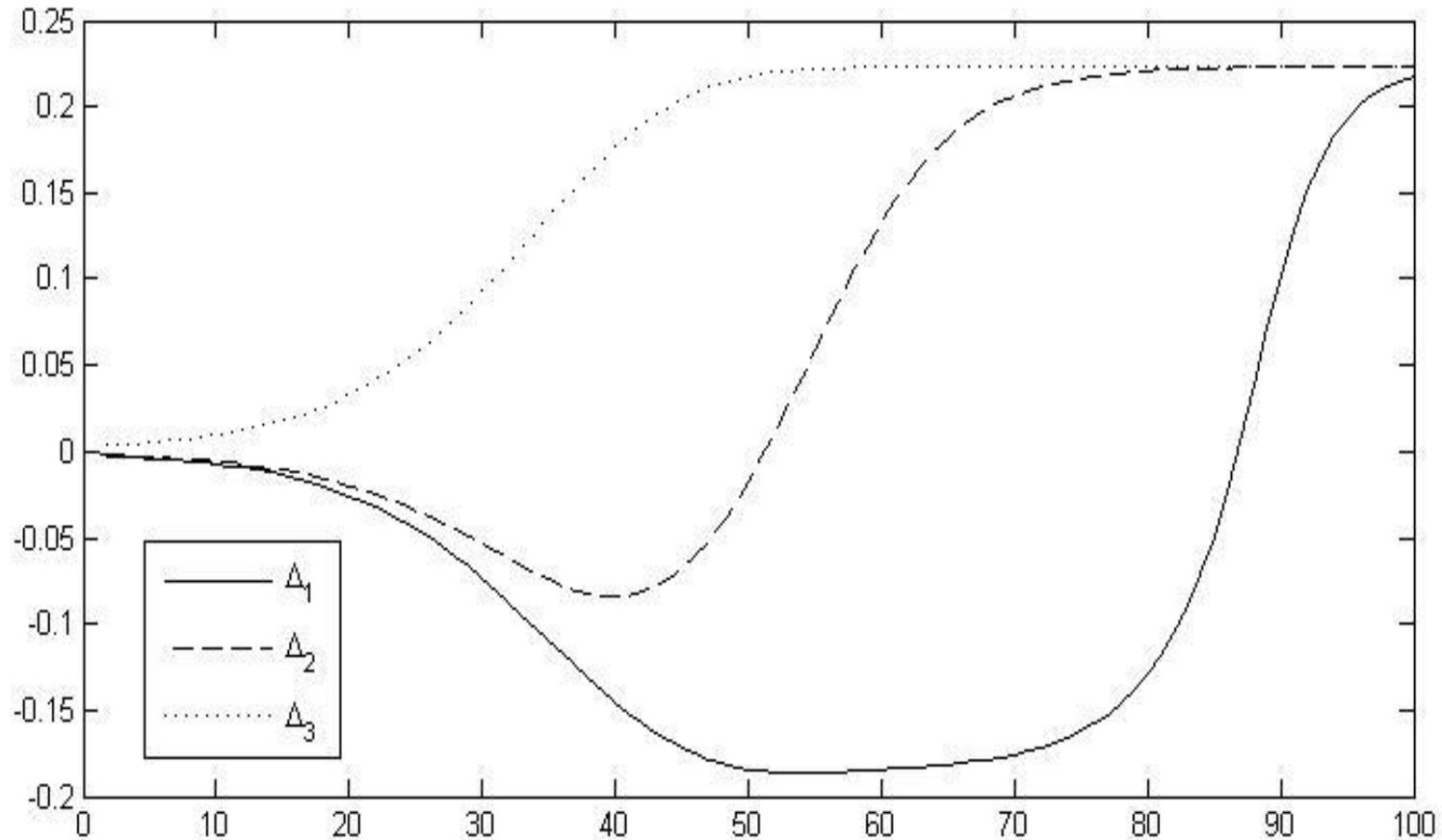


Figure 2. The dynamics of gains from the reform policy Δ^i

Land inequality and pro-growth policies

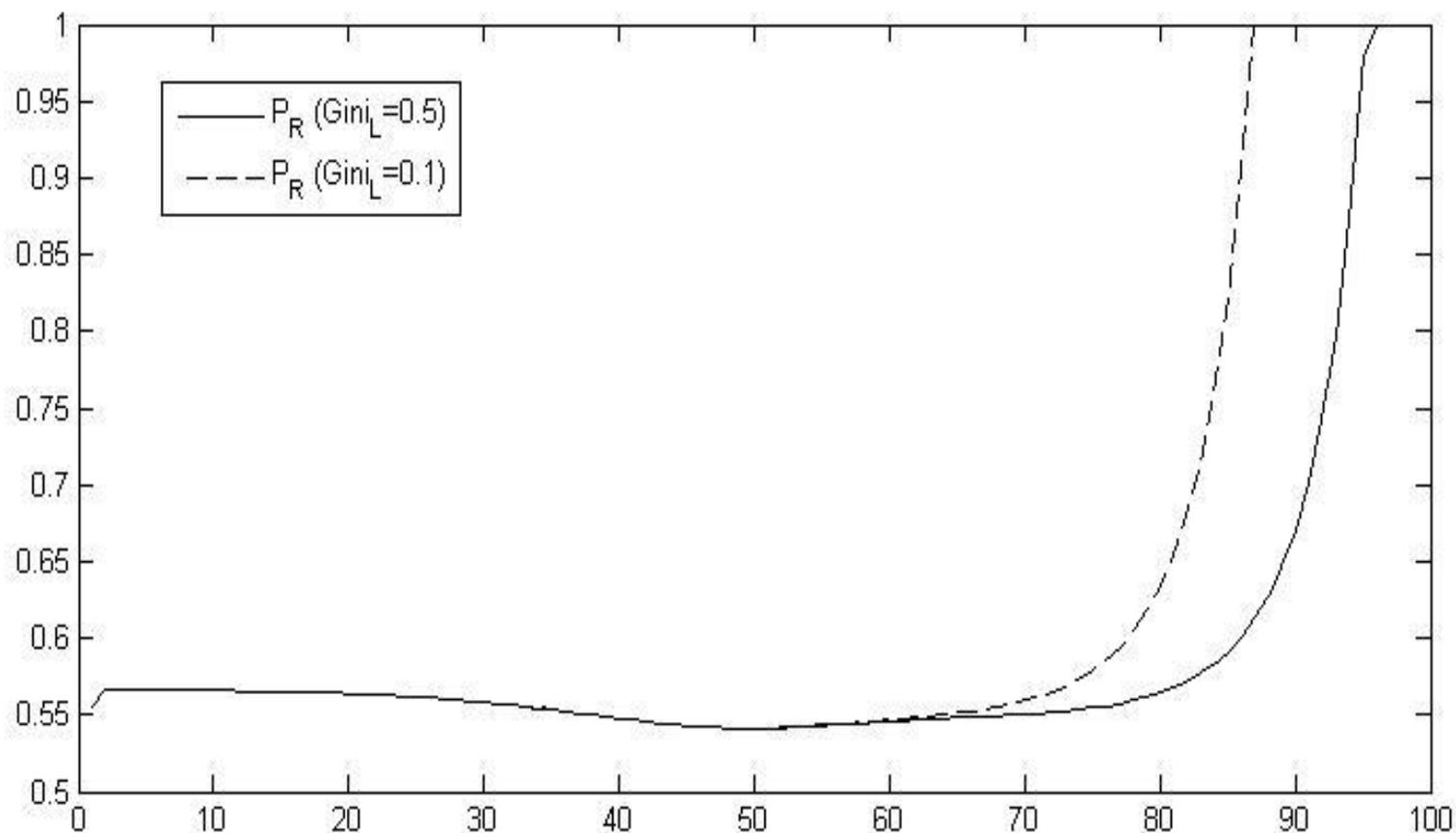


Figure 5. The dynamics of the reform policy probability in economies with different inequality of land within the elite

Land inequality and conflict intensity

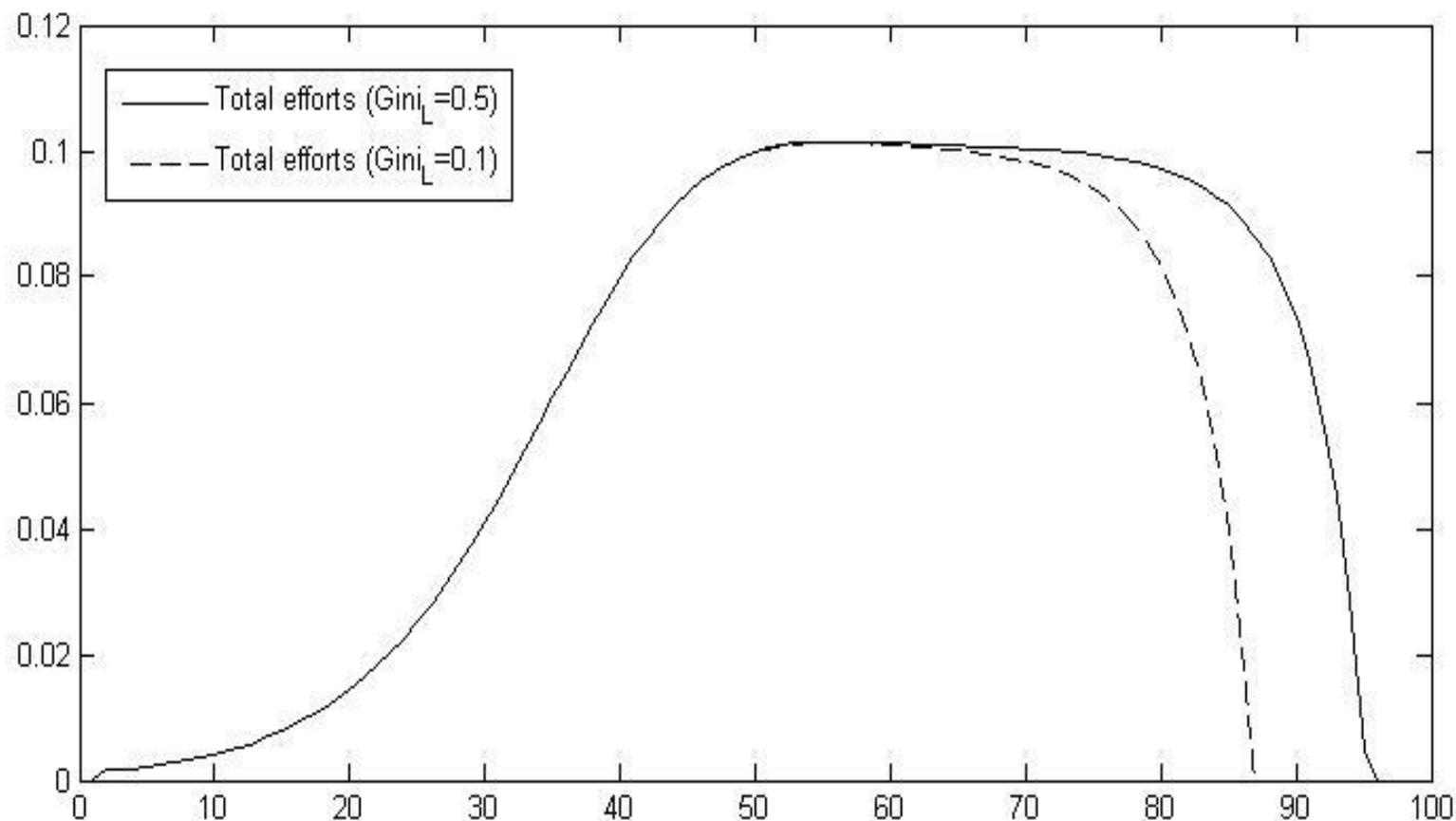


Figure 6. The dynamics of total effort in political contest in economies with different inequality of land within the elite

Land inequality and great divergence

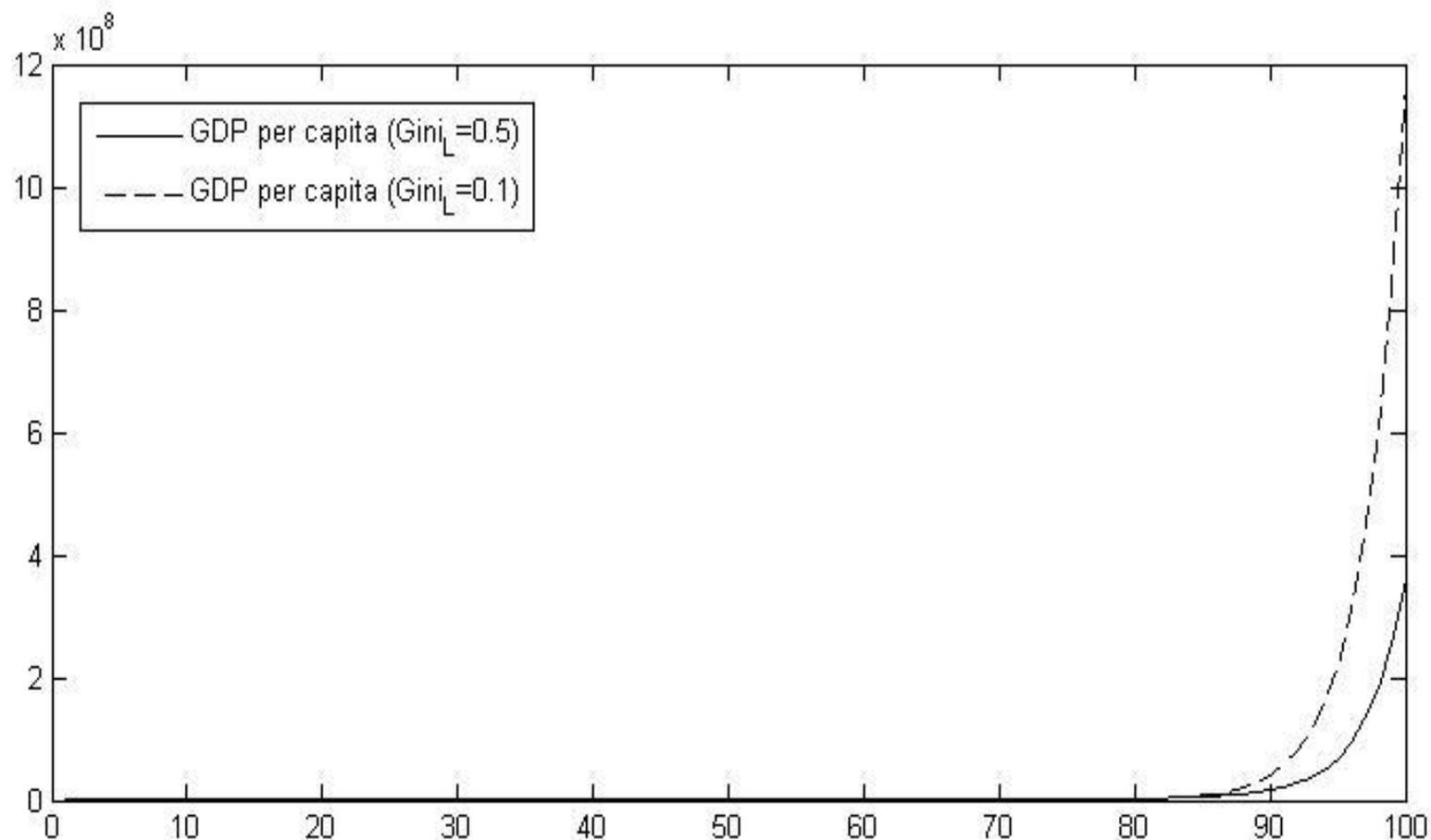


Figure 7. The dynamics of GDP per capita in the economy with high and low concentration of land within the elite

Capital inequality and conflict intensity

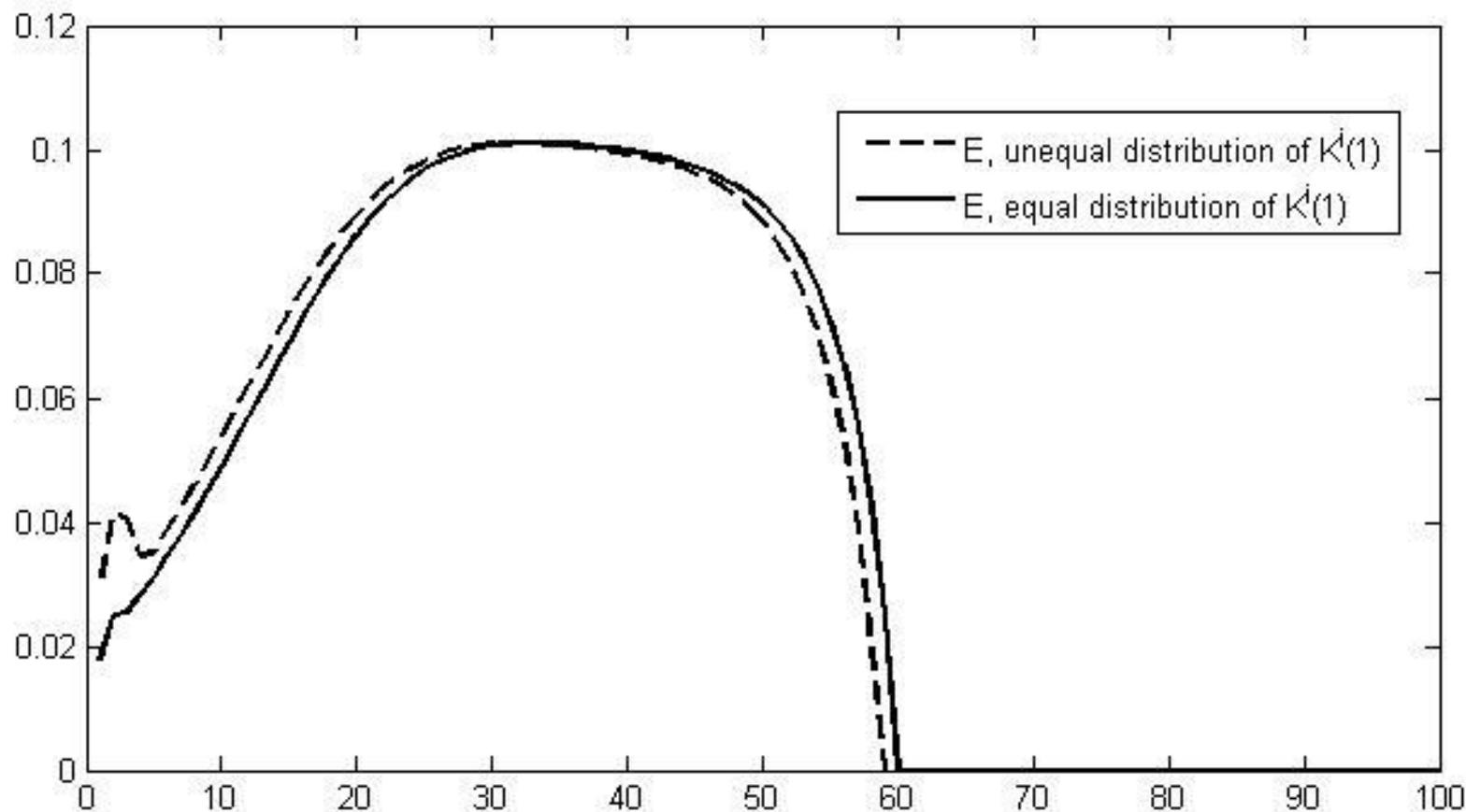


Figure 8. The dynamics of total effort in political contest for economies with high and low initial concentration of capital within a group of landless agents

Capital inequality and the Great Divergence

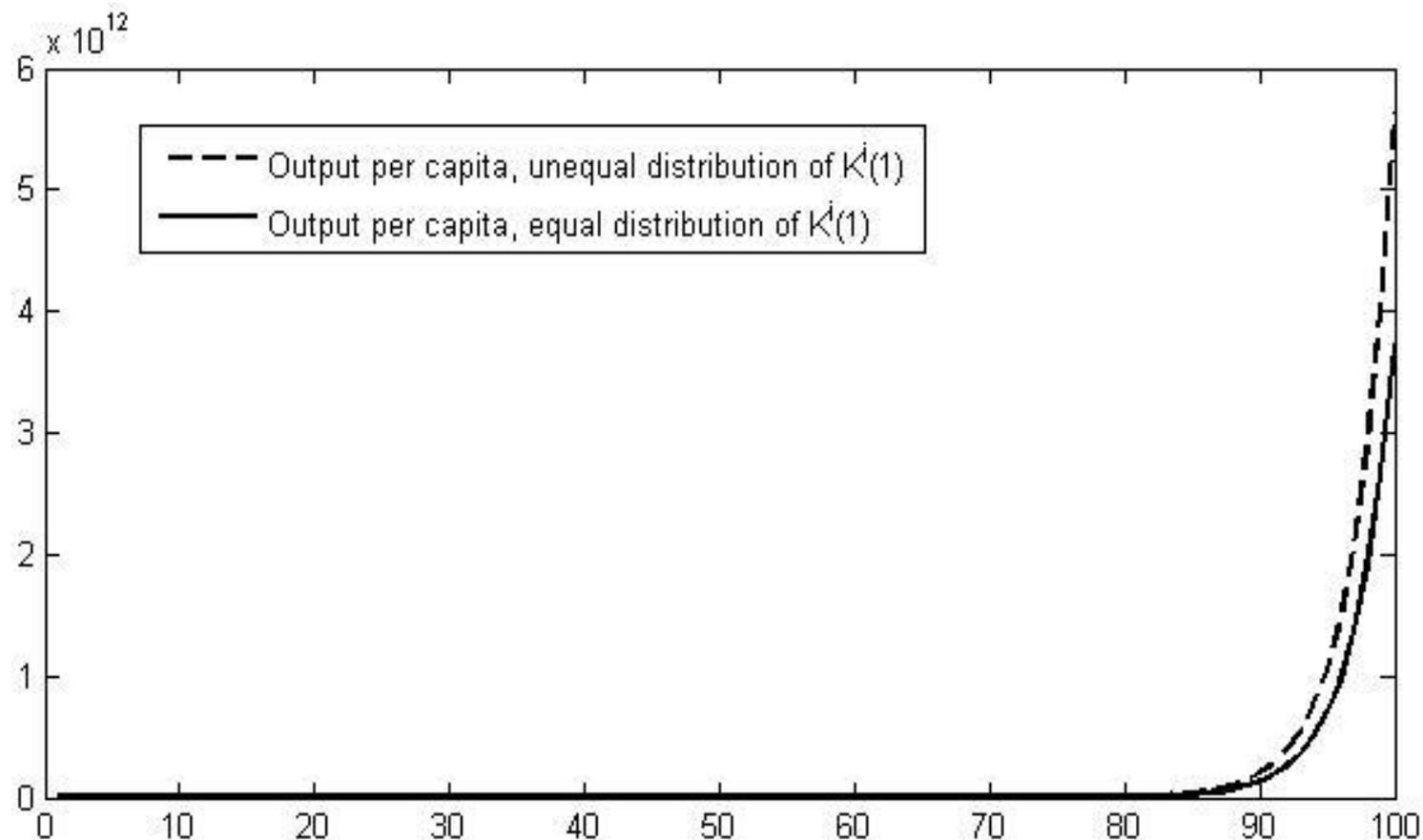


Figure 10. The dynamics of income per capita for economies with high and low initial concentration of capital within a group of landless agents

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

Thanks for your attention!