Spillover Effects From Chess, 1891-2021*

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Abstract

This paper explores the formation of upper-tail human capital under socialism and its longstanding impact on economic and political participation. I have formalised a model of the interplay between economic and intellectual life. I have collected a novel dataset of *2 155 chess protocols and 11 115 unique names* of chess players between 1891 and 2021 in the three levels of tournaments: local (cities and towns), republics, and international competitions held in the USSR and, after 1991, in Russia. Based on the data, I have found a variation in chess competitiveness by the level of tournaments and geographical units. It accounts for a more than 6 times decrease in the local competitiveness in the 30-s and, more importantly, in the 70-s and 80-s. Furthermore, this variation allows me to frame future opportunities to explore causal relationships between chess competitiveness and a) the probability of city participation in the cooperative movement, introduced in 1989; b) the exposure of political protest activities in 2007-2017 at the level of the city.

*I am grateful for the many valuable and inspiring suggestions and ideas from Noam Yuchtman, Jeremiah Dittmar and Neil Cummins. I also thank Marvin Suesse for his discussion of the paper and valuable comments. All mistakes are my own.

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Contents

1 Motivation

Branco Milanovich's *Capitalism Alone* claims that the glorious success of capitalism could be explained as the best system of reinforcing individuals' values.[1] This aligns with Aristotle's thoughts in Nicomachean Ethics about eudaimonia as a combination of happiness and harmony to be aimed for. Aristotle finds them connected, even when thinking about products of labour, which he believes should be useful and harmonical. By this logic, a society based on individual values, framed by capitalism, is more likely to aim at Aristotle's eudaimonia and be stable in self-reinforcing values. While Branco Milanovich points out that it is true for capitalism, I think it could be true for socialism as well. The idea of different social values under capitalism and socialism — individualism and collectivism — amplifies the question of whether these differences led to the dissolution of socialism around the globe.

Even though Branco Milanovich writes that there is no place for other socioeconomic systems now, it highlights two fields to explore deeper: a) the economic history of lasting communist regimes; and b) the observable differences of post-socialist countries within their new capitalism form compared to not-exposed countries. The values reinforced through capitalism today are still different between post-socialist and other countries, as Milanovich points out in his definition of political capitalism. However, his examples of political capitalism — China and decolonized African and Asian countries

1. Branko Milanovic, *Capitalism, Alone* (Harvard University Press, September 2022), https://doi.org/10.2307/j.ctv25250qr.

with ruling communist parties —fail to capture drastic differences in values toward economic actions in countries without an actual ruling party now. Similar to his idea of the success of socialism as a form of backwardness, it is hard to find a mechanism used to reinforce these different values except for thinking of a tight political regime.

These two pieces from Milanovich's *Capitalism Alone* partly contradict each other. On the one hand, he tries to present capitalism as the best system of self-reinforcing values while also accounting for political capitalism, where the state plays a larger role in maintaining those reinforcing mechanisms. On the other hand, his argumentation practically cuts a) the role of intellectual life beyond education in socialist countries, through which values can be reinforced in their new capitalist mode; b) the place of Russia and the post-Soviet values without politically reinforcing them and with resistance to communists political parties.

At this point, I rely on Doepke and Zilibotti's (2017) paper about parenting styles across countries that participated in the World Value Survey to show how these contradictions are significant to account for.[2] Although the paper discusses the trade off between educational outcomes and parenting styles, it shows correlations between income inequality and different social values in parenting. This is a way to highlight how social values, transmitted through another than political reinforcement channel, could shape individu-

2. Matthias Doepke and Fabrizio Zilibotti, "Parenting With Style: Altruism and Paternalism in Intergenerational Preference Transmission," *Econometrica* 85, no. 5 (September 2017): 1331–1371, ISSN: 1468-0262, https://doi.org/10.3982/ECTA14634.

als' behaviour. Based on their data, it highlights that the valuations of hard work, independence and imagination in China and Russia are dramatically different compared to other countries that participated in the survey. They are striking outliers for the importance of hard work, as I plotted in Figure 1, and they also show low importance of imagination in their core values in common compared to other countries. Although this example is not directly connected to the introduced topic, it highlights the motivation to find empirical evidence that self-reinforcement also could exist through different channels in socialist systems, which were not observed by Milanovich.

The self-reinforcement of values and skills beyond educational outcomes is highly relevant in forming upper-tail human capital, as shown by Squicciarini and Voigtländer (2015) in the example of knowledge elites.[3] They stress how the presence of knowledge elites before industrialisation has affected the outcomes of city growth, providing a possible framework for the interplay between upper-tail human capital formation and technological advancements. While the initial idea of Squicciarini and Voigtländer's paper is mostly related to debates on industrialisation and the spirit of capitalism, I find it fruitful to apply this framework to understanding the extent to which intellectual life under socialism shapes the human capital formation and, consequently, the structure of economic participation after the dissolution of socialist systems.

Aleksander Gerschenkron already partially has framed this motivation

3. Mara P. Squicciarini and Nico Voigtländer, "Human Capital and Industrialization: Evidence from the Age of Enlightenment," *Quarterly Journal of Economics* 130, no. 4 (November 2015): 1825–1883, ISSN: 1531-4650, https://doi.org/10.1093/QJE/QJV025.

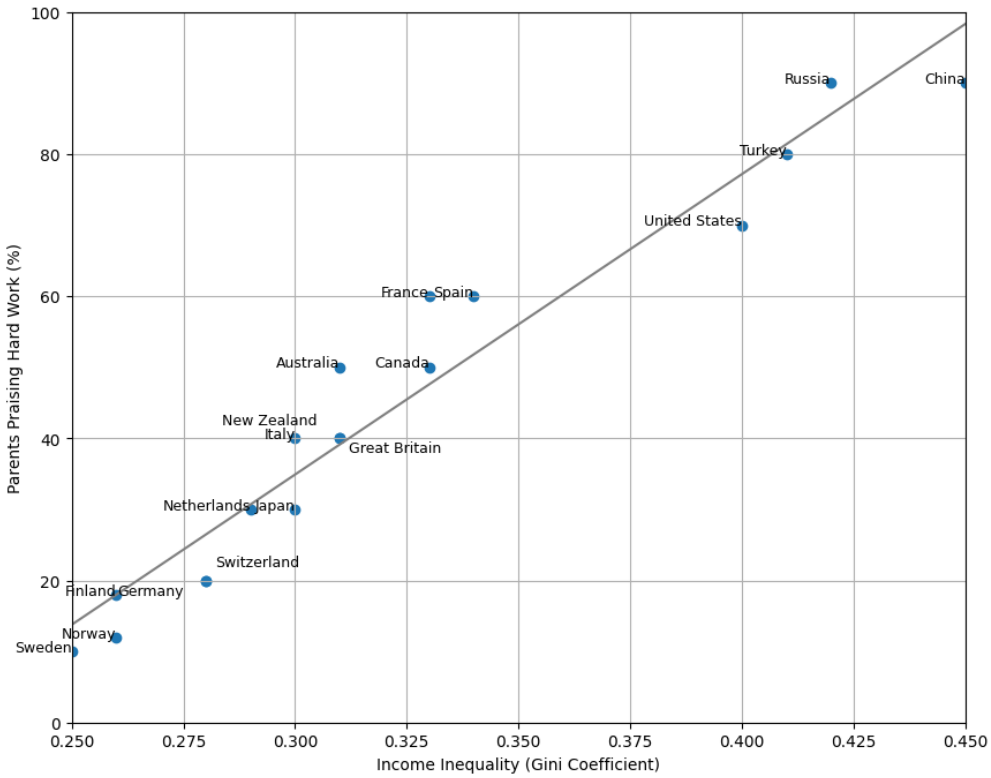

Figure 1: Income Inequality and Parenting Values

Note: Replicated from Doepke and Zilibotti (2017). The scale of the x-axis has been changed (from 0.05 points to 0.025).

in his *Economic Backwardness in Historical Perspective.*[4] He emphasises the importance, in the Russian context, of understanding whether capitalism creates capitalists' spirit, or if the spirit creates capitalism. For example, this idea was mostly developed by Tamila Lankina, who combined the Russian Empire's entrepreneurial class, meshchane, with post-USSR political com-

4. Alexander Gerschenkron, *Economic Backwardness in Historical Perspective: A Book of Essays* (Belknap Press of Harvard University Press, 1962), 456, ISBN: 9780674226003.

petition at a granular level.[5] She shows the positive effect of assigning this historical group to post-Soviet territories for democratization, arguing that in the case of Russia, there are non-state dependent roots of transmitting values, such as family and non-state policies. However, returning to Gerschenkron's book, in the section *Social Attitudes, Entrepreneurship, and Economic Development*, he stresses the idea of entrepreneurship as a social role rather than a stable group, which is more rooted in Durkheim's *The Division of Labour in Society*.[6] Gerschenkron's question — what is more important in the Russian context, the spirit or the capitalism — remains puzzling in the literature and has not moved since the ground-breaking works of Gerschenkron and Chayanov.

This question is still puzzling partly because of a previous scarcity of data outside of the Soviet Union about the economy, contrasted with the abundance of data within the USSR, mostly collected in non-numerical contexts or from sources which were not suitable for actual research programs of social sciences in this time. In this context, as Gerschenkron also points out in his essay *Notes on Doctor Zhivago*, there are many alternative sources to write about Soviet economic history, which will underline Soviet economic life. Even though the literature the largest source of information which has

5. Tomila V. Lankina and Alexander Libman, "The Two-Pronged Middle Class: The Old Bourgeoisie, New State-Engineered Middle Class, and Democratic Development," *American Political Science Review* 115, no. 3 (August 2021): 948–966, ISSN: 0003-0554, https://doi.org/10.1017/S000305542100023X.

6. Émile Durkheim, Steven Lukes, and W. D. Halls, *The Division of Labour in Society*, 2nd ed. (Palgrave Macmillan, 2013), 370, ISBN: 9781137031823.

been produced in the Soviet Union, the protocols of chess tournaments and math Olympiads, which I will discuss in the corresponding section, provide granular information about intellectual life in the Soviet Union and could be prolific in matching intellectual life and economic outcomes under socialism.

As discussed above, in this essay, I frame the potential of intellectual life under socialism to reproduce values that influence economic actions in post-socialist settings and shape upper-tail human capital formation. This motivation aligns with the works of Milanovich and Gerschenkron. Additionally, I explore the variation in chess and math to highlight the concept of backwardness from the standpoint of intellectual competitions.

2 Stylized Model

To develop my intuition from the motivation part, I propose a model for the formation of upper-tail human capital under socialism, with a focus on competition and the effects of this competition after economic opportunities largely became available.[7]

The output function Y_i of each economic region $r \in R$ and industry $i \in I$ has a form of the Leontief function with an elasticity of substitution, $\sigma = 0$, between capital and labour.[8] Each industry-based output is divided into two

7. In the style, I primarly rely on the Acemoglu and Restrepo (2020) model of automation. Daron Acemoglu and Pascual Restrepo, "Robots and Jobs: Evidence from US Labor Markets," *Journal of Political Economy* 128, no. 6 (2020): 2188–2244, https://doi.org/10.1086/705716

8. Wassily Leontief, "Output, Employment, Consumption, and Investment," *The Quarterly Journal of Economics* 58, no. 2 (February 1944): 290–314, ISSN: 0033-5533, https:

elements: capital, which is fixed by the plan authorities in a socialist system, and manual (L_{Mi}) and non-manual (L_{Ni}) labour which have the CES form:

$$Y_{ri} = \min\left(aK_{ri}, \left(\alpha L_{M,ri}^{\rho} + (1-\alpha)L_{N,ri}^{\rho}\right)^{\frac{1}{\rho}}\right). \tag{1}$$

Manual and non-manual labour compete for different tasks X_{ri}.

2.1 Labour Supply

Non-manual labour (L_N) *supplies* at wage (W_i) in each economic region with (Y_c) negative income effect and Frish elacticity(Φ) as follow:

$$W_i = \Phi Y_i L_i^{\epsilon_i}. \tag{2}$$

The utility of supplying labor for non-manual workers (U_{Ni}) can be expressed using Becker's utility function, with the output vectors (x_m) and time preferences (T_m):

$$U_N\left(f_1(x_1, T_1), \ldots, f_m(x_m, T_m)\right), \tag{3}$$

is subject to budget constrain (wT) as follow:

$$\sum_{m=1}^{M} p_m x_m + \alpha w F = wT, \tag{4}$$

where p_m is the price of consumption x_m, w is the hour-wage, F is the

//doi.org/10.2307/1883321.

amount of free time, T is the total time, and α is a preference for free time out of wage-driven consumption ($\alpha > 1$).[9]

To derive the upper-tail human capital from non-manual group of workers, I am writing down the intertemporal utility functon U_t^F for intellectual (U_t^I) and non-intellectual (U_t^L) types of leisure as follow:

$$U_t^N = \begin{cases} (1+\phi)U_t^I + U_t^L & \text{if } \phi > 0 \\ U_t^I + U_t^L & \text{if } \phi = 0 \end{cases} \tag{5}$$

where if $\phi = 0$, intellectual and non-intellectual leisure activities are equally perceived intemperately. If $\phi > 0$, this is an upper-tail human capital group with an intertemporal reward for choosing intellectual leisure activities.

2.2 Labour Demand

The *demand* of non-manual labour is less elastic, even for labour in general, and can be effectively summarised in the style of Becker's model of taste discrimination.[10]

Employers' utility function U_N for non-manual labor includes the composition of groups E_I and E_l, the level of profit π, which is constrained by the planning system, and skills beyond productivity ϕ as follows:

9. Gary S. Becker, "A Theory of the Allocation of Time," *The Economic Journal* 75, no. 299 (September 1965): 493–517, ISSN: 0013-0133, https://doi.org/10.2307/2228949.

10. Gary S. Becker, *The Economics of Discrimination. [La economía de la discriminación]* (University of Chicago Press, 1971), ISBN: 9780226041162.

$$U_N = U(E_I, E_l, \pi, \phi). \tag{6}$$

An employer who is in favour to hire of upper-tail human capital workers $U_I = \frac{\partial U}{\partial E_I} > 0$. An employer who prefer to hire other group of non-manual workers $U_l = \frac{\partial U}{\partial E_l} < 0$. Depends of this decision, the employer's profit π is given by:

$$\pi = pf(\phi L_I + L_l) - w_N E_I - w_N E_l, \tag{7}$$

where p is the price of output, $f(\phi L_I + L_l)$ is the production function by labor and the spillover effect ϕ of upper-tail human capital.

As differences in productivity between non-manual workers are unobserved, I derive the Backer's discrimination coefficient d, indicating a bias toward hiring upper-tail human capital:

$$d = pf'(\phi L_I + L_l) - \frac{w_N}{\phi}, \tag{8}$$

$$pf'(\phi L_I + L_l) - w_N = 0. \tag{9}$$

To sum up *the supply and demand sections*, I have pointed out the mechanism of deriving upper-tail human capital from leisure preferences. From the supply side, intellectual leisure increases the utility of upper-tail labor, leading to the greater preferences for free time compared to other non-manual

labor under fixed wages. From the demand side, non-manual labour has biased toward hiring upper-tail human capital due to premium for skills beyond productivity.

In Appendix A, I account for historical evidence of why this model largely describes the supply and demand of labor in the USSR. Let's now turn to the effects of intellectual leisure preferences.

2.3 Upper-Tail Human Capital

While differences in the supply of non-manual labour are not observed through productivity and wages, the premium for intellectual preferences in leisure $\phi > 0$ and biased toward upper-tail human capital d shape the intertemporal preferences to hire workers.

The spillover effect depends on barriers to free participation in economic life, proxied by performing tasks $x \in X_{ri}$. Under socialism $[0, M_i]$, intellectual life generates hiring biases and no observed productivity effect when $x < M_i$. After the dissolution of socialism or the openness to entrepreneurship, when $x > M_i$, leisure preferences generate productivity and wage differences, which are mainly concentrated in economic and political participation preferences as follows:

$$X_{ri}(x) = \begin{cases} l_{ci}(x) + e_{ci}(x) + p_{ci}(x) & \text{if } x > M_i, \\ (1+\phi) l_{ci}(x) & \text{if } x < M_i. \end{cases} \tag{10}$$

The specification for estimating the parameters of the impact of intellectual life under socialism (ϕ) as well as economic (e_{ci}) and political (p_{ci}) spillover, when it becomes available $x > M_i$, is as follows:

$$\phi_{ri} = \lambda_0 + \lambda_1 C_r + \lambda_2 P_{a,r} + \lambda_3 (C_r \cdot P_{a,r}) + \lambda_4 Z_{ri} + \epsilon_{ri}, \tag{11}$$

where C_{ri} is a function of intellectual competition in region i and industry r, P_{ar} shows political preferences to shape intellectual life, $(C_{ri} \cdot C_{ri})$ denotes their interaction, and Z_{ri} is a set of control variables.

The spillover effects for economic Y_{ri} and political participation P_{ri} are as follows:

$$Y_{ri} = \gamma_0 + \gamma_1 \phi_{ri} + \gamma_2 Z_{ri} + \epsilon_{ri}, \tag{12}$$

$$P_{ri} = \delta_0 + \delta_1 \phi_{ri} + \delta_2 Z_{ri} + \epsilon_{ri}. \tag{13}$$

In this part, I have explained the meaning of intellectual life, mainly shaped by competition, and how this competition can result in spillover effects on economic and political participation after the shift to deliberate economic participation or capitalism.

3 Data

In this section, I introduce chess protocols as a primary source. Additionally, I highlight my secondary sources: shares of participation in the cooperative movement at the regional level, after the introduction of the Law on Cooperatives in 1988; and participation in political protests between 2007 and 2017, also at the regional level.[11]

3.1 Primary Source

3.1.1 Using Chess as a Source

Chess played an unprecedentedly large role in the early formation of the Soviet Union.[12] There is much anecdotal evidence that chess was important in justifying the meritocratic and intellectual nature of socialist power, often used in propaganda showing soviet leaders playing chess. One fascinating example of this is the question of whether Vladimir Lenin played chess, as it was extensively depicted in the pamphlets. From a few photos and contemporaries' notes, Lenin indeed thought positively about chess and played, for example, in this photo with a party member and pioneer in blood transfusion theory, Alexander Bogdanov and, crouching around the table, writer

11. Lankina and Libman, "The Two-Pronged Middle Class: The Old Bourgeoisie, New State-Engineered Middle Class, and Democratic Development"; Tamila Lankina, *Lankina Russian protest event dataset*, 2018.

12. Michael Andrew Hudson, "Storming Fortresses: A Political History of Chess in the Soviet Union, 1917–1948," *PhD Dissertation*, 2013,

Maxim Gorky.[13] The Soviet propaganda changed the attitudes toward chess, transforming it from bourgeois leisure into a mass intellectual movement.

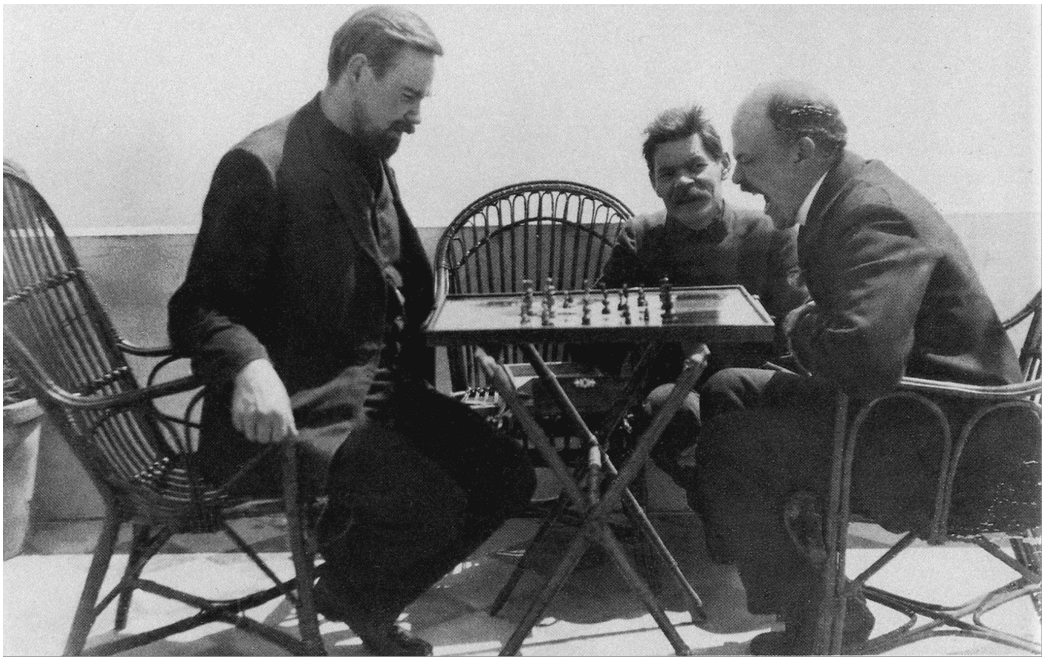

Figure 2: Lenin, Bogdanov, and Gorky play chess, 1908.

Note: from Gorky Media, the article 'Lenin Was Not a Social Racist', April 23, 2018.

Chess was also prolifically framed within a utopia of a communist economy and the role of education in it. Party members Nikolai Bukharin and Evgenii Preobrazhensky in *ABC of Communism* point out a program on how to build a communist society based on much higher 'mental development' of workers than in capitalism.[14] They stress the core role of the workers and extensive investments in their needs, prioritizing them over profits. This logic

13. Gorky Media, *[Lenin Was Not a Social Racist]*, 2018.
14. Nikolai Bukharin and Evgenii Preobrazhensky, *The ABC of Communism - Chapter III : Communism and the Dictatorship of the Proletariat.*

leads to overcoming any divisions of labour. Quote from *Chapter 3*:

> "Under communism people receive a many-sided culture, and find themselves at home in various branches of production: today I work in an administrative capacity, I reckon up how many felt boots or how many French rolls must be produced during the following month: tomorrow I shall be working in a soap factory, next month perhaps in a steam laundry, and the month after in an electric power station. This will be possible when all the members of society have been suitably educated."

The intellectual development of workers was mainly conducted in workers' clubs and special faculties for workers (*rabfak*), outside of the commonly understood higher education system. The workers' clubs were introduced in the early 20-s as facilities for workers to shape their leisure time. On one hand, this policy aimed to improve workers' productivity, which was commonly believed at this time to be effectively achieved through sports and intellectual games. On the other hand, it was designed to create Bukharin and Preobrazhensky's utopian type of Soviet worker. From both perspectives, chess played a significant role as a leisure activity.

The design of workers' clubs was similar to that of social clubs, providing venues for workers to gather. They included easily accessible facilities, such as shelves with books and chess boards, and monopolised the place for workers' time out of work. In 1925, Soviet artist Alexander Rodchenko presented

a prototype of these clubs at the Paris World Fair, demonstrating how Soviet workers spend their free time.[15] The focus of this exposition was chess, with red and black chess pieces symbolizing both a new type of leisure for Soviet workers and an imaginable standoff between Soviets and capitalists. Considering both the ideological and intellectual roles of chess, it also includes a trade-off between playing and competing. According to this, the Soviets incentivised workers to compete by creating a large-scale system of competitions, from the lowest level of workers' clubs to international tournaments.

Mechanically, the Soviet system had two types of competitions: championships, in which players advanced to the next stage, and tournaments, which gathered grandmasters and players already selected at the Republican level. Championships were usually held at the level of workers' clubs, cities, regions, and more rarely at the level of Republics. The rules for conducting games were provided by the USSR Chess Federation in the form of a Chess Code, which remained relatively stable over time. Games were organised in a round-robin system, where each game had a value of 1 point. A draw in a game allocated 0.5 points to each player, while the winner received 1 and the loser 0 points.

In summary, chess characterizes a large part of the formation of Soviet Union ideology toward labour forces, becoming a not state-based channel of intellectual development. Intersecting with my stylised model, it includes

15. Alexander Rodchenko, *V Parizhe. Iz pisem domoj [In Paris: From Letters Home]*, Second Edition (Moscow: Publisher, 2023).

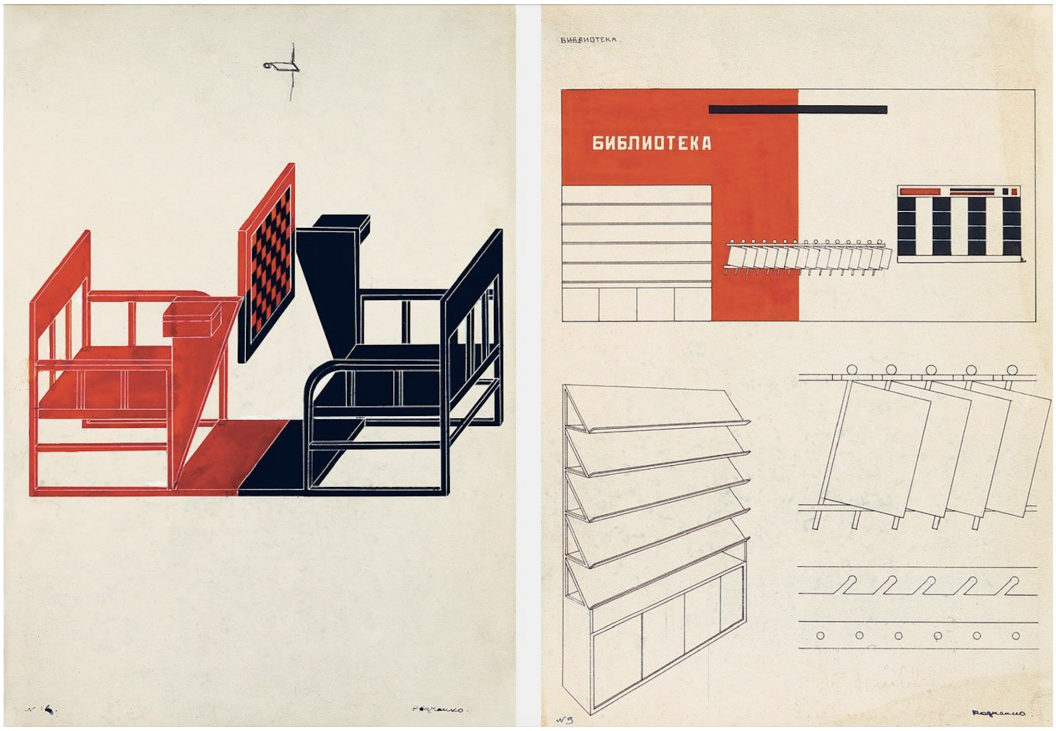

Figure 3: The project sketches of the 'Workers' Club' by Alexander Rodchenko, 1925. From the book 'V Parizhe. Iz pisem domoj [In Paris: From Letters Home].'

underlying information on how intellectual competition evolved from maximising intellectual leisure on a granular level.

3.1.2 Chess Protocols and Dataset Parsing

Aligning with the history of chess, I have considered chess protocols as ego documents from open sources, published by chess players themselves. As the game remains popular worldwide, many former players publish the protocols of their games in tournaments. Moreover, these protocols have

high reliability as sources, rooted in the requirement for winners to collect them if they want to be promoted to the next chess class. To collect these protocols, I rely in most cases on the open-source platform Russian Chess Base, where players upload their protocols along with the Portable Game Notation (PGN) of games, as shown in an example in Table 2.[16] If a protocol is uploaded without PGN notation, it is usually possible to verify the source through local newspapers or books about the history of chess. For high-ranked players, I verify their games using the apps *ChessBase 17* and *Mega Database 2024*. Together, these programs contain more than 10.4 million games back to the 19th century, primarily focusing on grandmasters' games.

Using web scraping, I have gathered the data for three levels of competition: cities, which mainly include data of cities or districts; republics; and international level among masters, including the best players from the Republican lower level competing together. I have listed the variables extracted from the protocol's data in Table 1.

The player's name statistics appear significantly missing (34% of all gathered data) at the city level and partly in the republic-level data. However, in only 54% of missing cases, the data does not include the name of the first player (the winner), decreasing the overall share of completely missing names to 16.4%. In the republic-level competitions, only 40% of missing names are empty, reducing the overall share to 8.6%.

16. *Russian Chess Base*, https://al20102007.narod.ru/, 28. 05. 2024.

Table 1: Summary of Observations from Collected Data

Variable	**Unique Observations**	**Saturation**
Name of a 'home' geographical unit		
City level	130	100%
Republic Level	14	100%
International level	1	100%
Players		
City level	11,115	66%
Republic Level	4,902	80%
International level	3,091	100%
Number of games		
City level	390,868	100%
Republic Level	94,291	100%
International level	96,393	100%
Average number of players per tournament		
City level	13	100%
Republic Level	17	100%
International level	21	100%
Elo rating		
City level	-	-
Republic Level	-	-
International level	390	9%
Points		
City level	954	84%
Republic Level	572	91%
International level	391	100%

Note: The column with unique observations shows how many of them are non-repeating, which is important for city names and player names. Saturation indicates how many observations are not initially missing in the protocol data. This is relevant for player names, which could be missing in the primary protocols.

Table 2: Championship of Kiev - 1930

Rk	**Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**P**
1	Rauzer V.	*	0	1	1/2	1	1/2	1	1	1	1	1	8.0
2	Poliak E.	1	*	1	0	1	1	0	1/2	0	1	1	6.5
3	Ratner B.	0	0	*	1	1/2	1	0	1	1/2	1	1	6.0
4	Zamikhovsky A.	1/2	1	0	*	1/2	0	1	1	0	1	1	6.0
5	Konstantinopolsky A.	0	0	1/2	1/2	*	1/2	1	1/2	1	1	1	6.0
6	Pogrebyssky I.	1/2	0	0	1	1/2	*	1	1/2	1	0	1	5.5
7	Smyslov	0	1	1	0	0	0	*	1	1/2	1	1/2	5.0
8	Kofman A.	0	1/2	0	0	1/2	1/2	0	*	1	1	0	3.5
9	Grinberg A.	0	1	1/2	1	0	0	1/2	0	*	0	1/2	3.5
10	Kalina V.	0	0	0	0	0	1	0	0	1	*	1/2	2.5
11	Edelman	0	0	0	0	0	0	1/2	1	1/2	1/2	*	2.5
12	Bogatyrchuk F. (retired)	0	1	0	1.0(4)	-	-	-	-	-	-	-	-

Source: chess tournament results from Shakhmatnyj listok, December 1930, page 206.
Note: example of notation is as follows: [Event "Ch Kiev"] [Site "Kiev (Ukraine)"] [Date "1930.??.??"] [Round "?"] [White "Rauzer Vsevolod (RUS)"] [Black "Konstantinopolski Alexander (RUS)"] [Result "1-0"] [ECO "E38"] [WhiteElo "0"] [BlackElo "0"] [Annotator ""] [Source ""] [Remark ""] 1.d4 Nf6 2.c4 e6 3.Nc3 Bb4 4.Qc2 c5 5.dxc5 Nc6 6.Nf3 Bxc5 7.Bf4 O-O 8.e3 b6 9.Be2 Bb7 10.O-O d5 11.Rfd1 Qe7 12.cxd5 Nb4 13.d6 Nxc2 14.dxe7 Bxe7 15.Rac1 Nb4 16.Nb5 Nfd5 17.Bd6 Bxd6 18.Nxd6 Ba6 19.Bxa6 Nxa6 20.Ne5 Nc5 21.Nc6 a5 22.a3 a4 23.g3 f5 24.Rc4 Nf6 25.f3 g5 26.h3 Nd5 27.Kf2 f4 28.gxf4 gxf4 29.e4 Ne3 30.Rg1+ Kh8 31.Ne5 Ra7 32.Rd4 Rg7 33.Ndf7+ Kg8 34.Nh6+ Kh8 35.Nef7+ Rgxf7 36.Nxf7+ 1-0

The *geographical distribution* of collected city-level protocols is presented in Figure 4. It aligns with the population density, concentrating in the European part and some of the centres in the South Asian part. Moreover, the data compliments the history of chess, highlighting the higher density of playing in the Ukrainian and Caucasian republics, as shown in Figure 5.

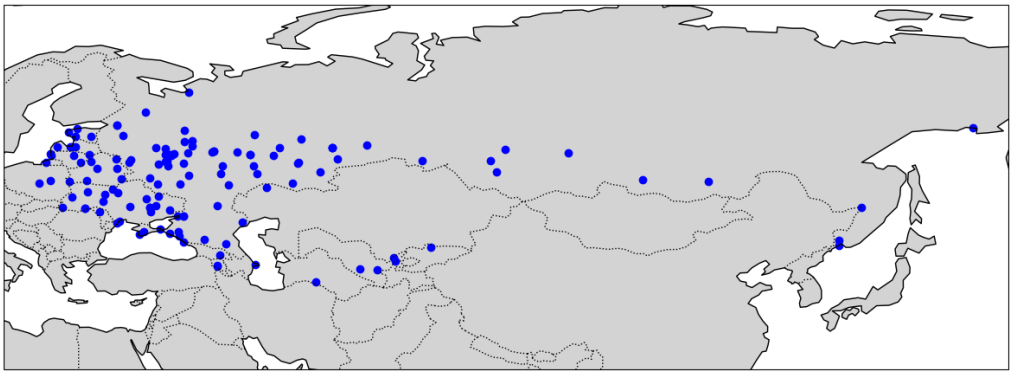

Figure 4: Distribution of Cities with Local Championhsips, 1891-1997.

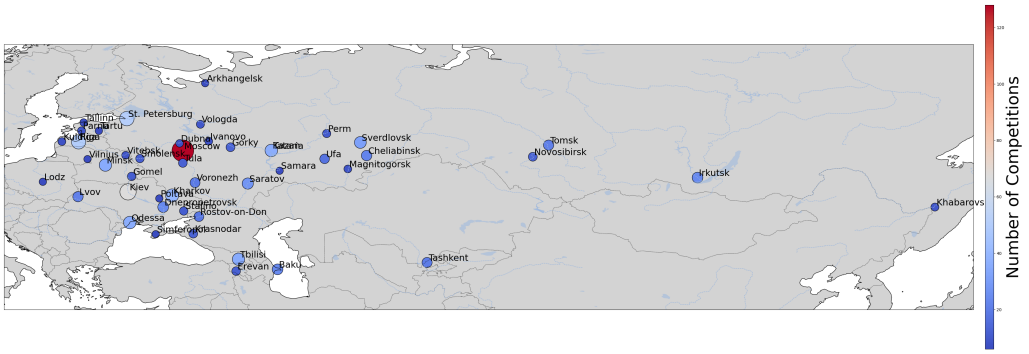

Figure 5: Cities with More than 5 Competitions.

The time distribution of competitions is presented in Figure 6 and Figure 7 , showing the intensity of play at the city level and below, as well as the necessity to hold republican competitions to select players for the USSR

Championship. Relying on the gathered data, the clear disconnect between local and republican competitions and their structure, when local competitions are part of the selection process, gives an interesting variation in how selection relates to outcomes in the next stages.

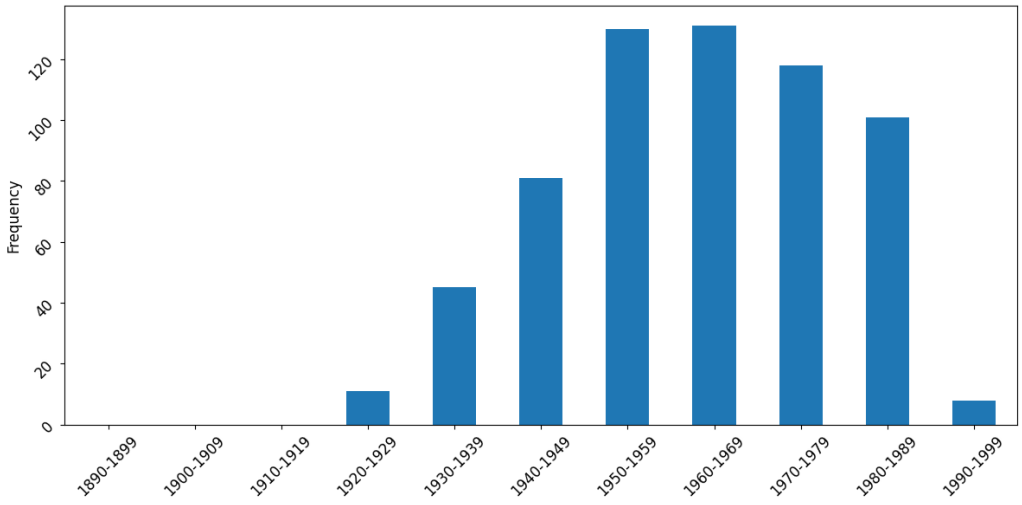

Figure 6: Frequency of Republic-Level Championships.

3.1.3 Chess Competition and Identification of Model's ϕ

Based on my data and stylized model (equation 11), chess approximates intellectual competition shaped by political preferences. As described in the subsection *Using Chess as a Source*, the development of the game was closely associated with the ideological and, consequently, economic goals of the Soviets. Within this context, party members believed in the role of intellectual leisure to enhance labour productivity. The competition drawn from chess demonstrates an intellectual potential beyond the educational

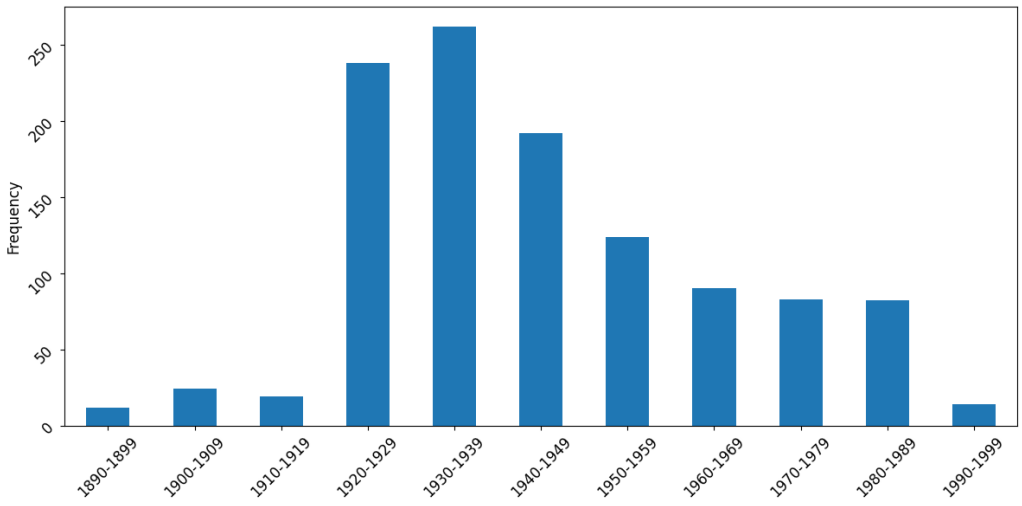

Figure 7: Frequency of City-Level Championships.

focus of human capital development, providing a compelling example of how intellectual competition contributes to economic actions.

There are three ways to measure this degree of intellectual competition from the chess protocols. The first way is to calculate the share of the first-ranked player's score, as the CR ratio, in the overall championship score. It highlights how easily the winner won a competition, and it's a simple and conservative measure. The second measure is to observe how competitive each championship is, showing how easily the winner of the competition changes over time. Although this approach provides a way to work with competition as a categorical variable, it is expected to provide a less conservative measure than the first approach, as it does not show the underlying competition beyond the first-ranked player. The third quantification corresponds with the economics of sport and tournaments with home and visit matches, measuring

a degree of competition as an opportunity to win in a visit compared with home matches. In the chess context, the probability of a first-ranked player winning the next-stage championship and losing the next home-city competition would be a measure of competition. Although this method provides a more theoretically meaningful measure of competition, it halves the collected data because Republic competitions only began in the 20-s and were used actively only after WW2, and it also limits observing pre-Soviet trends.

In this essay, I construct the measure of competition based on the CR ratio rather than name shuffling or the opportunity of winning and losing, as follows:

$$CR\ ratio = \frac{Points\ of\ the\ winner}{Played\ points}. \tag{14}$$

This approach provides an opportunity to measure chess competition from a longer perspective and offers a first approximation of future possible measures as the opportunity-based measure. Additionally, I ignore measures related to Elo rating construction based on the assumption that they will poorly work at the local level due to a lack of history of games for most players.

3.2 Secondary Sources

3.2.1 Math Olympiads and Mathematicians

As an external validity case, I utilise protocols of math competitions from the All-Russian Olympiad of Schoolchildren for the period 2009 – 2019. This competition is the final stage of the 5-level Olympiad, providing data on the overall score of each participant, along with their home region and school. Another potential option to explore math as a data source is the Mathematics Genealogy Project, which has included information on all received PhD titles in math since the 19th century. This project provides an opportunity to study an interplay between chess participation and academic occupations, which could be further explored.

3.2.2 Controls

As a set of controls, I use comprehensive datasets from Tamila Lankina's papers. The first dataset includes wide information about Imperial Russia and the USSR. It comprises sets of variables explaining political participation, historical shares of different social classes, employment shares over time, and educational variables such as the number of engineers with university degrees, shares of educated people, and the shares of doctors with university degrees. The second dataset provides information on participation in political protests in Russia at the regional level, highlighting the variation in protest political participation across regions from 2007 to 2016. In summary,

both datasets provide additional information on the structure of human capital at the regional level, which I will use to study the spillover effect from chess competition.

4 Results

4.1 Intellectual Competition

Based on the CR ratio measure of chess competition, I have found an increase in competition between local and republic levels within three time periods: the 30-s, 70-s, and 80-s. *Using the CR ratio, a larger CR ratio explains a higher share of the first player's scores and, hence, smaller competition.* I have constructed averages of residual-based differences in competition within each regional bin, with cities assigned to regions, over 10-year intervals, as shown in Figure 8.

These increasing events in competition are associated with steady growth at the local level, as presented in Figure 9. The highest competition is associated with period of 70-s, when Bobby Fisher won Boris Spassky in the World Chess Championships.

At the city level, the distribution of the competition has changed over time, particularly between chess centres such as Moscow and Kyiv. Moscow's competition was strikingly decreasing before WW2 and skyrocketed shortly after. Kyiv and other historical centres of chess experienced increasing competition over time, especially after WW2. I show the interplay between

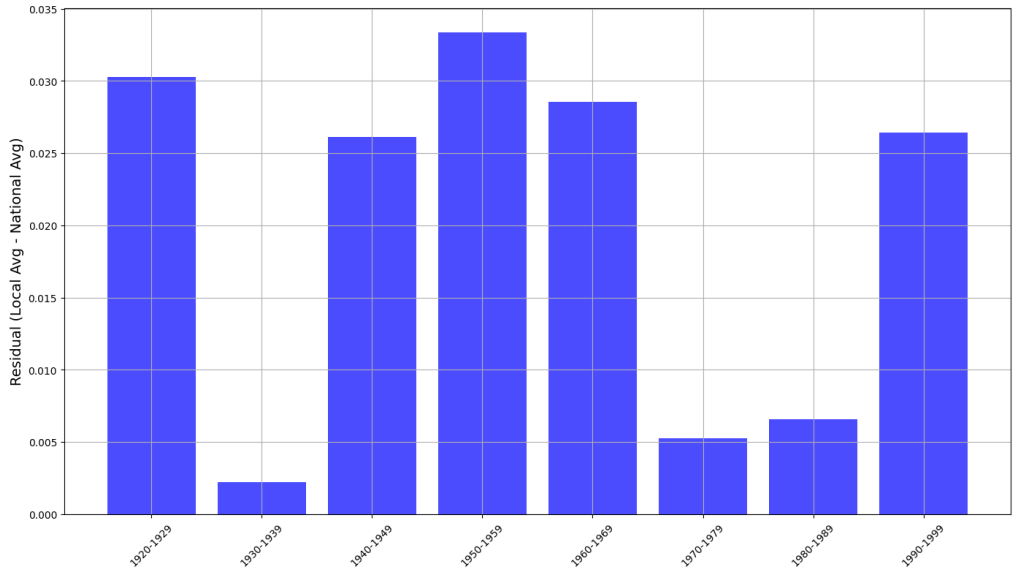

Figure 8: Residuals of CR Ratio by 10-Year Bins.

Note: Residuals calculated as averaged-in bins local CR ratios minus corresponding republic-level ratios. I exclude CR Ratios more than 0.5).

Moscow and Kyiv CR ratios in Figure 10, where the post-WW2 differences could be driven by the political redistribution of human capital to Moscow, particularly among upper-tail human capital.

The republic-level competition shows a different perspective on the interplay between competition and results than the city-level, providing evidence of a declining CR ratio in the level of republics after 70-s. As shown in Figure 11, I focus on the Russian, Ukrainian and Georgian republics because they consist of different trends at the local level, although similar results apply to other republics as well.

To sum up Figures 9-11 above, I observe the overall increase of competi-

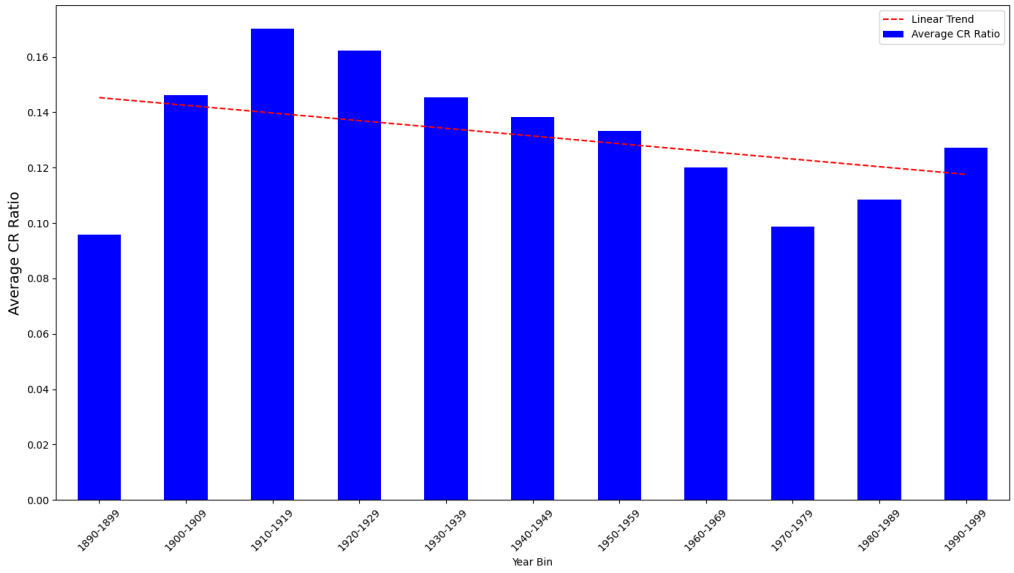

Figure 9: Average competition in 10-year bins.

tion in the chess centres over time, except Moscow before WW2. From my perspective, it is associated with the starting of a larger role of Moscow in chess after 40-s, when superstar players moved to Moscow, possibly increasing the overall level of playing chess. In other cases, increasing competition is associated with the same increase in the republic level, confirming that higher selection led to more competitive next stages. The decline in competition at the republic level started in the '70s when the Soviets first time lost the World Championship. Technically, since the 1937 win of Alexander Alekhine, they were hegemons of international tournaments. Moreover, the linkages between local and republic competitions, using the residual measure, confirm that in the 70-s, the Soviets experienced a significant slump in republic-level relative to city-level competitions, as it also is in the 30-s and

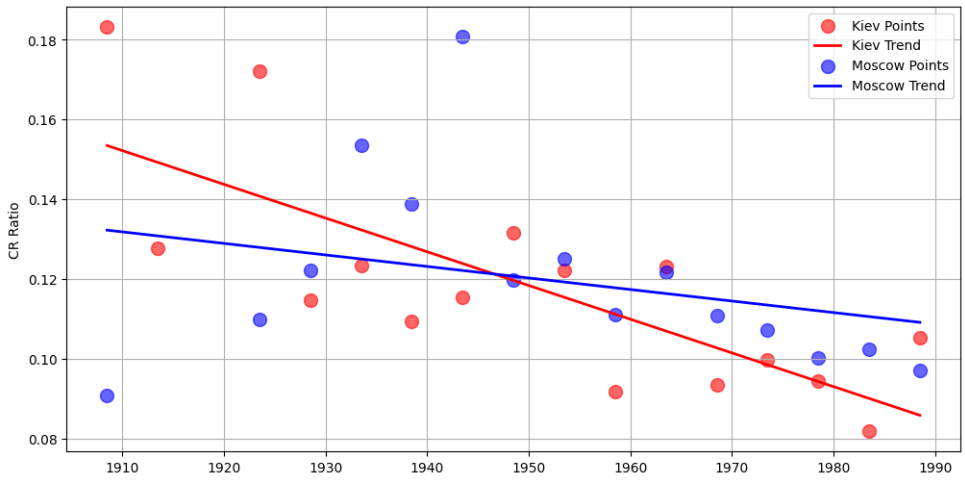

Figure 10: Competition in Moscow and Kyiv by 5-Year Bins.

80-s.

These results are still robust if I group all observed cities into two bins: a) cities historically considered as centres of chess, and b) other cities. As expressed in Figure 12, after the 50-s, the centres experienced a relative decrease in competition, whereas other cities continued to experience growth in competition.

4.2 Spillover Effects

The first spillover effect which I plan to observe is the probability of regions with higher chess competition being more widely participated in the cooperative movement after 1989. Although this specification allows me to show the economic outcomes of the intellectual competition from my stylised model, I did not find causal relationships between my measure of chess com-

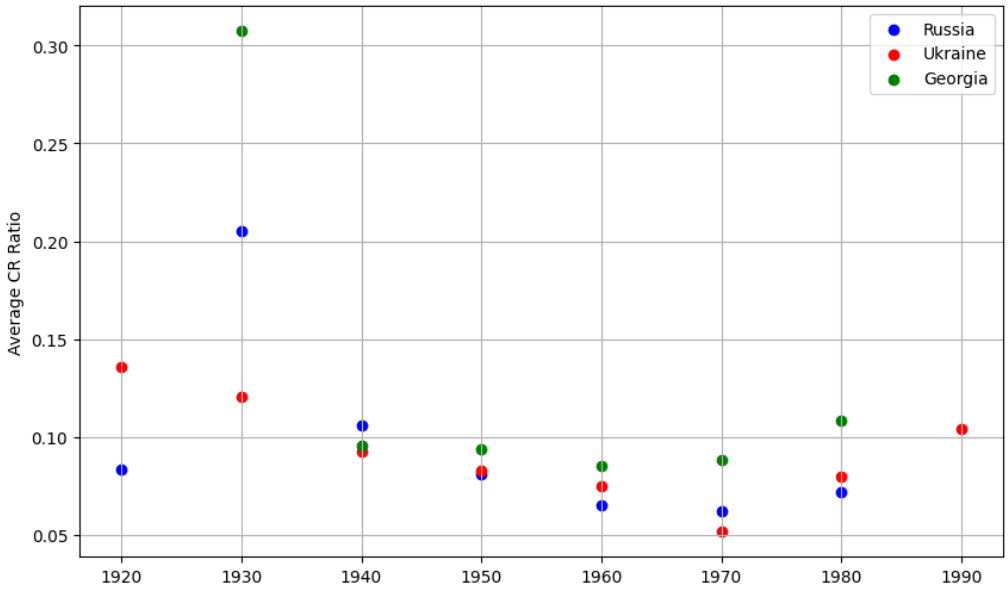

Figure 11: The Dynamics of Competition at Republic Level.

petition and political variables used by Tamila Lankina, such as the number of cooperatives and their employment. As an intermediate result, I present a scatter plot showing the correlation between chess concentration and the number of cooperatives at the regional level for twenty cities with the largest number of competitions held. While the relationships between variables are insignificant, it could represent a form where lower competition is associated with smaller participation in the cooperative movement, as shown in Figure 13.

This finding is contrary to my stylised model and expected significant positive spillover from chess competition, suggesting a few possible avenues for further analysis. On the one hand, the collected cooperative data is incomplete, not accounting for the dynamic in their registration after the

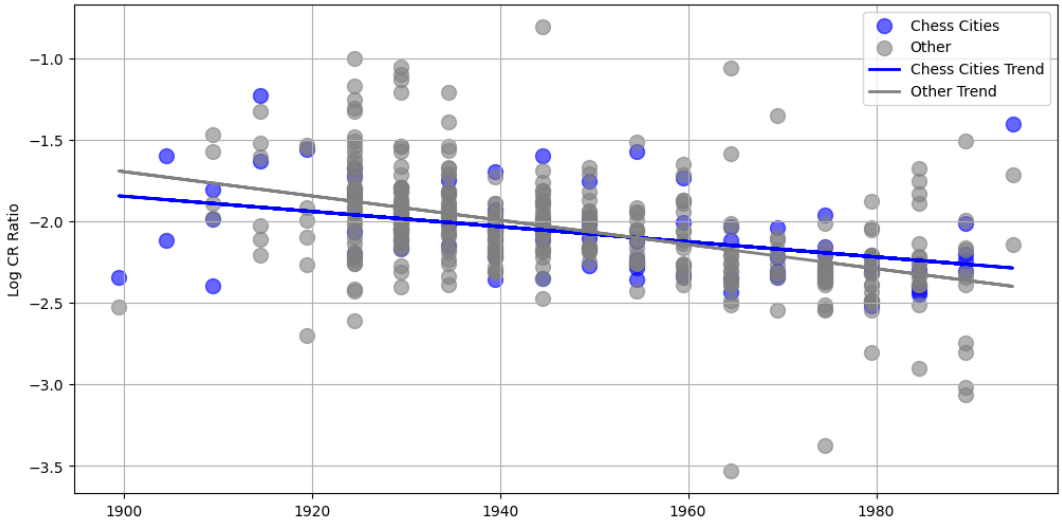

Figure 12: Competition in Centers and Other Cities.

introduction of the Law on Cooperatives in 1988. A future investigation of primary sources regarding the dynamics of cooperation before and after 1988 could be beneficial. On the other hand, my measure of competition may not capture the underlying dynamic of intellectual competition which could shape economic participation when it becomes available. Another measure could be the dynamic of upper-tail human capital workers after the dissolution of the USSR, tracing their professional trajectories.

The second spillover effect for political participation has been framed with the intuition that larger exposure to chess competition will result in increased protest political activity through the formation of human capital. I investigated it using the Russian protests dataset and did not find significant relationships between these variables. As an additional intermediate result, I present a possible form of their relationships in Figure 14, where smaller

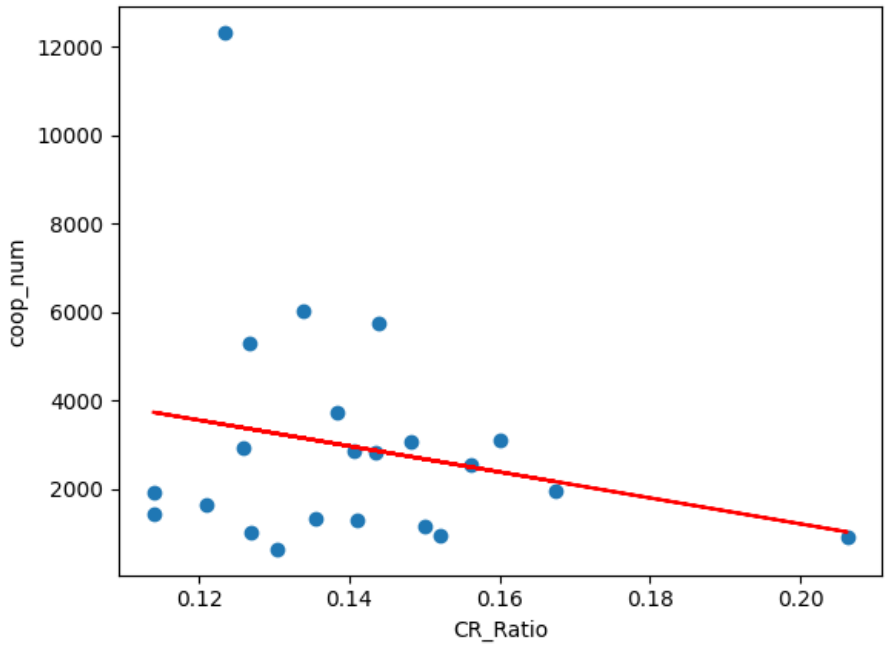

Figure 13: Chess Competition and Number of Cooperatives

Note: corr = -0.23 for the 20 cities with the largest number of collected protocols.

competition is associated with larger protest activity. This form could lead to another way of shaping political participation, where chess could trigger growth in support for the state and, hence, greater representation from regions with more chess champions, such as the example of Anatoly Karpov.

5 Conclusion

This essay aims to uncover intellectual competition as an underlying force in the formation of upper-tail human capital under socialism. I frame the concept of upper-tail human capital under socialism as prioritising intellec-

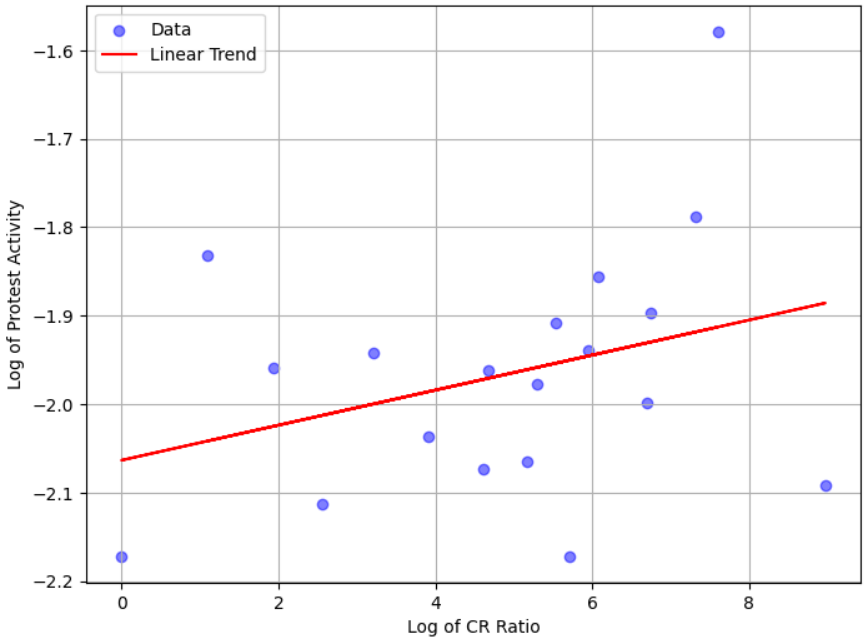

Figure 14: Chess Competition and Political Protests

Note: corr = 0.04 for the 20 cities with the largest number of collected protocols.

tual leisure over other types of leisure and, partly, working time, developing this idea in my stylised model. Building on the motivation of extending Branco Milanovich's book, I discuss the differences in values even within state-led capitalism, attempting to revisit the USSR settings and illustrate how Soviet intellectual life may have shaped economic actions today.

For these purposes, I collected an extensive chess dataset for the period from 1891 to 2021. Using this data, I have analysed the dynamics of chess competition over time at both local and republic levels. Moreover, I have explained why Boby Fisher won the World Championship in 1972. From my perspective, the increased competition at the republic level may lead to a

negative selection bias for Boris Spassky compared to players at the same level.

Although I have comprehensively illustrated the dynamics of chess competition, I was only able to suggest a possible form of spillover effects from chess to economic and political participation. This raises another set of questions regarding more suitable data, as well as a potential for misleading intuition about identification of intellectual competition using chess. At the same time, it highlights an extensive, partly undiscovered field: *how intellectual life, particularly intellectual competition, shapes economic participation.* It also amplifies the Gerschenkron's question — what is more important in the Russian context, the spirit or the capitalism — which still remains open.

A Appendix: Historical Background

Based on the motivation from Chapter *Notes on Doctor Zhivago* from Gerschenkron's *Economic Backwardness in Historical Perspective*, I list some of the books and sources which highlight the role of chess in Soviet society.

In the early 1930s, the official culture in the Soviet Union, whose authors had opportunities to be published and receive benefits from the state, was named socialist realism (socrealism). Simply, they were part of propaganda, although some of them wrote high-quality works.

For example, the Soviet writer Vasily Ilyenkov wrote a novel *Sunshine City (Solnechnyj gorod)* in 1935, which depicted the building of a metallurgical plant in the USSR.[17] They choice in some way oxymoron to describe soviet future, and, partly for that, they received much more beneftics of intellectual work to compare with non-official culture writers.

My idea behind is to stress the role of intellectual leisure, particularly chess, in this literature movement, showing a portion of attention to chess as utopian imagination of Soviet workers. I plan to do it as a future step to understand the embeddeness of chess in Soviet culture.

However, there is another movement in literature, presented by Nabokov's *The Defense*, which depicts an opposite imagination of chess, portraying it as a bourgeois game.[18] It could be profound to compare Russian immigrant novels and socialist realism writers of how they understand and value chess.

17. Vasily Ilyenkov, *The Sunshine City [olnechnyj gorod)]* (N/A, 1935).
18. Vladimir Vladimirovich Nabokov, *The defense : a novel* (Vintage Books, 1990).

B Appendix: Zipf's Law

While I am using city-based measures of competition, I am wondering if they fulfill the Zipf's law. I am following Axtell (2001) to do it.[19] I highlight the observation in the style of the map in Figure 5 for complementarity.

From the Figure 15, my data seems not to hold to Zipf's Law, especially in the center of distribution. This could indicate many uncollected observations in the center and at the bottom.

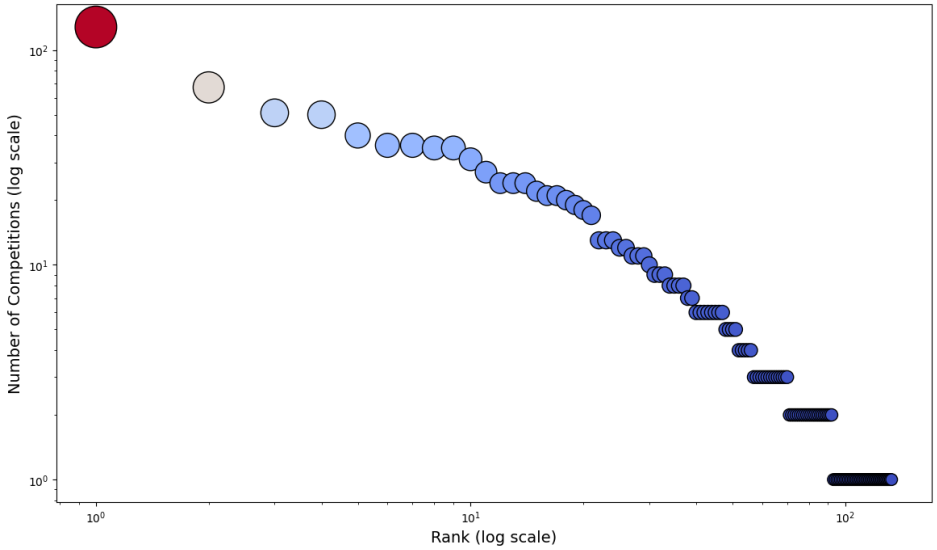

Figure 15: Zipf's Form

19. R. L. Axtell, "Zipf distribution of U.S. firm sizes," *Science* 293 (5536 2001): 1818–1820, ISSN: 00368075, https://doi.org/10.1126/SCIENCE.1062081/ASSET/95A3E02E-04EE-48BE-A8EF-9C3ECE05A4C5/ASSETS/GRAPHIC/SE3519729002.JPEG.

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