



Cereals, appropriability, and hierarchy

Joram Mayshar, Omer Moav, Zvika Neeman,
Luigi Pascali

Conventional theory suggests that hierarchy and state institutions emerged due to increased productivity following the Neolithic transition to farming. This column argues that these social developments were a result of an increase in the ability of both robbers and the emergent elite to appropriate crops. Hierarchy and state institutions developed, therefore, only in regions where appropriable cereal crops had sufficient productivity advantage over non-appropriable roots and tubers.

What explains underdevelopment?

One of the most pressing problems of our age is the underdevelopment of countries in which government malfunction seems endemic. Many of these countries are located close to the Equator.¹ Acemoglu *et al.* (2001) point to extractive institutions as the root cause for underdevelopment. Besley and Persson (2014) emphasise the persistent effects of low fiscal capacity in underdeveloped countries. On the other hand, Diamond (1997) argues that it is geographical factors that explain why some regions of the world remain underdeveloped. In particular, he argues that the east-west orientation of Eurasia resulted in greater variety and productivity of cultivable crops, and in larger economic surplus, which facilitated the development of state institutions in this major landmass. Less fortunate regions, including New Guinea and sub-Saharan Africa, were left underdeveloped due to low land productivity.

In a recent paper (Mayshar *et al.* 2015), we contend that fiscal capacity and viable state institutions are conditioned to a major extent by geography. Thus, like Diamond, we argue that geography matters a great deal. But in contrast to Diamond, and against conventional opinion, we contend that it is not high farming productivity and the availability of food surplus that accounts for the economic success of Eurasia.

- We propose an alternative mechanism by which environmental factors imply the appropriability of crops and thereby the emergence of complex social institutions.

To understand why surplus is neither necessary nor sufficient for the emergence of hierarchy, consider a hypothetical community of farmers who cultivate cassava (a major source of calories in sub-Saharan Africa, and the main crop cultivated in Nigeria), and assume that the annual output is well above subsistence. Cassava is a perennial root that is highly perishable upon harvest. Since this crop rots shortly after harvest, it isn't stored and it is thus difficult to steal or confiscate. As a result, the assumed available surplus would not facilitate the emergence of a non-food producing elite, and may be expected to lead to a population increase.

Consider now another hypothetical farming community that grows a cereal grain – such as wheat, rice or maize – yet with an annual produce that just meets each family's subsistence needs, without any surplus. Since the grain has to be harvested within a short period and then stored until the next harvest, a

visiting robber or tax collector could readily confiscate part of the stored produce. Such ongoing confiscation may be expected to lead to a downward adjustment in population density, but it will nevertheless facilitate the emergence of non-producing elite, even though there was no surplus.

Emergence of fiscal capacity and hierarchy and the cultivation of cereals

This simple scenario shows that surplus isn't a precondition for taxation. It also illustrates our alternative theory that the transition to agriculture enabled hierarchy to emerge only where the cultivated crops were vulnerable to appropriation.

- In particular, we contend that the Neolithic emergence of fiscal capacity and hierarchy was conditioned on the cultivation of appropriable cereals as the staple crops, in contrast to less appropriable staples such as roots and tubers.

According to this theory, complex hierarchy did not emerge among hunter-gatherers because hunter-gatherers essentially live from hand-to-mouth, with little that can be expropriated from them to feed a would-be elite.²

- Thus, rather than surplus facilitating the emergence of the elite, we argue that the elite only emerged when and where it was possible to expropriate crops.

Due to increasing returns to scale in the provision of protection from theft, early farmers had to aggregate and to cooperate to defend their stored grains. Food storage and the demand for protection thus led to population agglomeration in villages and to the creation of a non-food producing elite that oversaw the provision of protection. Once a group became larger than a few dozen immediate kin, it is unlikely that those who sought protection services were as forthcoming in financing the security they desired. This public-good nature of protection was resolved by the ability of those in charge of protecting the stored food to appropriate the necessary means.

- That is, we argue that it was this transformation of the appropriation technology, due to the transition to cereals, which created both the demand for protection and the means for its provision.

This is how we explain the emergence of complex and hereditary social hierarchy, and eventually the state.

Applied to Diamond's prototypic contrast between Eurasia and New Guinea, our theory suggests that the crucial distinction between these two regions is that farming in Eurasia relied on the cultivation of cereals, while in New Guinea it relied mostly on the cultivation of tubers (yam and taro, and, more recently, sweet potato) and bananas, where long-term storage is neither feasible (due to perishability) nor necessary (because harvesting is essentially non-seasonal). This provided farmers in New Guinea with sufficient immunity against bandits and potential tax collectors. More generally, we contend that the underdevelopment of tropical areas is not due to low land fertility but rather the reverse. Farmers in the tropics can choose to cultivate highly productive, non-appropriable tuber crops. This inhibits both the demand for socially provided protection and the emergence of a protection-providing elite. It is a curse of plenty.

In the empirical section of our paper we demonstrate that, contrary to the standard productivity-and-surplus theory, land productivity per se has no direct effect on hierarchy. We also show that, consistent with our theory, the cultivation of roots or tubers is indeed detrimental to hierarchy.

Empirical findings

These results are established by employing two datasets with information on social hierarchy: a cross section and a panel of countries. For our cross-sectional analysis we use Murdock's (1967) *Ethnographic Atlas*, which contains information on cultural, institutional, and economic features of 1,267 societies from around the world at an idealised time period of first contact with Europeans. Our main outcome variable is 'jurisdictional hierarchy beyond the local community'. The *Ethnographic Atlas* also provides information on the major crop type grown by societies that practice agriculture.

Since the cultivated crop is a decision variable, we instrument for the crop type by using data on land suitability for different crops from the Food and Agriculture Organisation. We first show that the decision whether to cultivate cereals as a main crop depends positively on the productivity advantage of cereals over roots and tubers (in terms of potential caloric yields per hectare). We then find that societies tend to have a more complex hierarchal organisation where the productivity advantage of cereals over roots and tubers is higher, as predicted by our theory. Furthermore, we find that societies that practice agriculture are more hierarchical only where they cultivate cereals. This means that societies that cultivate roots and tubers have similar levels of hierarchy to those of pastoral or foraging societies.

We also show that land productivity, measured by the potential yield of calories per acre of the most productive crop in each area, does not affect hierarchy once we control for the productivity advantage of cereals. Thus, our empirical findings challenge the conventional argument that it is increased land productivity that leads to more hierarchical societies.

Although this cross-sectional analysis accounts for a wide range of confounding factors, we cannot rule out completely that omitted variables may bias the estimates. To overcome this concern, we employ another dataset compiled by Borcan *et al.* (2014). This is a panel, based on present-day boundaries of 159 countries, with institutional information every five decades over the last millennium. This panel enables us to exploit the 'Columbian exchange' of crops across continents as a natural experiment. The new crops that became available after 1492 in the New and the Old World changed both the productivity of land and the productivity advantage of cereals over roots and tubers in the majority of the countries in the sample. Consistent with our theory, the panel regressions confirm that an increase in the productivity advantage of cereals over roots and tubers has a positive impact on hierarchical complexity, while an increase in land productivity does not.

Concluding remarks

These findings support our theory that it is not agricultural productivity and surplus per se that explains more complex hierarchical societies, but rather the productivity advantage of cereals over roots and tubers, the type of crop that is cultivated as a result, and the appropriability of the crop type. Given that the productivity of roots and tubers is typically high in the tropics, these results also support the claim that deep-rooted geographical factors may explain the current weakness of state institutions in these regions.

References

Acemoglu, D, S Johnson and J A Robinson (2001), "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 91, 1369-1401.

Besley, T and T Persson (2014), "Why Do Developing Countries Tax So Little?" *Journal of Economic Perspectives*, 28, 99-120.

Borcan, O, O Olsson and L Putterman, (2014), "State History and Economic Development: Evidence from Six Millennia." Brown University – Department of Economics – Working Paper Series.

Diamond, J (1997) *Guns, Germs, and Steel: The Fates of Human Societies*, Norton, New York.

Mayshar, J, O Moav, Z Neeman, Z and L Pascali (2015), "Cereals, Appropriability and Hierarchy," CEPR Discussion Paper 10742.

Murdock, G P (1967) *Ethnographic Atlas*, University of Pittsburgh Press, Pittsburgh.

Spolaore, E and R Wacziarg (2013), "How Deep Are the Roots of Economic Development?" *Journal of Economic Literature*, 51, 1-45.

Footnotes

1. See Spolaore and Wacziarg (2013) for a survey.

2. In the paper, we provide evidence that hunter-gatherers who used storage developed hierarchies similar to those of early farmers.

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