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Comments

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"To some, history (including evolution) is not a science, because its results cannot be replicated and thus cannot be tested by the experimental method", Cavalli-Sforza (2000, p. VIII)

"The Neolithic revolution (...) has to be presented as a single event because archaeology can only recognize the result: the several steps leading up thereto are beyond the range of direct observation" (Childe, 1951, p. 87).

Testing causal relationships expressed by mathematical models on facts about human behaviour across history is challenging. A prominent example is the Neolithic agricultural revolution [1]. Many theoretical models of the adoption of agriculture has been put forward [2] but none has been tested. The only exception is [3], that uses a computational approach with agent-based simulations of evolutionary games. Here, we propose two games that resemble the conditions of human societies before and after the agricultural revolution. The agricultural revolution is modelled as an exogenous shock in the lab (n=180, 60 independent groups), and the transition from foraging to farming results from an equilibrium selection process decided by experimental subjects. The experimental data replicate the known facts that foragers organized themselves around division of labour [4] and were more egalitarian than farmers [5]. There is also evidence of bi-modal distribution along the foraging-farming axis with many in-between groups [6, 7, 8]. These results provide direct evidence that the modes of production determine the system of values of societies (inequality) and lend support for the idea that human moved in a widespread manner from foraging to farming societies. We also find that cultural and institutional preconditions were crucial for farming [9], as more egalitarian foraging groups adopted earlier agricultural techniques, but inequality raises in farming societies as agriculture settles [10], with the long run success of agriculture being determined by the land-owner's legitimacy. These results enrich our understanding of the Neolithic agricultural revolution and highlight the relevance of experimental methodology to generate a rich dataset that complements the fragmented evidence from archaeological sites.

JEL codes. C72, C92, D02, D31, D70, N00, N50, O33, P14, Z13

Keywords. *Inequality, agricultural revolution, foragers societies, farming societies, property rights, land-owner, human values, experimental economics*

A long run analysis of economic inequality is necessary to better understand its historical causes [11, 12, 13, 14, 15, 16], but the deeper we delve into history, written records disappear and we must rely on archaeological evidence [5, 10, 17]. The fragmented archaeological evidence does not allow for the *causality analysis* required to assess the influence of technologies -as it is the tradition in economics, [18]- and institutions -as it is the tradition in history, [19]- on economic inequality.

To handle the causality analysis, some researchers have used mathematical models. Agriculture has been considered "the first economic revolution" [20], and the starting point to the increase in inequality [1], thus a great deal of attention has been directed towards understanding the prehistoric shift from foraging to farming societies. In economics, this shift has been modelled using growth theory and technological change, i.e. superior labour productivity in farming over hunting (see [2] for a survey of economic explanations of the agricultural revolution).

Can a causal explanation expressed by a mathematical model about facts than happened ten thousand years ago be tested? Some researches [4, 21, 22] use a computational approach and run agent-based simulations of evolutionary games to test their prediction of the co-evolution of the adoption of a new technology (farming) and the arrival of a new institution (land private property) (see also [23]). In this paper, we advocate an alternative avenue: the experimental methodology. We show that the experimental methodology has the potential to contribute to the debate on the causes of inequality in human history. We attempt to test a long-standing question about whether the modes of production determine the value system of societies –particularly the levels of inequality. This idea already present in Marxism [24, 25, 26] has been recently revitalized [27].

The basic claim in [27] is that foraging societies were more egalitarian than foraging societies, because of the differences in the modes of production. He shows a positive correlation between the modes of production (as measured by the percentage of GDP from non-agricultural sectors) and value systems (proxied by a measure from the World Value Survey of the relative predominance of traditional versus secular values). Some authors, however, conclude that this approach "*is not theoretically well-grounded nor empirically documented*" [28] (pg. 1133) because this correlation does not imply causality. In addition, there are alternative causal mechanisms, as differences in value systems (in particular, the level of inequality) can be explained by growing population sizes [29].

The above criticisms can be easily addressed by the experimental methodology. We design an experiment that captures the conditions under which the agricultural revolution took place. We have 40 independent groups of three members each, with a total n=120 (n=180, 60 independent groups, including a robustness treatment). The experimental design comprises two blocks of twenty rounds where subjects face two non-cooperative games that represent foraging societies ("hunt-gather" game) and farming societies ("hunt-farm" game). In each round of each game, experimental subjects first choose unilaterally which economic activity to engage in and they receive earnings depending on their choices and the choices of the other members in their group. Then, they decide how to redistribute their earnings between themselves and the other members of the group in a redistribution stage. In both games, there are two equilibrium configurations matching what is known about the prevalent economic behaviour of both foragers, egalitarian societies with social division of labour [30], and farmers, more unequal societies concentrated on land use [16]. Hence, the transition from foraging to farming is an equilibrium selection process decided by experimental subjects, because they make choices about the prevalent mode of production (i.e., the economic activities predominantly chosen within a group) and the value system (i.e., how the earnings are distributed among the members of the group).

The agricultural revolution is modelled as an unexpected exogenous technological shock that happens between the end of the twenty repetitions of the "hunt-gather" game and the beginning of the twenty repetitions of the "hunt-farm" game. Acknowledging previous contributions [3, 22, 31], we impose uncontested property rights and assign the land to the member of the group that gathered most in the "hunt-gather" game. This member will become the landowner for the twenty repetitions of the "hunt-farm" game, and in each round, he receives the totality of earnings from farming activities, although redistribution is always available in the redistribution stage.

The experiment reproduces the basic facts about the Neolithic agricultural revolution known from archaeological and ethnographic studies. In the "hunt-gather" game, the modal economic system is based on social division of labour. Once farming techniques were available and land ownership was assigned to one group member, there is a significant drop in social division of labour from 37% to 18% and we observe a clear shift towards the other equilibrium outcome, farming activities, from 21% to 56%. As for the level of inequality, the median Gini index in the "hunt-gather" game is significantly smaller than in the “hunt-farm” game (0.053 *vs* 0.284). These findings provide empirical evidence of a direct *causal* relationship between the modes of production and the level of inequality. Quite interestingly, our results suggest also that the agricultural revolution was not a smooth uniform process. If we compute the percentage of periods that groups farmed the land in the “hunt-farm” game, we obtain a bimodal distribution, with around 50% of groups in the extremes of the distribution: 20% of the groups never experienced the agricultural revolution and 30% of the groups nearly farmed all the periods. In-between, there are groups with short and long lasting agricultural experiences. This result is in line with the hypothesis that groups were heterogeneous when moving from foraging to farming societies ([6, 7, 8].

But the lab also offers new insights into the agricultural revolution. One key element of the design is that the group composition remains unaltered across games. Given that the transition from foraging to farming is an equilibrium selection process, this feature allows institutions and shared norms developed by groups in the “hunt-gather” game to determine the adoption of agriculture, as has been postulated in archaeology [9]. The experimental data offers some results on this account. Experimental foraging groups can be described by their prevalent economic system and by their redistributive efforts. We find that the more egalitarian groups are in the social division of labour, the more likely they are to quickly adopt agriculture. The long-term survival of agricultural practices, however, seems to depend on the legitimacy of the land-owner. Finally, once farming has been stablished as the stable economic activity in a group, the experimental data shows raising inequality, revealing that the hierarchical structure of farming groups, with a landowner and two peasants, has a natural tendency towards inequality; i.e., our data suggest that the advent of farming did not create inequality in the short-run but this was the result in the long-run in farming societies with long-lasting experience.

Bringing the Neolithic revolution to the lab. Experimental design

In the experimental sessions, subjects were matched in groups of three members and participated in two blocks of 20 rounds each. Each round had two phases: a *decision stage* and a *redistribution stage*. In the decision stage, subjects chose between two economic activities that paid off differently depending on their choices and the choices of other members in their group (see below). Subjects received feedback on the choices and payoffs of all members in their group before proceeding to the redistribution stage, in which they could make transfers to other members, i.e. subjects could give up any part of their payoff to increase the payoff of any other member in their group. The value system (i.e., the level of inequality) results then from subjects' choices.

At the end of each round, subjects got to know about the final payoffs of all members before moving to the next round. A history table, containing for each past round information about the action profile chosen by the group and the payoff to each economic activity, was also available at the end of each round.

Block I (rounds 1-20) represents the functioning of *foraging societies*, where the two main economic activities are *hunting* and *gathering*. Once Block I finishes, we change the strategic interaction within groups to model the *Neolithic agricultural revolution* [32]. Block II (rounds 21-40) then represents the functioning of *farming societies*, where the two main economic activities are *hunting* and *farming*. When subjects participated in the first block of the experiment they knew there existed a second block, but the details were not disclosed after the first block was played. We kept constant the composition of the groups across rounds and blocks; i.e., we rely on a partner-matching protocol. This is to allow the shared values or norms developed within groups in Block I to influence the behaviour in Block II [9, 33].

Foraging societies

Table 1 displays the payoff parameterization of the "hunt-gather" game that subjects played during the decision stage in Block I. The payoffs are based on ethnographic studies that compute the average productivity of hunting and gathering (measured in caloric gain per hour) in three modern foraging societies, namely the Ache of Paraguay [34], the Hazda of Tanzania [35] and the Hiwi of Venezuela [36]. These studies reveal two stylized facts: (i) (sexual) division of labour and (ii) larger productivity of hunting relative to gathering, although the returns from hunting are less predictable than those from gathering. For a discussion of this literature, see [37]. The data on the large productivity of hunting relative to gathering comes mainly from large game or large pray hunting.

In our setting, action A ("gathering") yields a secure payoff of 20 while the payoffs of action B ("hunting") depend upon the size of the hunting group and reach a maximum of 50 when there is division of labour and two out of the three members of the groups decide to hunt together.[1]

Table 1. Experimental payoffs depending on the action of the other two members in the group in Block I

Foraging societies	Action of others		
Block I (hunt-gather game)	BB	AB	AA
Action A (Gathering)	20	20	20
Action B (Hunting)	10	50	0

In the hunt-gather game, there are 4 different earning outcomes, (20, 20, 20), (20, 20, 0), (20, 50, 50) and (10, 10, 10), associated to 0, 1, 2 and 3 hunters respectively. Two of these outcomes are egalitarian, corresponding to the symmetric profile in which all members choose gathering (AAA) and all members go hunting (BBB). The asymmetric profiles in which there is division of labour (AAB and ABB) yield unequal payoffs.

Under selfish preferences, in equilibrium, there will be no transfers in the redistribution stage, hence the game has two classes of (subgame perfect) equilibria in pure strategies: one egalitarian and another unequal.[2] The first class contains the symmetric profile AAA, and it corresponds to a foraging group in which all three members of the group gather. This outcome does not maximize the earnings of the group but payoffs are equally distributed (20, 20, 20). The second class contains three asymmetric equilibria with *social division of labour* (ABB), where one member gathers and the other two hunt. This profile maximizes the earnings of the group (efficient outcome) although it implies a unequal distribution of payoffs (20, 50, 50), because under this profile, hunting is more productive than gathering. This second class of Nash equilibria captures the above-mentioned stylized features of the foraging societies: social division of labour with returns from hunting larger, but more uncertain, than returns from gathering.[3]

[1] Large pray hunting intuitively yields the concavity of the payoffs from hunting. Let assume that the value of the prey is V, the probability that a solo man kills the prey is p and the expected cost from hunting to a solo hunter is c. The probability $p(n)$ that a group of n hunters kills the prey is $p(n) = 1 - (1-p)^n$ and the individual expected payoffs to a hunter in a group of n hunters is $\pi(n) = p(n)\frac{H}{n} - \frac{c}{n}$. While the probability $p(n)$ is increasing in the group size n, individual payoffs from hunting are not, because the larger the group, the smaller the fraction of the prey that is allocated to each group member. Therefore, individual payoffs from hunting are concave, implying that there exists a group size n* after which individual payoffs from hunting start to decline.

[2] There are also two symmetric mixed-strategy equilibria in which subjects gather with probability 0.1507 and 0.7382 respectively.

[3] Payoffs are uncertain because of the coordination problem inherent to the action profile ABB. Recall that there are three equivalent Nash equilibria all with one gatherer and two hunters. Hence, the group has

Even if an action profile yields an asymmetric distribution of payoffs, subjects had the opportunity to redistribute earnings during the redistribution stage. Hence, the game allows a group with social division of labour to end up with a fully egalitarian outcome.

Farming societies

We model the agricultural revolution as a technological change. Earnings from action B ("hunting") are the same as in Block I, but earnings from action A ("farming") change. There is evidence that at the beginning of the agricultural revolution, foraging was as productive as farming was [39], although later on, the more favourable climate conditions [40, 41] and the development of better cropping techniques increased the land productivity [42]. This allowed farmers to increase the capture of energy by a factor of 4 or 5 [27, 43]. To incorporate this fact, we assume that earnings from action A depend upon the "quality of land". At the beginning of Block II (round 21), the land is of low-quality and produces exactly the same earnings as the most efficient allocation in foraging societies (120). Earnings from farming are increased up to 480 (i.e., by a factor of 4) when the land is of high-quality. In order to assure a high-quality land in the next round, an investment of 120 points is required in the previous round. This implies that jumping from low to high-quality land in the short-run comes at the cost of having no earnings today, as the total earnings from farming a low-quality land (120) is to be invested. These features imply that farming had no immediate benefits [39] or that the transition to agriculture required huge effort by members of the group [42, 44].[4]

Another key element of the agricultural revolution concerns the existence of property rights, which are absent in foraging societies [3, 45, 46, 47]. To assign property rights, we rely on the idea that labour and effort lead to an innate psychological claim, thereby affecting the emergence of (and respect for) property rights [31]. This translates into considering that the subject who chose action A "gathering" more frequently in Block I becomes the landowner in Block II. The landowner receives all the earnings from farming after the decision stage and has to decide how to redistribute them in the redistribution stage. The landowner decides also whether to invest 120 points in

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to coordinate on who will be the gatherer. This, in turn, implies that cooperation may not occur due to coordination problems [38]

[4] The experimental design strengthens this fact as we paid one round of each block at random to experimental subjects. Thus, subjects who invested the 120 points to change the quality of the land would give up their earnings of Block II if this round were selected for payment.

securing a high-quality land in the next round. The investment decision is done before the redistribution stage. Table 2 below displays the experimental payoffs in Block II.

Table 2. Experimental payoffs depending on the actions of others in the group in Block II

Farming societies	Actions of others		
Block II (hunt-farm game)	BB	AB	AA
Action A* (Farming Low-quality land)	20	70	120
Action A* (Farming High-quality land)	40	240	480
Action B (Hunting)	10	50	0

* Payoffs from action A in Block II are allocated to the landowner, who can redistribute them during the redistribution stage. The landowner needs to allocate 120 points to land investment in order to benefit from High-quality land next round.

Under selfish preferences, in equilibrium, there will no transfers in the redistribution stage, hence the hunt-farm game in Block II has the same two classes of (subgame perfect) Nash equilibria in pure strategies as the hunt-gather game in Block I: AAA and ABB. In the *foraging equilibrium*, ABB, the farmer earns 20 and each of the two hunters earn 50. In the *farming equilibrium*, AAA, the landowner keeps all earnings form farming (120) and peasants gets no earnings. In addition, there is no investment to enhance the quality of land in equilibrium, thus the increase in productivity does not lead to the farming outcome [23].

Experimental Methods

We run two experimental sessions at the Laboratory for Experimental and Behavioural Economics LINEEX (Valencia) in 2018 and 2019. We recruited a total of 120 subjects to participate in our computerized sessions [48]. An additional treatment with 20 groups (60 subjects) was run for robustness. Payoffs in the experiment were presented in terms of points and then converted into euros at the end of each session (10 points = 1 euro). The average duration of each session was 90 min and the average payoff was 17 euros (we paid out one round of each block at random). At the end of the experiment, and while experimental subjects waited to be paid, we used a questionnaire to collect their gender, age, risk attitudes, and trusting behaviour.[5]

Replicating the basic facts of the Neolithic revolution in the lab

In this section, we provide evidence that the main results of the Neolithic revolution can be observed in our experimental data. We first focus on the modes of production and the level of economic inequality in each block of the experiment. Then we analyse the transition from foraging to farming societies.

Modes of production and economic inequality

Panel A in Figure 1 displays the evolution of the action profiles across rounds, labelling those that correspond to the equilibrium outcomes AAA (all gathering/farming) and ABB (division of labour).[6] We measure the wealth of subjects using their (total) earnings in each of the two blocks. Panel B in Figure 2 displays the Gini using a box plot.[7]

Table 3 summarizes the choices of subjects during the two blocks of the experiment. This includes information on the frequency of rounds that groups played in the low and high-quality land and presents the median Gini index in each block.

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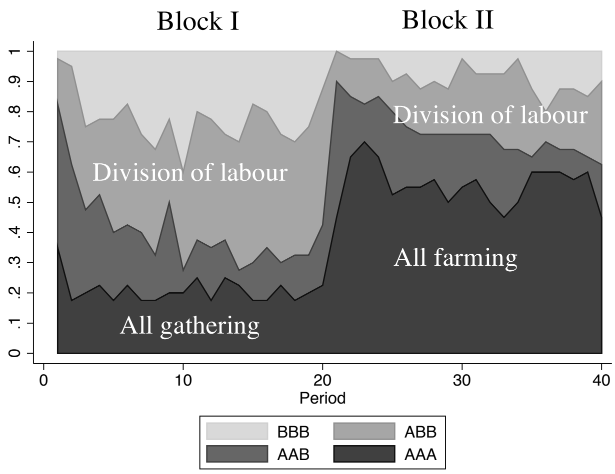
[5] We measure risk aversion using the investment game in [49], while we measure trusting behaviour as in the General Social Survey [50], using the question "Generally speaking, Do you think that most people can be trusted or that you can't be too careful in dealing with people?"

[6] We observe that in both blocks, choices settle after a few rounds, suggesting a quite stable distribution across rounds. Appendix A contains econometric estimates of the transition probabilities from and to the different action profiles at the group level, which illustrate the equilibrium nature of the profiles AAA and ABB. This also contains a detailed analysis of the propensity to choose action A at the individual level. In line with our theory, we observe that risk aversion predicts this choice as subjects who are more risk averse are more likely to gather in Block I.

[7] The Gini index takes the value 0 if all members in the group earned the same amount, while a Gini index that takes the value 1 implies that all earnings of the group are concentrated in one member. Our approach follows the methodology in [5] who examine the disparities of wealth inequality across societies using the Gini index. They authors compare this index in foraging, horticultural and agricultural societies and find that the lowest median value corresponds to foraging societies (0.17) and the largest median to the agricultural ones (0.35). For the evolution of evolution of the inequality within each of the groups across blocks see the Appendix.

Figure 1. The Neolithic revolution in the lab

(a) The evolution of the modes of production



(b) The evolution of inequality

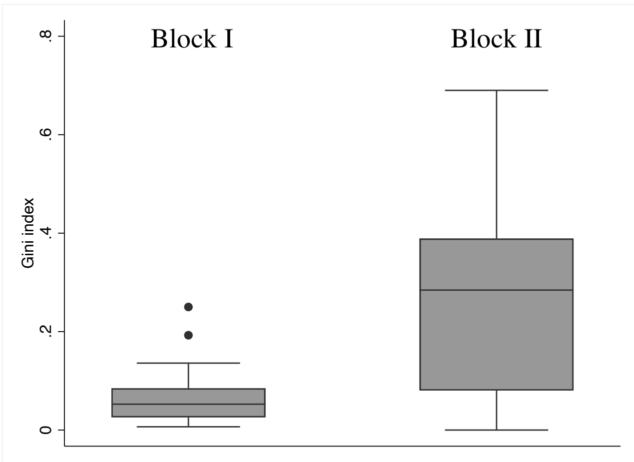


Table 3. Summary of action profiles by Block

	Foraging Societies	**Farming Societies**		
	Block I (Rounds 1-20)	**Block II (Rounds 21-40)**	**Land quality**	
	Frequency	Frequency	Low	High
AAA (*NE*)	0.21	0.56	0.16	0.86
AAB	0.20	0.18	0.26	0.11
ABB (*NE*)	0.37	0.18	0.39	0.02
BBB	0.22	0.08	0.19	0.01
Gini index	0.05	0.28		
Observations	800	800	345	455

Notes. For each block, we report the frequency of choices of all groups per round; i.e., we have a total of 40 groups x 20 rounds = 800 observations in each block. The frequencies can also be interpreted as the percentage of rounds that each group played each of the action profiles.

We observe heterogeneity of economic activities in Block I, although modal choice corresponds to the Nash equilibrium outcome with social division of labour (ABB) which is observed in 37 percent of choices; i.e., on average, foraging groups achieved social division of labour in 37 percent of the rounds, with seven groups that never chose the profile ABB and one group that played it all periods (the median value is 40 percent and the top quartile chooses ABB in at least 10 rounds). The other three outcomes, which include a group of three gatherers (AAA) have a frequency around 21 percent each. We observe in Block II a significant drop in the outcome with social division of labour from 37% to 18% (Wilcoxon-test, $p < 0.001$); while there is a clear shift to farming activities from 21% to 56% (Wilcoxon-test, $p < 0.001$). In fact, the modal outcome in Block II corresponds to groups of three farmers (AAA) that work in the high-quality land, meaning that the successful implementation of agriculture was associated to the participation of all the three members of the group choosing the farming activity.[8]

As for the level of inequality, we find that the Gini index in Block I is significantly smaller than in Block II, using the median test (0.053 *vs* 0.284, $p < 0.001$) and the Wilcoxon signed-rank test ($p < 0.001$). This, in turn, suggests that groups in Block I were more egalitarian than groups in Block II, as earnings were more concentrated in one of the members of the group in Block II. In fact, if we look at the member of the group who accumulates the most earnings in each block we find that this member obtains, on average, 36 percent of the total earnings of the group in Block I and 46 percent of the total earnings of the group in Block II.[9]

Result 1. *Our experiment replicates the basic features of the evolution of economic activities of human societies across history:*

i) *Groups in Block I (foraging societies) mostly organized themselves around social division of labour. The advent of agricultural revolution caused a strong shift towards farming activities in Block II (farming societies)*

[8] Low-quality land occurs in 43 percent of the choices in Block II (345/800) and this is more evenly distributed among all profiles of economic activities, with a prevalence of groups with division of labour (39 percent).

[9] We can provide further evidence to support the result that there is more inequality in Block II by looking at the behaviour of subjects in the redistribution stage. If we examine the transfers received by the lowest income subject in the asymmetric profiles where earnings were unequally distributed (ABB and AAB), we find the member of the group that decided to gather in ABB in Block I received an average transfer of 6.68 from the hunters (the median transfer is 5). In Block II, this member received on average 0.64 from the hunters (the median transfer is 0). As for the action profile in which one of the members hunts alone (AAB), she receives an average transfer of 1.94 from gatherers in Block I, while she receives an average transfer of 1.06 from the landowner in Block II. This, in turn, indicates that those members of the group who gather (farm) or hunt alone receive less transfers from the rest of the members of the group in the farming societies. See the Appendix for the evolution of the earnings over the rounds.

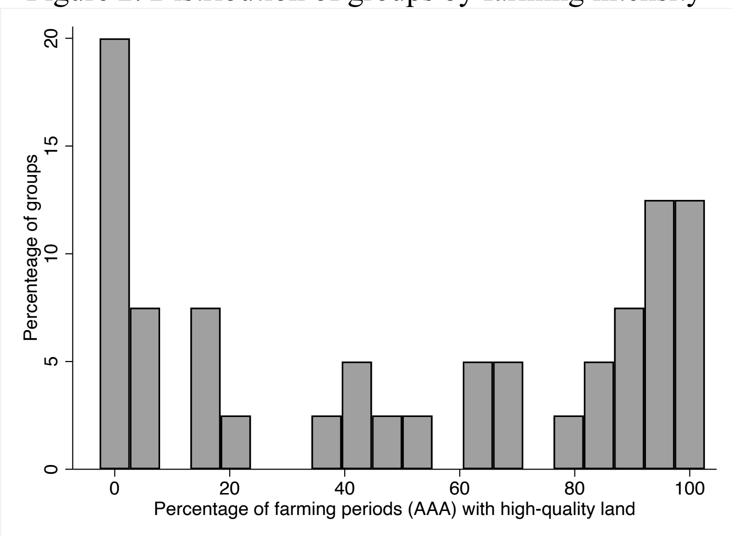
ii) The level of wealth inequality is higher in Block II than in Block I; i.e., foraging societies were more egalitarian than farming societies.

Modes of production and economic inequality

Our previous findings provide casual evidence to support the idea that the Neolithic revolution affected the modes of production and the level of inequality, but they should not be understood as conveying a lineal and smooth path from full foraging societies to full farming societies, as the standard view typically holds [1]. Rather, there are groups that never jumped to farming and many in-between societies that relied both on hunting and farming [6, 7, 8]. This heterogeneity is precisely what we observe in our data, as displayed in Figure 2.

Figure 2 depicts the distribution of groups in Block II by presenting the percentage of rounds that each group played the symmetric action profile AAA with high-quality land in Block II. The bimodal distribution puts nearly 60% of groups in the extremes of the distribution. There are groups (20 percent) that never experienced the agricultural revolution. The remaining groups can be split into two categories: short-lasting groups (40 percent) and long-lasting groups (40 percent), depending on whether their farming experiences in Block II were below or above the median number of rounds (80 percent) that groups played the action profile AAA with high-quality land.

Figure 2. Distribution of groups by farming intensity



Result 2. *There is a heterogeneous transition from Block I to Block II; i.e., while some groups never experienced the agricultural revolution, other groups became agriculturalists.*

Being confident that the experiment captures the basic economic development of foraging and farming societies, we next exploit the rich dataset provided by the experiment to shed light into the determinants of the success of the adoption of agriculture and the evolution of economic inequality across time.

New insights into the effect of the Neolithic revolution on the modes of production and the level of inequality

In this section, we investigate which characteristics of the groups in Block I determined the early adoption of the agricultural practices and its success in the long-run. We also examine the behaviour of landowners in farming societies during Block II.

Early adoption and success of the agricultural practice

For each group, we define a measure of the *intensity of use* of each economic activity (as the frequency of rounds each group chose each action profile) and two measures of *redistribution* (given by the average transfers received by the lower payoff member of the group in the asymmetric profiles with unequal payoffs, ABB and AAB). [10] We also define the *legitimacy* of the landowner as difference between the number of rounds that this member chose action A in Block I, compared with the two other members of the group. We use these variables to predict the adoption and success of agriculture in Block II. Our analysis includes controls for the average level of trust and the average degree of risk aversion of the members of the group (Table 4).

To capture the early adoption of agriculture, we run logit analysis in regressions (1) to (4). First, the dependent variable in regressions (1) or (2) is a dummy variable that takes the value 1 if all members of the group decided to farm in round 21, which is the first round of Block II. Regressions (3) and (4) replicate the analysis for groups that

[10] The intensity of the profile AAA is the omitted variable. We do not consider transfers in the symmetric profiles AAA or BBB because they lead an equal distribution of payoffs.

implemented the agricultural practice in the short-run (i.e., the dependent variable takes the value 1 if all members of the group were farming in a high-quality land in rounds 22 or 23). Regressions (5) to (8) look at the success of the agricultural practices in the long-run. We use a Tobit model in regressions (5) and (6) to predict the number of rounds that each group implemented the high-quality land with the three members of the group farming. Regressions (7) and (8) use a logit model to predict whether this outcome profile was observed in the last round of the experiment (round 40).[11]

Table 4. Determinants of early adoption and long-term success of agriculture in Block II

	Short-term (Early adoption of agriculture)				Long-term (Success of agriculture)			
	Logit: Round 21		Logit: Round 22 or 23		Tobit: Number rounds		Logit: Round 40	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-6.503	-7.786	-22.12*	-20.68*	33.30***	30.13***	-1.840	-1.353
	(10.36)	(10.73)	(13.04)	(10.91)	(8.326)	(7.533)	(5.609)	(7.047)
IntensityAAB	2.073	4.910	14.48	13.28	9.271	5.617	3.467	1.711
	(11.80)	(13.18)	(11.90)	(10.12)	(19.75)	(20.15)	(7.283)	(9.818)
IntensityABB	-0.955	1.341	6.239	7.732	-4.863	-0.542	-3.632	-2.707
	(8.727)	(8.427)	(5.773)	(5.965)	(15.94)	(16.01)	(5.101)	(5.918)
IntensityBBB	-1.721	-1.411	16.99	13.81	26.30	19.11	8.529	5.859
	(9.094)	(10.10)	(14.13)	(11.44)	(16.47)	(16.41)	(5.946)	(7.371)
Redistribution ABB	0.297**	0.367***	0.438***	0.488**	0.520**	0.725**	-0.0631	0.030
	(0.140)	(0.121)	(0.156)	(0.191)	(0.251)	(0.267)	(0.095)	(0.095)
Redistribution AAB	-0.155	-0.270	-0.324	-0.522	-0.123	-0.739	0.0472	-0.221
	(0.251)	(0.302)	(0.275)	(0.454)	(0.543)	(0.621)	(0.376)	(0.423)
Legitimacy	-0.0733	-0.0933	0.411	0.331	0.731**	0.674**	0.351**	0.357*
	(0.223)	(0.207)	(0.342)	(0.324)	(0.332)	(0.318)	(0.164)	(0.186)
Controls (risk, trust)	No	Yes	No	Yes	No	Yes	No	Yes
Observations	32	32	32	32	32	32	32	32

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The regressions in Table 4 show that the only variable that affects the early adoption of agriculture is how redistributive groups were when they coordinated on social division of labour. No other shared norm developed in the group in Block I matters. For the long-term success of agriculture, models (5) and (6) in Table 4 indicate that the legitimacy of the land-owner is also important to determine the number of rounds that each group chose the farming activity in Block II; in fact, this is the only significant independent variable when we look at the likelihood of choosing the farming activity in the long-term (round 40).

[11] The results are robust if we consider farming groups in the high-quality land in the last two rounds of the experiment (rounds 39 and 40).

Result 3. *The more egalitarian a foraging group is in the social division of labour, the more prone the group is to an early adoption of agriculture. The legitimacy of the landowner-to-be in the pre-agricultural era is key to determine the long-term success of agriculture.*

Hierarchy and raising inequality over time

To study the evolution of inequality in Block II, Table 5 reports the average earnings of landowners and the transfers to each peasant in each group, with groups being characterized by the number of rounds they farmed in the high-quality land.

To understand what these figures mean, it is useful to recall that although the experimental design did not allow peasants to contest land ownership and the earnings from farming, they have a powerful tool for offsetting any "excess of power" by the landowner: they could decide to stop farming the land and receiving a payoff of 50 each by engaging in the alternative economic activity (hunting), leaving the landowner with a payoff of 20. So, 50 is what in technical terms is called the *reservation earnings* associated to the outside option. Outside meaning "outside from agriculture".

Table 5. Distribution of groups in Block II by farming experience

	Rounds	#Groups (Frequency)	Earnings of landowner	Transfers to each peasant	Likelihood investment
No agricultural experience	0	8 (0.20)			
Short-lasting experiences	1-14	16 (0.40)	259.20	57.20	0.91
Ephemeral groups	1-5	7 (0.17)	314.76	33.33	
Other groups	6-15	9 (0.22)	215.99	75.76	
Long-lasting experiences	15-19	16 (0.40)	165.14	99.79	0.96
Hierarchical groups	15-19	8 (0.20)	198.71	82.84	
Egalitarian groups	16-19	8 (0.20)	131.59	116.74	
	N	40			

We observe that groups with short-lasting experiences are characterized by landowners keeping a high proportion of the surplus (259.20) and transferring to each peasant an amount (57.20) that barely exceeds the outside option. In this category, we can identify 7 groups that had very ephemeral experiences (less than 5 rounds). In these groups, the transfer to each peasant (33.33) was short of their reservation earnings and as a result, peasants decided not to farm after a few rounds.[12] In groups with long-lasting experiences (more than 15 rounds) the landowner kept on average 165.14 and transferred 99.79 to each peasant. We can also identify differences in the behaviour of landowners in these groups. There are 8 groups in which landowners were highly egalitarian (e.g., they kept roughly 120 for most of the rounds), while there are 8 groups in which landowners were more unequal (e.g., they kept on average 198.71 and transferred 82.84 to each peasant). Importantly, the experience of these groups does not seem to vary significantly; e.g., the average number of rounds that the egalitarian (unequal) groups experienced the high-quality land with the three members choosing the farming activity is 18 (17.28), respectively (Mann-Whitney test, $p = 0.39$).[13]

Overall, these findings suggest that agriculturalist groups in which the landowner demands a very high amount (especially in the first rounds) are doomed to fail, but agriculture can be sustained in the long-run (especially in groups where the legitimacy of the landowner is high), even if landowners do not implement an equal distribution of earnings. Hence, we observe in the lab how the evolution of agriculturalist societies leads to the evolution of different shared norms or institutions, in line with the idea that different populations can converge to different norms [28].

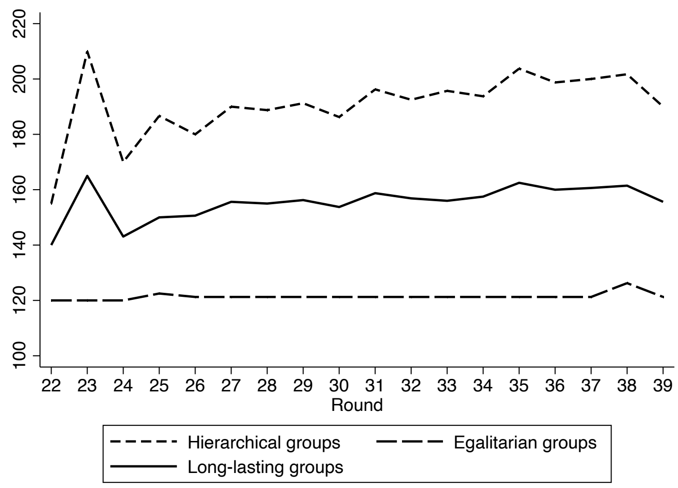
To see the dynamics of long-lasting agriculturalist groups, Figure 3 displays the earnings of the landowner across rounds. We observe that landowners in egalitarian groups divide the earnings equally across rounds. In hierarchical groups though, landowners keep on average 150 in the first rounds; i.e., they transfer to each peasant around 150, an amount that prevents them from choosing the outside option in the next round. However, landowners increase their demand across rounds and end up asking for more than half of the total earnings (200 out of 360) from rounds 36 to 39. A regression analysis using OLS for the earnings of landowners in long-lasting agriculturalist groups

[12] For the other 9 groups that had short-lasting experiences (7-14 rounds) the average earnings of the landowner are 215.99 and the average transfer to peasants is 75.76. These groups had on average 10 rounds of experience with the agricultural activity.

[13] These groups have also similar experiences regarding the number of consecutive rounds that each group was in the high-quality land with the three members of the group farming, as the average length of consecutive rounds is 8.47 (9.86) for the egalitarian (hierarchical) groups, respectively

in Block II confirms that the variable Round is positive and significant for long-lasting unequal groups ($p = 0.044$) but not for long-lasting egalitarian groups ($p = 0.175$).[14]

Figure 3. Evolution of earnings of landowners in long-lasting agriculturalist groups in Block II.



Result 4. *In long-lasting agriculturalist groups, there is a tendency for landowners to relentless increase the appropriation of the agricultural surplus across rounds.*

Robustness

We conducted an additional treatment with 20 groups ($n = 60$ participants) to check the robustness of our previous findings. We were particularly interested in testing whether the shift towards the farming activity occurs even if we facilitated the asymmetric equilibrium with division of labour (ABB). Thus, we decided to force the landowner to farm during Block II so as to prevent any miscoordination problem in efficiency-seeking groups that ended up choosing the BBB outcome (instead of ABB). This feature of our design should also create incentives for the landowner to be more egalitarian during Block II, as peasants have an evident outside option (hunting) that pays them 50, and their coordination is easy -in fact, the landowner cannot *punish* them by hunting as well.

[14] We exclude the last-round from the analysis as landowners kept most of the surplus from the agricultural practice in this round. Our analysis is robust when we include controls for age, gender, risk attitudes and trust as regressors.

Appendix A summarizes the main results of this treatment, where we observe a shift to farming activities in Block II from 15% to 47% ($p < 0.001$). Groups are also heterogeneous in their transition from foraging to farming societies. There are 7 groups that never experienced the agricultural experience in Block II. There are 3 groups that had very ephemeral experiences (only 1 round), while the remaining 10 groups had long-lasting experience with a minimum (maximum) number of rounds of 12 (19) rounds farming in a high-quality land, respectively (Median number of rounds = 17). In these groups, we can also distinguish between egalitarian landowners (5 groups) and hierarchical land-owners (5 groups), depending on whether or not they divided the earnings from landing equally among the members of the group. Interestingly enough, a regression analysis using OLS confirms that landowners in hierarchical groups exhibit a tendency towards increasing the appropriation of the agricultural surplus across rounds ($p = 0.013$). These results contribute to the fact that we also observe more inequality in Block II than in Block I in this treatment, as measured by the (median) Gini index (0.088 vs 0.171, $p = 0.019$).

Conclusions

This research applies the experimental methodology developed in the field of economics to the study of the Neolithic agricultural revolution. Game theory combined with experiments allow the experimenter to observe how a group of individuals, making choices about economic activities and sharing behaviour, evolves as new technologies are available and how the adoption of the new technologies affect their economic choices and their norms of sharing.

The experimental data replicate some stylized fact of foraging societies –egalitarian groups characterized by social division of labour- and farming societies -intensive use of land and less egalitarian than foraging societies. But the data add as well to the archaeological literature on how the institutions developed in a foraging group affect their transition to farming and that transition to farming is heterogeneous. We find that more egalitarian groups under social division of labour are more prone to an early adoption of agriculture and that the long-term success of an agriculturalist group is determined by the legitimacy of the landowner. The mechanism would be as follows: the higher the legitimacy of the landowner, the less that peasants dispute his decisions on the redistribution of earnings from farming. In our game, peasants could not directly challenge the property right over the land, but they could easily deactivate it by engaging in the alternative activity: hunting. Land is a valuable asset only when the joint effort of the three group members. It seems that the evolution of respect for land property rights is a prerequisite for the long-term success of agriculture. This is in line with the results in [22] about the co-evolution of agriculture and property rights. Once agricultural practices were the norm, landowners started to reap off the benefits from farming little by little, raising the inequality in agriculturalist societies.

There are many ways in which the experimental design can be expanded. We believe that our results would be more even more pronounced if we allowed for hunting to disappear after groups devoted a few rounds to farming activities. This would align with the idea that intensive farming practices destroy the habitat for wild plants and animals, thereby affecting the possibility to hunt again [27]. There are other features that could be incorporated in our design as well. For example, communication can facilitate coordination [51] or provide information about the norms or rules (see [38] and references therein). This is left for future research.

We find appealing to conclude this paper by claiming that the success of agriculture was "mandatory" during the Holocene, not (only) because of climate reasons,[15] but because anthropological and archaeological studies reveal that foraging societies had the feature that our experiment has isolated as the key determinant of the quick adoption of agriculture: they were egalitarian groups. It is ironic that equality was the origin of the raise of inequality.

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[15] This phrase comes from the title of [52]. They claim a climatic hypothesis: "In The Long Run, Agriculture Is Compulsory In The Holocene" because in contrast to the Pleistocene, stable Holocene climates allowed the evolution of agriculture.

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APPENDIX A.

A.1. The equilibrium nature of the games.

The "hunt-gather" game in Block I is a coordination game, with two classes of Nash equilibria, AAA and ABB. Can we say something about the transition probabilities among the different action profiles within groups? Can these transition probabilities reflect the equilibrium structure of the game? The following table reports the likelihood of observing a action profile in round *t* depending on the action profile chosen by the group in a previous round *t*-1, for foraging societies.

Table A1. Transition probabilities for foraging societies

	AAA(t)	AAB(t)	ABB(t)	BBB(t)
AAA (t-1)	40.00	23.03	22.42	14.55
AAB (t-1)	21.79	22.44	35.90	19.87
ABB (t-1)	12.10	16.01	43.77	28.11
BBB (t-1)	14.61	16.85	42.70	25.84

In foraging societies, we find that a group with three gatherers in a particular round AAA(t-1) have a likelihood of 40% to be a group with three gatherers in the subsequent round AAA(t), while groups with division of labour in a round ABB(t-1) have a likelihood of 43.77% of being in the same profile in the subsequent round ABB(t).

Table A2 displays econometric estimations of logit models with errors clustered at the group level for foraging societies. The dependent variables are dummies for the different action profiles (e.g. AAA(t) takes value 1 if the group has chosen action profile AAA in round t and 0 otherwise). The set of the independent variables include the *Round* and dummies for the action profile dummies of the group in the previous round.

Table A2. Econometric estimation of the transition probabilities among action profiles

	(1)	(2)	(3)	(4)
Variable	AAA(t)	AAB(t)	ABB(t)	BBB(t)
AAA (t-1)	0.150	-0.932	1.337	13.69***
	(0.684)	(0.580)	(1.078)	(0.495)
AAB (t-1)	-0.708	-1.139**	2.088**	14.10***
	(0.496)	(0.505)	(1.005)	(0.365)
ABB (t-1)	-1.434***	-1.310**	2.301**	14.51***
	(0.513)	(0.581)	(0.963)	(0.336)
BBB (t-1)	-1.217**	-1.244**	2.260**	14.40***
	(0.522)	(0.546)	(0.962)	(0.365)
Round	0.007	-0.076***	0.037**	0.012
	(0.015)	(0.021)	(0.016)	(0.016)
Constant	-0.626	0.482	-2.981***	-15.59***
	(0.473)	(0.457)	(1.041)	(0.238)
Observations	800	800	800	800

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note that all estimates for models (3) and (4) are positive while all estimates for models (1) and (2) are negative. The only exception is the positive estimate of the variable

AAB(t-1) on AAA(t), reflecting the equilibrium nature of the profile AAA (but it is not powerful enough to be significant). This reveals an attraction towards action profiles with large number of hunters (ABB and BBB). However, coordination problems are evident as all estimates for model (4) are positive and highly significant. Still, we can see the equilibrium nature of ABB from the estimates of model (3), where the only significant estimate is actually the lagged variable ABB. Even more, groups learn to coordinate on this efficient class of Nash equilibria as times passes, as is evidenced by the positive and significant estimate of the variable period in model (3). The only other occasion in which the variable period is significant is in model (2). In this case, it is negative.

We do not perform this analysis for farming societies, because the action profile in a particular period depends not only on the action profile in the previous one but also on the quality of the land, as it is shown in our analysis in the main text. At any event, Table A3 replicates the analysis in Table A1 for farming societies.

Table A3. Transition probabilities for farming societies

	AAA(t)	AAB(t)	ABB(t)	BBB(t)
AAA (t-1)	61.10	17.39	13.73	7.78
AAB (t-1)	57.35	22.06	15.44	5.15
ABB (t-1)	45.77	13.38	27.46	13.38
BBB (t-1)	41.54	16-92	18.33	8.72

It can be seen that the “agricultural equilibria” (AAA) has a high degree of attraction.

A.2. The determinants of choosing “gather”. Table A4 reports econometric estimation of a logit model where the dependent variable is the dummy “gathering” that takes value 1 if the experimental subject has chosen action A in a period and 0 otherwise and the independent variables are the period, some sociodemographic variables, such as age, female gender and risk aversion. In one specification, we add some control variables as the action profile in the previous round.

Table A.4. Probability of choosing action A “gathering” at round t

VARIABLES	(1) Gathering at round t	(2) Gathering at round t
Female	0.146	0.090
	(0.225)	(0.217)
Risk	0.161***	0.155***
	(0.056)	(0.056)
Age	-0.018	-0.010
	(0.012)	(0.011)
AAA (t-1)		-0.245
		(0.530)
AAB (t-1)		-0.761**
		(0.340)

ABB (t-1)		-1.171***
		(0.315)
BBB (t-1)		-1.094***
		(0.312)
Round	-0.030***	-0.018*
	(0.009)	(0.009)
Constant	-0.285	0.339
	(0.413)	(0.491)
Observations	2,400	2,400

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Errors clustered at the group level

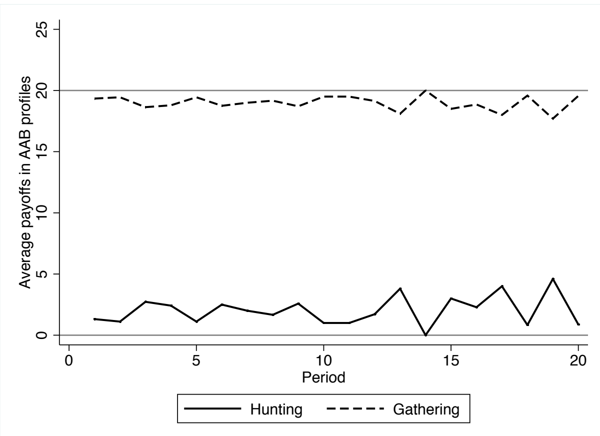
The presence of the control variables does not have a huge impact on the estimates. The estimate for the variable *Female* is positive but not significant, showing that females do not choose A significantly more often than males. We find a significant effect of risk aversion on the probability of choosing A: the more risk averse a subject is, the higher is the probability of choosing A. This effect is consistent with the description of the two actions in the game, as action B is riskier than action A.

A.3. Evolution of earnings in the "hunt-gather" game in the asymmetric profiles.

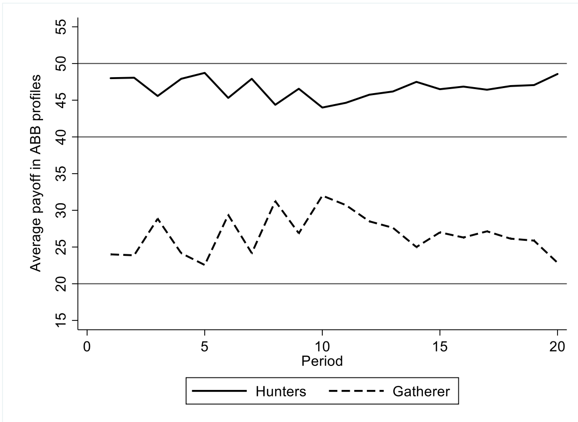
Panel A of Figure 1A presents the evolution over rounds of the average payoffs per round (after the redistribution stage) of gatherers (A) and hunters (B) when the group chose the action profile AAB. This figure includes two horizontal lines at 0 and 20 corresponding to the final payoffs in the absence of any transfer. The evolution of the average payoffs after the redistribution stage when the group chose the action profile with division of labour (ABB) is presented in Panel B of Figure 1A. This figure includes two horizontal lines at 20 and 50 corresponding to the final payoffs in the absence of any transfer and one additional horizontal line at 40, corresponding to full redistribution

Figure 1A. Evolution of earnings in the "hunt-gather" game in the asymmetric profiles**.**

a) *Evolution of earnings in groups that choose the profile AAB*



b) *Evolution of earnings in groups that choose the profile ABB*

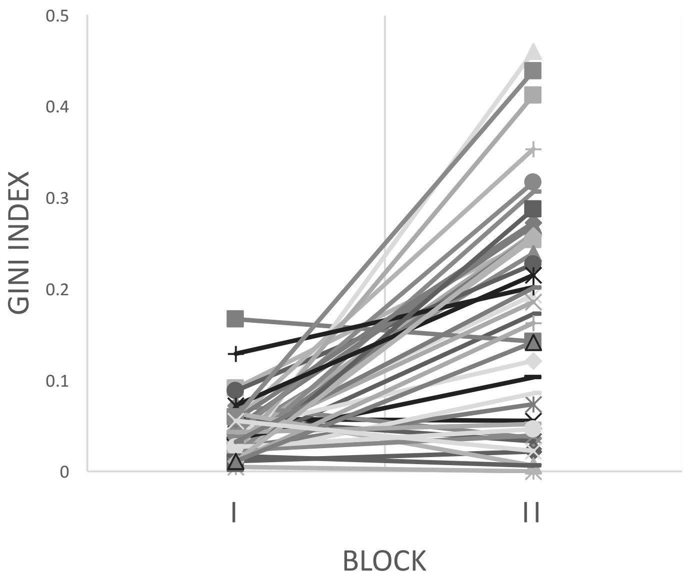


The bottom panel of Figure 1A shows that there is an increasing redistributive effort with a peak at round 10, where groups were on average redistributing half of total earnings (average payoffs 30-45-45, with an associated Gini Index 0.125) and then a drop in the second part of the block. At any even, gatherer receives on average positive transfers from hunters. As reported in the main text, this is in contrast to the observed behaviour in Block II.

A.4. The evolution of inequality within groups

Figure 2A presents the Gini index of each group in each block of the experiment. Overall, we observe a tendency to increase the level of inequality within groups. In particular there are 32 out of 40 groups (80 percent) that exhibits more inequality (i.e., a higher Gini index) in Block II than in Block I, while the remaining 8 groups (20 percent) exhibit more inequality in Block I than in Block II. The Wilcoxon signed-rank test provides evidence that the level of inequality is higher in Block II ($p < 0.001$).

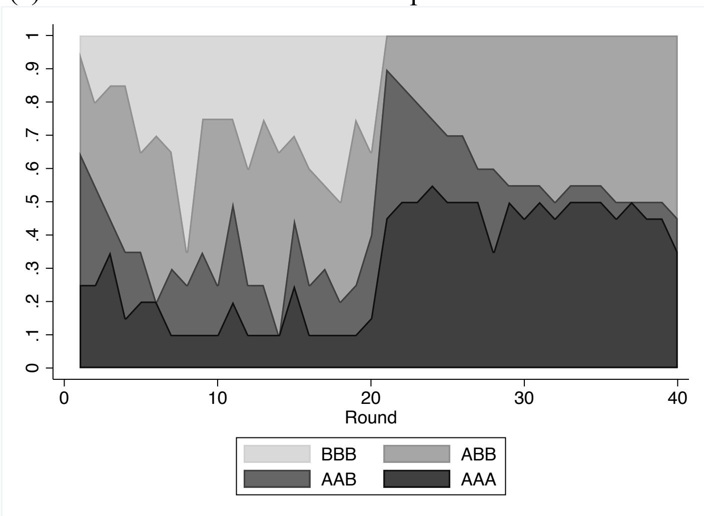
Figure 2A. Gini index in each block of the experiment (within groups).



A.5. Robustness check
Here we present the results of our additional treatment in which the landowner is forced to farm in Block II, so that BBB is not a possible outcome in Block II. Figure 3A presents the evolution of the modes of production and the level of inequality, as measured by the Gini index. Figure 4A shows the distribution of groups by farming intensity in Block II; i.e., we depict the percentage of rounds each group decided to farm (AAA) in a high-quality land. Finally, Figure 5A presents the earnings of landowners across rounds in hierarchical groups that had long-lasting experiences with agriculture (more than 60 percent of rounds). We do not depict the earnings in the last round of the experiment in which landowners kept most of the surplus from agricultural practices.

Figure 3A. The evolution of the modes of production (upper panel) and the level of inequality (bottom panel) in our additional treatment.

(a) The evolution of the modes of production



(b) The evolution of inequality

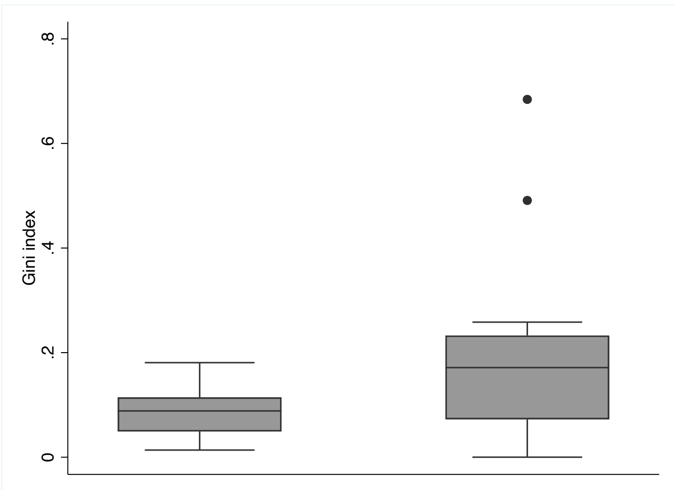


Figure 4A. Distribution of groups by farming intensity

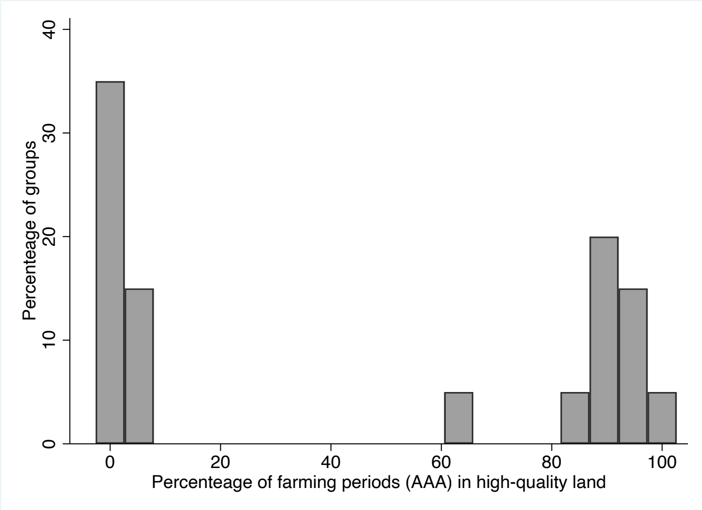
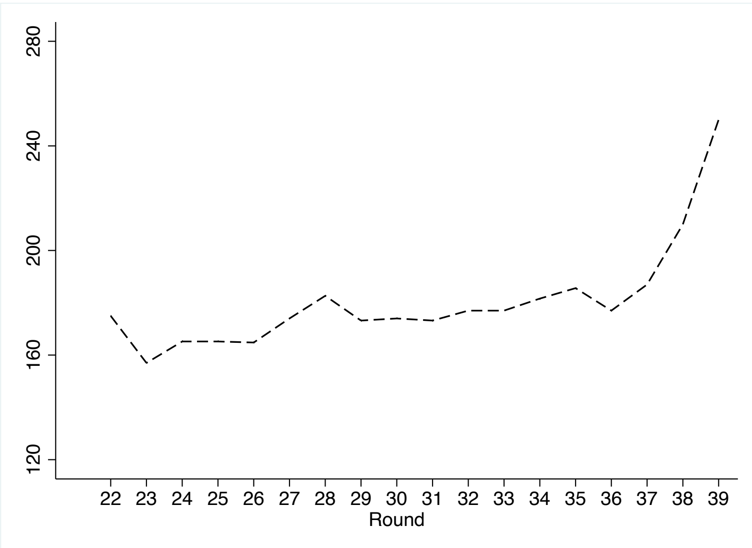


Figure 5A. Evolution of earnings of landowners in long-lasting agriculturalist groups in Block II.



APPENDIX B – EXPERIMENTAL INSTRUCTIONS

Welcome to the experiment

This is an experiment to study how individuals make decisions. We are only interested in average behaviour, so no particular behaviour is expected from you. Your decisions, however, will influence your earnings, as we will explain below. For any questions that may arise during the experiment, we ask you to raise your hand and you will be attended by a member of the lab staff. Other than this, any type of communication between you is prohibited.

This experiment consists of two phases. Below we explain the instructions of the first phase.

Instructions for Phase 1

This phase consists of 20 rounds. At the beginning, we are going to match you randomly with two other subjects in this room to form a group of three people, which will be maintained throughout the experiment. In this first phase, each member of the group must choose between action A or action B. The points generated by each action depend on the number of members who have chosen it. The next table displays the provisional points generated and how many points correspond to each member of the group:

Action	Number of subjects in the group choosing the action	Provisional points generated by the action	Provisional points allocated to each subject choosing the action
A	1	20	20
	2	40	20
	3	60	20
B	1	0	0
	2	100	50
	3	30	10

As you see, action A will generate 20, 40 or 60 provisional points depending on whether 1, 2 or 3 members of your group choose it. These points will be divided among those who choose Action A, so choosing Action A will give you 20 points, regardless of how many people in your group have chosen Action A. If you choose Action B, your payment will depend on how many people have chosen action B. As indicated in the table, you will receive 0 points if you are the only person in the group who has chosen action B. If you and another person choose action B, 100 points will be generated, so that each one will receive 50 points. Finally, if the three members of the group choose Action B, 30 points will be generated and each of you will receive 10 points.

As we have said previously, these are provisional points. To determine the final points (which will be important to the final payment for this experiment), we will allow group members to make point transfers.

What happens during the transfer phase?

After choosing your actions, we will announce how many group members have chosen actions A and B, and the provisional points allocated to each member. Once you know the allocation of the provisional points, you can transfer points to other members (if you want). Each point you transfer will be deducted from your provisional points and will be added to the points of the member to whom you send them. In this transfer phase, you could also receive points from other members of your group.

At the end of each round, we will again inform you of each member's actions and announce the transfers that have taken place, so that you will know what your final points of the round are. A table containing information on actions and final points will be available at the end of each round. Remember that this first phase will last 20 rounds and we will keep the group constant.

How many points will I earn by participating in this phase?

When the experiment ends, we will randomly choose a round from this phase and pay you based on the final points you have earned in the chosen round. To determine the final payment, we will convert the points into Euros (10 points = 1 Euro).

Phase 2 Instructions

This phase consists of a total of 20 rounds, during which you will be matched with the same subjects as in the previous phase; that is, the composition of your group does not change. In this second phase, the members of the group will be of two possible types: types I, and types II. Both types can choose, as in the previous phase, between actions A and B. In each group, there will be one type I member and two type II members. The member of the group that is type I is the one that chose action A the most times in the previous phase.

As in the previous phase, the provisional points generated by each action depend on the number of group members who have chosen it, as shown in the following table:

Action	Number of subjects in the group choosing the action	Provisional points generated by the action		Provisional points allocated to each subject choosing the action
		Low level	High level	
A	1	20	40	All provisional points from action A will be allocated to Type I member
	2	70	240	
	3	120	480	
B	1	0		0
	2	100		50
	3	30		10

The provisional points generated by action B are obtained in a similar way to the previous phase. If only one subject has chosen action B, that person will receive 0 provisional points. If two subjects have chosen Action B, each will receive 50 points. If all three group members have chosen Action B, they will each receive 10 points.

The provisional points associated with option A are now different from what happened in the previous phase in two aspects: First, the points will depend not only on how many members of the group have chosen option A but also on something we will call "level " (High or low). In addition, the type I member will be the one who receives the provisional points generated by action A. This member may, however, transfer points to other members of the group during the transfer phase. We explain this in more detail.

Firstly, the provisional points generated depend on the level and number of subjects who choose action A.

- <u>If the level is LOW</u>: If only one subject chooses option A, 20 provisional points will be generated. If two members choose action A, a total of 70 provisional points will be generated. If action A is chosen by the three members of the group, then a total of 120 provisional points will be generated.
- <u>If the level is HIGH</u>: If only one subject chooses option A, 40 provisional points will be generated. The total provisional points will be 240 points (if two subjects choose action A) and 480 points (if three subjects choose action A).

In all cases, the type I member will be the one who receives the provisional points generated by action A.

How is the level determined (HIGH or LOW)?

At the beginning of this phase, your group will be at the LOW level, so choosing Action A can result in 20, 70 or 120 points depending on how many members of the group choose it. If the provisional points generated by action A in a given round reach 120 points, the type I member can pay 120 points to switch the level to HIGH. If the Type I member decides to do so, then no member of the group will receive provisional points that round, but the group will be at the HIGH level in the next round. This means that action A would generate 40, 240 or 480 provisional points in the next round, depending on how many members of the group choose action A. If the group reaches the HIGH level in a round, then 120 points must be used to maintain this level in the next round. Otherwise, the level return to LOW next round. In all cases, it will be the type I member who decides if he wants to switch or keep the level. Once this decision has been made, the transfer phase will take place.

What happens during the transfer phase?

After choosing the actions, we will announce how many group members have chosen actions A and B, and what the provisional points are for each member. Remember that action A will generate a number of provisional points that will be assigned to the type I member, while action type B will generate provisional points for those members who choose it.

If action A has generated at least 120 provisional points in a round, then we will ask the type I member to also choose if he wants to change the level (if he is at the LOW level) or keep the same level (if he is at the HIGH level). Once this decision has been made, all the members of the group will know what the provisional points are and they will be able to transfer points, as was the case in the previous phase. Each point you transfer will be deducted from your provisional points and will be added to the points of the member to whom you send them. In this transfer phase, you could also receive points from other members of your group. This transfer phase will determine what each member's final points are.

At the end of each round, we will tell you each member's actions and announce the transfers that have taken place, so that you will know what your round's points are. A table containing information on actions and points will be available at the end of each round. Remember that this second phase will last 20 rounds and we will keep the group constant.

How much will I earn by participating in this phase?

When the experiment ends, we will randomly choose a round from this phase and pay you based on the points you have earned in the chosen round. To determine the final payment, we will cash the points into Euros (10 points = 1 Euro).