9

Agriculture

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9.1 Introduction

Economists have long been aware of the strategic role of agriculture for development (Lewis 1954; Johnston and Mellor 1961; Rostow 1962; Bairoch 1963). Nevertheless, as early as the eighteenth century, the idea began to form in people's minds that modern growth was essentially industrial and urban. In particular, after World War II and decolonization, the governments of developing countries often favoured urban areas and the industrial sector. In the past decade, these urban biased policies

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have, however, been called into question by the maintenance of high poverty ratios and the resurgence of food insecurity.[1]

Today, roughly one half of the world's population lives in rural areas, and it is estimated that three-quarters of the people who live there are poor (World Bank 2008). Equally, it should not be forgotten that agriculture is destined to satisfy food needs and that it accounts for a significant proportion of rural income. For all these reasons, agriculture is a key factor for eradicating poverty and undernourishment, the objective fixed by the first Millennium Development Goal. Agriculture should, therefore, be at the very centre of development programmes and there is growing consensus about the strategic role of agriculture, notably focused in the World Bank's 2008 development report.

What is more, Byerlee et al. (2009) argue that a new paradigm is needed to understand the contemporary links between agriculture and development. The standard structural transformation paradigm is not sufficient to establish agriculture's role in five central pillars of the development agenda (triggering economic growth, reducing poverty, narrowing income and gender disparities, providing food security and delivering environmental services). The "agriculture for development" paradigm rejects the well-established idea of agriculture as the handmaiden of industrialization, and underlines the multiple roles of agriculture per se.

Nevertheless, agricultural priorities vary greatly across countries, with each nation adopting one specific agricultural model according to its agroclimatic, cultural, socioeconomic and political context. So, we need greater elements of knowledge about agriculture models at both the outcomes and institutional levels. At the microeconomic level, the Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), the Food and Agriculture Organization (FAO) and the International Fund for Agricultural Development (IFAD) created a joint initiative in 2009, the World Agriculture Watch, to monitor structural changes in agriculture and to inform policy dialogue, focusing on farmer's organizations,

[1] At the beginning of the new millennium, the number of undernourished people started to increase after decades of continuous decrease. More precisely, the FAO's 2006 Hunger Report estimates that, in 2004, 852 million people in the world were suffering from hunger, compared with 826 billion in 2001. The 2008 report confirmed this trend, and the 2007–2008 "hunger riots" were particularly symptomatic of this new period of food insecurity.

a crucial dimension of agricultural sector coordination. Their framework is, however, poorly informed about such macroeconomic characteristics as the types of agriculture involved, as well as about institutional outcomes regarding land rights. In 2008, the World Bank proposed its own agricultural models classification, taking into account agriculture's share in GDP, the proportion of the rural population and the poverty ratio. However, this classification neglects the complex relations between agents, which eventually lead, through institutions, to a specific agricultural development model that assumes a crucial part in developing countries' economic systems.

The present chapter explicitly takes into account the institutional dimension, which is necessary to understand agricultural systems. We use an original and broad database to construct a multidimensional classification for our set of 140 countries that enables the identification of distinct agricultural models, not only in terms of performance, but also in terms of institutions. More precisely, we focus on property rights, recognized as a central institution influencing technological improvements and investment decisions in agriculture (De Soto 2000; Deininger 2003; Goldstein and Udry 2008; Grimm and Klasen 2009; Macours et al. 2010). With that aim, a review of the literature dealing with the role of agriculture and property rights in development (first section) precedes our empirical study identifying different varieties of agricultural sector coordination (second section).

9.2 Agricultural Models for Development: A Review

Our literature review has identified three main dimensions in which agricultural regulation possibly impacts economic development and the shape of economic systems: (i) structural change, (ii) primary specialization and food security; and (iii) land property rights.

The theory of structural change emphasizes the determinant role of agriculture in development, because the agricultural and industrial sectors are interdependent at every stage of development (Szirmai 2005). During the development process, agriculture is central, and the state

plays a crucial role in its development by direct means, such as road construction, agricultural investment as well as by indirect means, including taxation and price incentives or subsidy provision. External effects and market failure[2] justify the role of the state in agrarian investments (Binswanger and Deininger 1997; Bezemer and Hedeay 2008). Nevertheless, public policies can lead to unbalanced development. One particular form of unbalanced development is the consequence of disproportionate transfers from agriculture to industry. This mechanism, known as urban bias (Myrdal 1958; Lipton 1977), is defined by Bezemer and Hedeay (2008) as a combination of price and the international trade system, with public expenditure and subsidies favouring industry and urban areas to the detriment of rural ones. This kind of unbalanced development can help explain differences in the development levels of the emergent and less developed countries.

Primary exportations are a way to reach higher economic wealth and structural change, but they can also have a negative impact on food security. An extensive literature has emphasized that excessive emphasis on exporting may prove risky, especially in the context of worsening terms of trade, primary goods price volatility or demographic increase. Demographic growth increases national food needs, thereby reinforcing the competition between lands dedicated to food production and those dedicated to cash production. All of these elements contribute to explaining increased food dependence in developing economies, and are key elements in current food security issues.

At a more microeconomic level, peasant economy studies clearly help to identify key forces of agricultural system transformation. After Chayanov's study of Russian small-farm agriculture (Chayanov 1966), the literature on the peasant economy has described the smallholder peasant economy as being embedded in rural society: land rights are not systematically individual, and a part of the production is dedicated to the satisfaction of social obligations. Similar structures can be found,

[2] Market failures that are determinant for agricultural development are information asymmetry, transaction costs and labour market distortions, the extreme volatility and covariance of incomes due to the absence of agricultural insurance markets, the distortion of land markets, and the indivisibility of many rural investments.

nowadays, in rural areas of developing countries, such as in China, for example. Two contrasting approaches of the peasant economy actually coexist. The first one emphasizes their rather good adaptation to the specific constraints they face (Chayanov 1966; Schultz 1964; Berry and Cline 1979; Hill 1986; Boserup 1990; Dufumier 2007), whereas the second one places more emphasis on their low productive capacities, with demographic pressure putting even more stress on their underlying bottlenecks (World Bank 2008; UNCTAD 2010). Smallholders are, in fact, risk-averse because they live so close to subsistence level that the slightest income loss leads to unbearable situations. In such a context, security is valued more than innovativeness (Scott 1976), thereby creating resistance to innovation amongst populations of vulnerable smallholders. Popkin (1979), however, emphasizes that peasants are actually engaged in the pursuit of their own interests, and are not always reluctant to invest in order to improve their welfare. They are ready to take risks, if potential losses are not excessive. In what concerns the perception of risks, rural societies, in developing countries, are highly heterogeneous and hierarchically socially structured (Ellis 1988). Consequently, any public policy or institutional reform that can reduce small-farm holders' exposure to risk and improve risk management might facilitate the diffusion of innovation and productivity increase.

Recent literature has emphasized the role of institutions and, more particularly, of property rights, in limiting risks in peasant economies. Macours et al. (2010) show that land rights' insecurity can have large efficiency costs, reducing investment and access to credit. The reinforcement of property rights' security is, therefore, seen as a vector of rural development. For Grimm and Klasen (2009), demographic pressure induces the need for more secure forms of property rights than "traditional" ones. In response, the emergence of new systems of property rights influences technological improvements and investment decisions in agriculture.

The next section proposes an original analysis of agricultural models taking into account not only agricultural systems' performance differentials but also, also, such crucial institutional issues as the policy- and institution-induced urban bias and land rights' securitization.

9.3 Assessing the Institutions of Agriculture Governance

Several variables have been selected to help us to characterize the diversity of agricultural systems. Our dataset comes from two main sources: the World Bank 2008 World Development Indicators, and the CEPII 2009 Institutional Profiles Database (IPD).[3]

The first set of variables is linked to the characterization of agricultural public policies and transfer policies. Special attention is given to the weight of agriculture in the national economy and to the existence of an urban bias. Concerning the share of agriculture in the national economy, two variables have been selected: the share of agricultural GDP in national GDP, and the percentage of agricultural workers in the active population. In line with Bezemer and Hedeay (2008), urban bias is measured by the difference between urban and rural areas of access to safe water.

The second set of variables deals with the multiple purposes of agricultural production (food crops vs. cash crops). We retain the share of agriculture in exportation, which is expected to be higher in less developed, more agriculture-dependent countries. On the contrary, the agro-industrial share of GDP may reflect greater integration between national industry and national agriculture and, thus, a lesser dependence on agriculture. Food security is measured by three variables: the malnutrition prevalence height for age—measured by the percentage of children under five, the malnutrition prevalence weight for age—the percentage of children under five, and the undernourishment and Global Hunger Index.[4]

Types of farm organization are described by three indicators: the use of fertilizer per hectare, the number of tractors per hectare, and the productivity of a worker in agriculture (measured by the GDP per worker in agriculture). Whereas these three variables are rather good at describing modern agriculture, they need to be complemented in order to depict

[3] The sources are presented in Table 9.6 in the Appendix. The CEPII 2009 IPD is available on: http://www.cepii.fr/francgraph/bdd/instit_form/login2009.asp

[4] The global hunger index is calculated on the basis of: (i) the proportion of undernourished people in the total population (in percentage); (ii) the prevalence of underweight in children under five (in percentage); (iii) the under-five mortality rate (per 1000 live births). See Wiesmann et al. (2006) for a more detailed presentation.

such peasant economy specificities as the small size of land assets, for which the land Gini, measuring the inequalities of land distribution, provides a good measurement.

As for strictly institutional aspects, these essentially focus on property rights. The six selected variables are provided by the CEPII 2009 IPD. They respectively characterize: (i) the diversity of land tenure rights systems (traditional, customary, collective, religious, "modern" rights, etc.); (ii) government recognition of this diversity; (iii) the significance of public land tenure policies,[5] (iv) the security of land tenure rights; (v) land pressure, measured by the strength of the demand for land; and (vi) the "Land tenure and large investors" variable measures the extent of large investment (national or international) in land property.

For all these variables, the reference year is 2005, with missing values, whenever possible, being completed by the nearest year for which a value is available. We have cut down the initial sample of 154 countries by eliminating those for which less than 50% of variables were known,[6] and then controlled for the representativeness of the remaining sample.[7] The PCA has thus been conducted for a sample of 145 countries for the year 2005. In the entire analysis, the role of the remaining missing data has been cancelled out by using the corresponding mean values. After sample adjustment, only 12 active variables have been retained for the empirical analysis: the percentage of agricultural workers in the active population, the share of agricultural GDP in national GDP, the urban bias indicator, the share of agriculture in exportation, the share of agro-industry in GDP, the number of tractors per hectare, the use of fertilizer per hectare, the productivity of a worker in agriculture, the diversity of land tenure right systems, the government recognition of the diversity of land tenure right systems, the significance of public land tenure policies, and the security of land tenure

[5] This variable is a synthesis of three elements: (i) the public arrangements available for formalisation/registration of land rights in urban, suburban and rural areas; (ii) the policy fostering access to land for certain disadvantaged groups (minorities, natives, indigenous peoples, immigrants, etc.); (iii) eviction operations over the last three years (excluding conflicts, civil wars, etc.).

[6] Afghanistan, Bosnia and Herzegovina, Chad, Cuba, Ireland, Liberia, Libya, Somalia and Virgin Islands have thus been excluded from the analysis. Moreover, Iceland and Singapore have also been excluded because they are extreme outliers.

[7] Note that complete information is available for 45.5% of the individuals and that 23.1% of them only suffer one single missing variable.

rights.[8] The data summary statistics and simple correlations between considered variables are shown in Tables 9.6 and 9.7 in the Appendix.

9.4 The Diversity of Agriculture Governance Models

9.4.1 Principal Component Analysis

We proceed to a Principal component analysis (PCA) of the 12 selected active variables. Three categorical variables, describing the geographical localization, HDI level and socioeconomic situation of each country, have been added as supplementary variables in the analysis.[9] Twenty-five bootstrap replications of the initial sample have been implemented in order to back up PCA results by providing confidence intervals for the coordinates of the projected active variables. The results of the bootstrap replications show that the initial position of all the variables that contribute to the orientation of the first and second components is reliable. However, the urban bias variable seems to have a doubtful position and should, therefore, be interpreted carefully on the basis of the second axis. Table 9.1 shows PCA eigenvalues. Figure 9.1 displays the projections of the 12 active variables on the first factorial plan (F_1, F_2), and Fig. 9.2 shows the projections of active individuals on the same plan.

Data sources: Author's calculations on data collected from World Bank, WDI, CEPII, FAO, National census and IFPRI; for details, see Table 9.6

The first principal component accounts for a fairly large part of the total variance (33.97%). As for the second and third components, they respectively represent 20.56% and 8.17% of the total sample heterogeneity. The third component, however, does not really enrich the information

[8] Six variables have been excluded from the PCA because they are misrepresented on the first two components, and because they do not significantly contribute to the axis orientation. These variables are the malnutrition prevalence height for age, the malnutrition prevalence weight for age, the undernourishment index, the Global Hunger Index, the land Gini, the demand for land, and the "land tenure and large investors" variable. Nevertheless, these six variables will be reintroduced in the second step of the analysis (cluster analysis) as supplementary variables in order to refine the characterization of the different country groups.

[9] Note that these variables do not affect the construction of principal factors.

Table 9.1 PCA Eigenvalues

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Eigenvalues	4.08	2.47	0.98	0.92	0.68	0.64	0.59	0.42	0.39
% of variance	33.97	20.56	8.17	7.65	5.68	5.30	4.89	3.47	3.29
Cumulative %	33.97	54.52	62.70	70.35	76.02	81.32	86.21	89.68	92.97

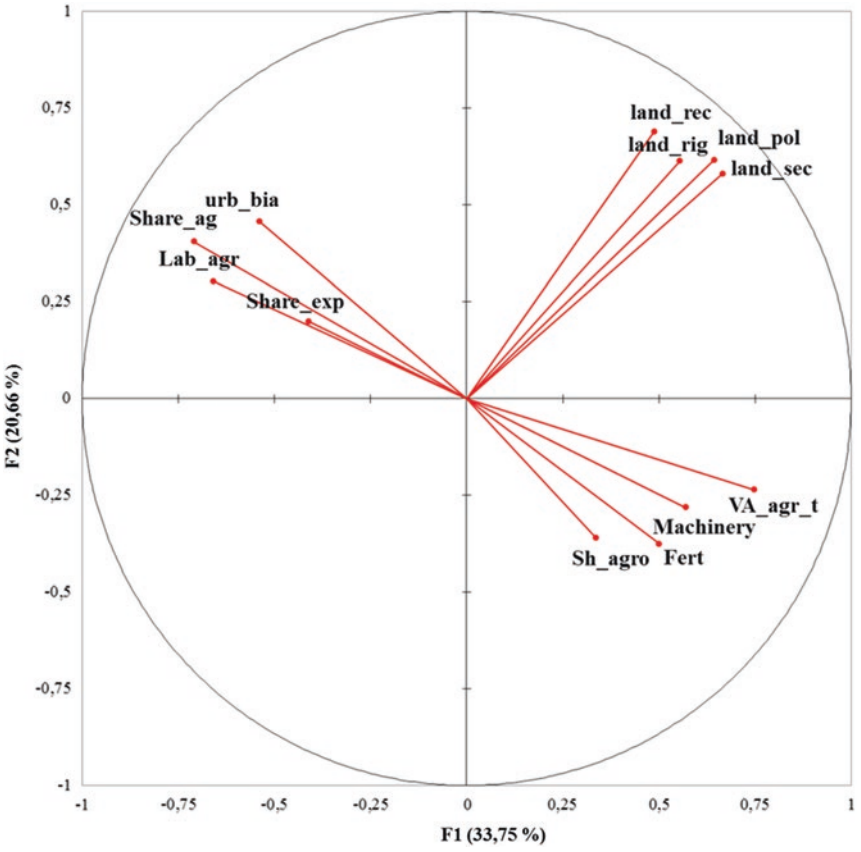

Fig. 9.1 Projection of the active variables on the first factorial plan. *Data source*: Author's calculations; see Table 9.6 for details

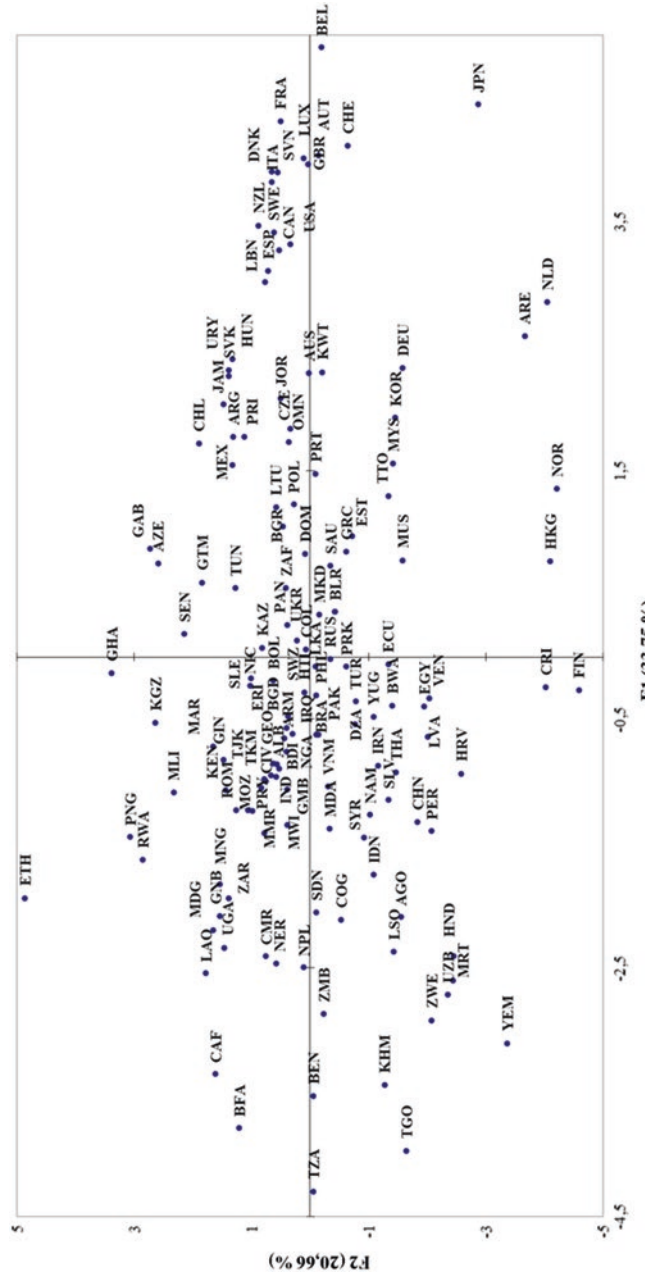

Fig. 9.2 Projection of the active individuals on the first factorial plan. *Data source*: Author's calculations

provided by the first two components. Therefore, we have chosen to retain the first and second factorial axes (F1 and F2), which provide a satisfactory representation of the data set (approximately 55% of the total variance). Table 9.2 shows active and supplementary variable correlations with each factor.

The correlation circle (Fig. 9.1) suggests that all the active variables are correctly represented. This raises three comments. First, the group of variables characterizing agricultural weight in the economy and the existence of an urban bias are negatively correlated with agricultural productivity variables. Second, the four institutional variables are positively correlated with each other. Third, since institutional variables are orthogonal to the two others groups of variables they, therefore, provide additional and complementary information to the traditionally used dimensions.

First principal component F_1 analysis reveals a clear-cut opposition between two types of agriculture. On the left-hand side, a first model of agriculture combines a high share of agriculture in the national economy,

Table 9.2 Active/supplementary variable-axes correlations and actives variable-axis correlations[a]

	PC1	PC2
Agricultural workers in active population	**−0.661**	0.300
Agriculture share in GDP	**−0.704**	0.413
Productivity of agricultural workers (value-added)	**0.743**	−0.242
Agriculture share in exports	−0.412	0.200
Urban bias	−0.543	**0.451**
Fertilizer use	0.506	−0.372
Machinery use	**0.572**	−0.281
Agro-industry share in GDP	0.333	−0.366
Diversity of land tenure right systems	0.562	**0.612**
Government recognition of the diversity of land tenure right systems	0.494	**0.687**
Significance of public land tenure policies	**0.649**	**0.613**
Security of land tenure rights	**0.672**	**0.576**

[a]For supplementary variables, significant correlations at a 5% level are shown in bold characters

Note: Emerging countries are those that have been considered as such by at least one of the following institutions: Boston Consulting Group, BNP Paribas, IMF or Standard and Poor's

Data sources: Author's calculations on data collected from World Bank, WDI, CEPII, FAO, National census and IFPRI; for details, see Table 9.6

both in terms of value added and labour force, and low productivity. On the right-hand side along the first component, a second model is characterized by a lower agricultural share in the economy and more productive organizations, as well as more secure and diversified land tenure systems. We can, therefore, draw, from this first axis, a distinction between those economies that are relatively dependent on agriculture, and those that rely on a more productive and efficient agriculture. In fact, F_1 could perfectly be interpreted as the structural change axis. Among the individuals that contribute most to the orientation of F_1, we can notice a clear opposition between two groups of countries.

Most industrialized and OECD countries with capital-intensive, more productive, and/or better-institutionalized agricultural systems (France, Belgium, Luxembourg, United Kingdom, USA, New Zealand, the Netherlands, Denmark, Italy, Spain, Sweden, Switzerland, Japan, Australia, Canada, Germany…) cluster on the right side of the graph. As explained above, the second principal component, F_2, provides additional information about land property rights. It draws an opposition between countries showing high dependence on agriculture and a strong urban bias (in the top left-hand corner) and countries where agriculture plays a significant role in the economy, but where urban bias is minor and the agricultural system is weakly institutionalized (in the bottom left-hand corner). Equally, F2 makes a distinction between countries featuring both a productive agriculture and strong regulations (in the top right-hand corner), and countries with a productive but weakly institutionalized agricultural system (in the bottom right-hand corner we find Hong Kong, Finland and Norway). So, the scale of structural change is complemented by institutional aspects to explain the differences between countries.

These two kinds of variables are introduced in a classification analysis in order to systematically identify country clusters.

9.4.2 The Cluster Analysis: Three Models of Agriculture Governance

Our sample of countries is classified according to the dominant structural and institutional traits of their agricultural governance model. Different types of agricultural systems can therefore be identified. A brief presen-

tation of our methodological choices precedes the presentation of the results.

Our classification analysis implements a mixed method adapted to establish homogeneous and meaningful clusters of countries. The 12 active variables used for the PCA are introduced in the mixed classification method, which combines: (i) a hierarchical cluster analysis that provides arguments to choose the number of clusters, and (ii) a consolidation of the cluster composition by using k-means-like iterations (maximizing inter-cluster variance while minimizing intra-cluster variance). In order to reinforce the coherence of the groups, a preliminary step consists in isolating, in a particular group, the countries situated at the centre of the scatter plot.[10]

Due to their central position, the assignment of these countries to one of the k-means groups would not be very consistent. Moreover, their marginal position within these groups could thin them down. The interpretation of the types of agricultural systems falling into that group is not easy, however. We would say that they differ from the types represented by the other clusters (established by the classification) although potentially being, simultaneously, different from one other. That is why this group has been called the *idiosyncratic* model.

In addition to this group, three clusters have emerged from the classification. Table 9.3 presents the mean value, by country group, of a selection of variables, with the active classification and additional characterization variables being respectively reported in the upper and lower panels. Table 9.4 shows the distribution of each country's agricultural type according to its geographic localization and its level of economic and social development. Table 9.5 reports lists of countries by cluster, and Fig. 9.3 maps the models in a world atlas.

Countries that belong to the *traditional agriculture* model are characterized by a great dependence on agriculture and weak agricultural productivity; for these countries, structural change did not happen significantly. That is why the cluster has been named as a *traditional agriculture* type. Legal formalization of land tenure rights is weak, except for the

[10] The closest countries, in terms of Euclidian distance to the barycentre of the scatter plot, have been *a priori* affected to this group.

Table 9.3 Compared means of active and supplementary variables by cluster

	Traditional	*Dualistic*	*Modern*	*Idiosyncratic*	All
Agriculture employment (% of total)	**48.52**[a] (25.06)	**34.10** (22.31)	**6.65** (4.93)	24.13 *(15.19)*	25.45 (24.00)
Agriculture value added (% of GDP)	**27** (14)	15 (11)	**4** (3)	13 ***(8)***	14.5 (13.25)
Agriculture V.A. per worker (US$)	**942.26** (1088.28)	**3466.13** (7881.15)	**20,402.88** (15,539.63)	**2798.08** *(3419.38)*	8008.7 (13,446.69)
Agriculture exportation share (%)	**11.60** (16.74)	4.00 (4.71)	**2.03** (2.19)	**3.52** *(3.25)*	5.26 (9.72)
Urban bias	**34.95** (16.32)	16.30 (14.51)	**4.10** (8.6)	18.38 *(11.94)*	19.02 (17.56)
Fertilizer consumption	**369.52** (617.34)	1144.18 (1468.55)	**2005.96** (1508.59)	**661.06** *(816)*	1398.4 (3111.93)
Machinery	**46.93** (65.04)	**168.63** (283.76)	**734.96** (934.04)	292.36 (389.94)	424.58 (1396.67)
Agro-industry (% of GDP)	**0.53** (0.63)	1.24 (1.12)	**2.68** (2.86)	**0.96** (0.7)	2.14 (6.19)
Rights diversity of land tenure systems	3.17 (0.83)	**2.15** (0.69)	**3.58** (0.70)	3.03 (0.5)	2.98 (0.92)
Rights recognition	**3.67** (0.52)	**2.07** (0.81)	**3.69** (0.60)	3.25 (0.47)	3.14 (0.97)
Land tenure policies	3.15 (0.71)	**2.20** (0.64)	**3.85** (0.32)	2.90 (0.46)	3.05 (0.86)
Rights security	2.69 (0.77)	**1.88** (0.51)	**3.41** (0.59)	2.55 (0.38)	2.65 (0.85)

GDP per capita (constant 2000 $ PPP)	**2771.81** (3047.82)	**6543.34** (8892.54)	**23,903.72** (11,572.95)	**7026.98** (6101.22)	11,001 (12,790.66)
HDI	**0.46** (0.15)	**0.56** (0.16)	**0.81** (0.07)	0.61 (0.15)	0.61 (0.19)
Gini index	41.43 (8.95)	41.20 (9.38)	**37.20** (8.07)	42.36 (9.21)	40.45 (8.98)
Gini index of land concentration	0.57 (0.15)	0.53 (0.18)	**0.65** (0.13)	0.67 (0.16)	0.60 (0.16)
Global hunger index	**19.71** (8.94)	**13.08** (10.07)	**4.68** (2.87)	15.67 (13.60)	14.71 (10.78)
Malnutrition prevalence weight for age	**22.91** (12.48)	20.09 (12.93)	**5.06** (4.41)	**12.96** (12.20)	17.23 (13.18)
Land tenure and large investors	2.55 (0.79)	2.77 (0.64)	2.85 (0.70)	2.81 (0.72)	2.72 (0.72)
Demand for land	2.29 (0.75)	2.39 (0.84)	2.56 (0.85)	**2.75** (0.51)	2.46 (0.80)

[a]The variable means that are significantly different from that computed for all other countries at the 5% confidence level are reported in bold characters

Data sources: Author's calculations on data collected from World Bank, WDI, CEPII, FAO, National census and IFPRI; for details, see Table 9.6

Table 9.4 Geographic and economic distribution of clusters

	Dualistic	*Traditional*	*Modern*	*Idiosyncratic*	All
OECD	2.78	0.00	52.78	0.00	15.38
East Asia and Pacific	13.89	15.79	5.56	11.11	11.89
Eastern Europe and Central Asia	8.33	13.16	16.67	44.44	18.18
Latin America and the Caribbean	19.44	10.53	16.67	11.11	14.69
Middle East and North Africa	13.89	5.26	8.33	7.41	9.79
Sub-Saharan Africa	33.33	50.00	0.00	25.93	26.57
South Asia	8.33	5.26	0.00	0.00	3.50
Total	100.00	100.00	100.00	100.00	100.00
Low HDI	38.89	64.86	0.00	20.00	31.39
Middle HDI	58.33	35.14	39.39	72.00	49.64
High HDI	2.78	0.00	57.58	8.00	17.52
Very high HDI	0.00	0.00	3.03	0.00	1.46
Total	100.00	0.00	100.00	100.00	100.00
Industrialized countries	8.33	10.53	55.56	33.33	26.57
Emerging countries[a]	36.11	18.42	36.11	37.04	30.07
Developing countries	27.78	28.95	5.56	18.52	22.38
Less developed countries	27.78	42.11	2.78	11.11	20.98
Total	100.00	100.00	100.00	100.00	100.00

[a]Emerging countries are those that have been considered as such by at least one of the following institutions: Boston Consulting Group, BNP Paribas, IMF or Standard and Poor's

Data sources: Author's calculations

recognition of the diversity of rights, which is significantly higher than for the whole sample. GDP per capita is low and the prevalence of malnutrition is high. Not surprisingly, this cluster includes developing countries (a significant share of the sub-Saharan countries and some Central Asian countries) and a small subset of emerging economies (Bolivia, India, Morocco, Nigeria and Romania).

At the opposite, the *modern agriculture* model cluster is characterized by a high productivity level, with agriculture amounting for a small percentage of employment, GDP and exports. Institutional aspects are

Table 9.5 Classification of countries in the different clusters[a]

Cluster 1—*Dualistic agriculture* (38 countries)				
Algeria	**Ecuador**	**Iran**	**Pakistan**	Uzbekistan
Angola	**Egypt**	Latvia	**Peru**	**Venezuela**
Botswana	**El Salvador**	Lesotho	**Sri Lanka**	Vietnam
Cambodia	Finland	Mauritania	Sudan	Yemen
China	Haiti	Mauritius	Syria	Zambia
Congo Rep.	Honduras	Namibia	Tanzania	**Zimbabwe**
Costa Rica	Hong Kong	Nepal	**Thailand**	
Croatia	**Indonesia**	Norway	Togo	
Cluster 2—*Traditional agriculture* (38 countries)				
Albania	Colombia	**India**	Mali	Papua New Guinea
Azerbaijan	Congo Dem. Rep.	Iraq	Mongolia	**Romania**
Bangladesh	Ethiopia	Kazakhstan	**Morocco**	Rwanda
Benin	Gabon	Kenya	Mozambique	Senegal
Bolivia	Ghana	Kyrgyz Rep.	Myanmar	Tajikistan
Burkina Faso	Guinea-Bissau	Lao PDR	Niger	Uganda
Cameroon	Guatemala	Madagascar	**Nigeria**	
Central Africa	Guinea	Malawi	Panama	
Cluster 3—*Modern formalized agriculture* (40 countries)				
Argentina	Denmark	Jamaica	**Mexico**	Spain
Australia	**Dominican R.**	Japan	Netherlands	Sweden
Austria	France	**Jordan**	New Zealand	Switzerland
Belgium	Germany	Kuwait	**Oman**	Trinidad and Tobago
Bulgaria	Greece	Lebanon	Portugal	United Arab Emirates
Canada	**Hungary**	Lithuania	Puerto Rico	United Kingdom
Chile	**Israel**	Luxembourg	Slovak Rep.	USA
Czech Republic	Italy	**Malaysia**	**Slovenia**	**Uruguay**
Cluster 4—*Idiosyncratic agriculture* (27 countries)				
Armenia	Estonia	Moldova	**Saudi Arabia**	**Turkey**
Belarus	Gambia	Nicaragua	Serbia-Herzeg.	Turkmenistan
Brazil	Georgia	Paraguay	Sierra Leone	Ukraine
Burundi	Korea DPR	**Philippines**	**South Africa**	
Cote d'Ivoire	**Korea Rep.**	**Poland**	Swaziland	
Eritrea	Macedonia	**Russia**	**Tunisia**	

[a]Bold characters denote emerging countries, in the sense that they have been considered as such by at least one of the following institutions: Boston Consulting Group, BNP Paribas, IMF or Standard and Poor's

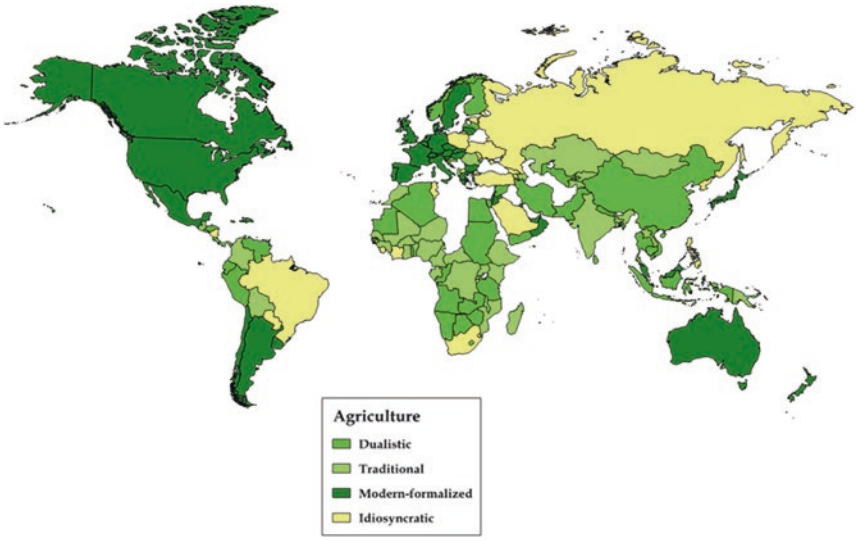

Fig. 9.3 World map of the models of agriculture governance

essential since the countries belonging to this type all exhibit remarkably high levels of legal formalization of land tenure systems. More specifically, in these countries, property rights are secure and land policies effective. Although almost all OECD countries unsurprisingly belong to this group, various emerging countries, especially those acknowledged for their dynamic agricultural exporting sector, like Argentina, Chile and Israel, also show *modern* agriculture governance.

The *dualistic agriculture* model cluster is certainly the most interesting for our purpose of identifying the types of agricultural systems that are specific to developing and countries. Almost one third of emerging countries belong to this group (among others, China, Ecuador, Indonesia, Peru, Sri Lanka, Thailand and Zimbabwe). This group is not necessarily characterized by strongly specific structural features since it is situated at an intermediate position alongside this dimension. This cluster is actually distinguished from either the traditional or the modern one by specific institutional features: land tenure systems are heterogeneous and land rights tend to be weakly recognized for a significant part of the farmers, the smallholder peasants. Moreover, land tenure policies are rarely

enforced, and only those actors that are sufficiently powerful both politically and economically succeed in securing their assets. This particularity drives land concentration and strengthens the dualistic structure of the agricultural sector. That is why this model is called the *dualistic agriculture* model. Higher levels of performance, notably with respect to the *traditional agriculture* type, are reached in spite of a weak legal environment. But this high-yielding agriculture is often concentrated in commodity-exporting large and formalized farms. Average good agricultural performance, despite the low level of overall land rights recognition and enforcement, can also be explained by recent modifications in agricultural practices introduced by new investors, foreign or domestic, small groups of entrepreneurial peasants who have adopted more productive methods than smallholders.

The progressive inclusion of new types of actors in rural areas probably increases property rights insecurity, with traditional land right systems, frequently informally guaranteed at local communitarian level, being progressively replaced by new better-established ones. It is worth noting that a similar phenomenon also tends to emerge in *traditional agriculture* countries, notably via the international land-grabbing phenomenon.

9.5 Conclusion

This chapter proposes a classification analysis of agriculture models based on a broad sample of countries and with the inclusion, in addition to more usual variables about productivity and the size of agriculture, of variables about land property rights, reflecting institutional aspects. The empirical strategy is based on the combination of PCA analysis and mixed classification analysis, which generate endogenous multidimensional classifications.

The introduction of institutional variables adds key information for the understanding of agriculture models. As shown by PCA, institutional variables constitute, on their own, an axis of observed heterogeneity explanation. They consequently play a key role in differentiating

agricultural models. Three agricultural models have been identified. The *traditional* and *modern* ones are clearly opposed with respect to both performance and institutional outcomes. The third model, named *dualistic*, is particularly interesting as regards property rights aspects. Somewhat paradoxically, higher levels of agricultural performance are to be found in countries with higher land rights insecurity.

The countries belonging to this group seem to be in a transition stage; changes in agricultural practices are undermining the traditional land right system's capacity to guarantee smallholder's land property, with these farmers' investment and productivity being eventually depressed. Concerning the endogenous dynamics of land property rights, we can formulate two hypotheses: (i) more adapted institutions have not yet emerged but are still to come, or (ii) insecurity could be a permanent characteristic in these countries or, at least, in some of them. The second scenario is supported by the idea that insecurity can serve the interests of the dominant groups. Since they are often better endowed with all forms of capital than the others, they commit more resources to protecting their own land rights and can even use the prevailing uncertainty to their advantage, notably by grabbing the insufficiently well-established land rights of the others, thereby generating violent conflicts.

Concerning the recent "agriculture for development" paradigm, that may only be realized by an inscription in land tenure systems (Byerlee et al. 2009), endogenously linked to the evolution of agricultural practices, although some important changes are at work in most developing countries, there is no indication that these changes will spontaneously reduce poverty and inequalities. Public policies will continue to have a central role to play in the agricultural development domain.

Appendix

Table 9.6 Statistical sources

Code	Label	Definition	Source
Classification variables			
Share_ag	Agriculture in GDP	Agriculture, value added (% of GDP) – Constructed variable	World Bank, WDI 2007
Lab_agr	Agricultural workers	Employment in agriculture (% of total employment)	World Bank, WDI 2007
Share_exp	Agricultural exports	Agricultural raw materials exports (% of merchandise exports)	World Bank, WDI 2007
Urb_bia	Urban bias	Urban/Rural differences in access to water (% of urban population with access to improved water sources in urban areas—% of rural population with access to improved water sources in rural areas)—Constructed variable	World Bank, WDI 2007
Fert	Fertilizer	Fertilizer consumption (100 grammes per hectare of arable land)	World Bank, WDI 2007
Machinery	Machinery	Agricultural machinery, tractors per 100 hectares of arable land	World Bank, WDI 2007
VA_agr_t	Workers productivity	Agriculture, value added per worker (constant 2000 US$)	World Bank, WDI 2007
Sh_agro	Agro-industry	Food, beverages and tobacco, value added (% of agriculture value added) – Constructed variable	World Bank, WDI 2007
Land_rig	Rights diversity	Diversity of land tenure right systems (from 1 = high diversity to 4 = single land system)	CEPII 2009
Land_rec	Rights recognition	Government recognition of the diversity of land tenure rights systems (from 1 = no formal government recognition to 4)	CEPII 2009

(*continued*)

Table 9.6 (continued)

Code	Label	Definition	Source
Land_sec	Rights security	Security of land tenure rights (from 1 = very high percentage of the population without recognized rights to 4 = very low or zero percentage)	CEPII 2009
Land_pol	Land tenure policies	Public land tenure policies (0 = no public arrangement; then from 1 = rarely enforced or inefficient to 4 = effective)	CEPII 2009
Variables used for the characterization			
LandGini	Gini's index of land concentration	Gini's index of land concentration	FAO, National census
Ghi	Global Hunger Index	Global Hunger Index	IFPRI
Malnut_w	Malnutrition prevalence weight for age	Malnutrition prevalence weight for age (% of children under 5)	World Bank, WDI 2007
Land_dem	Demand for land	Demand for land (from 1 = low demand for land to 4 = high demand)	CEPII 2009
Larg_inv	Land tenure and large investors	Land tenure and large investors (from 1 = very small-scale investors in urban/rural areas to 4 = very large scale)	CEPII 2009

Table 9.7 Simple correlations between the 12 agricultural variables

	Agricultural workers	Agriculture in GDP	Workers productivity	Agricultural exportation share	Urban bias	Fertilizers	Machinery	Agro-industry	Rights diversity	Rights recognition	Land tenure policies	Rights security
Agricultural workers	**1**											
Agriculture in GDP	**0.60**	**1**										
Workers productivity	**−0.50**	**−0.49**	**1**									
Agriculture exportation share	**0.18**	**0.44**	**−0.18**	**1**								
Urban bias	**0.38**	**0.50**	**−0.47**	**0.28**	**1**							
Fertilizers	**−0.32**	**−0.40**	**0.44**	**−0.21**	**−0.36**	**1**						
Machinery	**−0.38**	**−0.39**	**0.58**	**−0.17**	**−0.33**	**0.34**	**1**					
Agro-industry	**−0.32**	**−0.35**	**0.29**	−0.16	**−0.20**	**0.17**	0.14	**1**				
Rights diversity	−0.16	−0.16	**0.21**	−0.14	−0.02	0.115	0.130	−0.04	**1**			
Rights recognition	−0.16	−0.07	**0.20**	−0.05	0.028	−0.04	0.06	−0.01	**0.62**	**1**		
Land tenure policies	**−0.22**	**−0.19**	**0.32**	−0.12	−0.08	0.10	0.16	0.04	**0.63**	**0.65**	**1**	
Rights security	**−0.20**	**−0.24**	**0.36**	−0.15	−0.11	0.10	**0.21**	0.02	**0.62**	**0.61**	**0.79**	**1**

Note: Bold characters denote a significant correlation at the 5% level
Data sources: Author's calculations on data collected from World Bank, WDI, CEPII, FAO, National census and IFPRI; for details, see Table 9.6

Table 9.8 Data summary statistics (means and standard deviation), 145 countries

Variables	All	OECD	East Asia and Pacific	Europe and Central Asia	Latin America and the Caribbean	Middle East and North Africa	Sub-Saharan Africa	South Asia
Employment in agriculture (% of total)	25.45 (24.01)	4.30 (0.64)	38.07 (7.10)	24.71 (3.52)	18.20 (3.07)	24.89 (5.92)	48.21 (8.27)	54.80 (8.18)
Agriculture value added (GDP%)	14.50 (13.25)	2.36 (0.364)	20.07 (4.57)	11.42 (1.64)	9.5 (1.28)	8.93 (1.77)	25 (2.26)	23 (4.18)
Agriculture value added per worker (US$)	8008.7 (13,447)	31,660 (2420.2)	5755.4 (4104.8)	4699.9 (1628.3)	3451.1 (541.0)	8401.6 (3228.4)	655.76 (144.3)	470.60 (104.4)
Agriculture share of export (in %)	5.26 (9.72)	6.13 (2.33)	6.13 (2.33)	3.13 (0.68)	2.86 (0.64)	1.15 (0.59)	12.03 (2.77)	1.60 (0.24)
Urban bias	19.02 (17.56)	0.05 (0.05)	23.4 (4.99)	14.32 (3.73)	17.19 (2.71)	14.08 (4.46)	32.62 (2.28)	12 (3.15)
Fertilizer consumption	1398.4 (3111.9)	3130.6 (1096.91)	2990.8 (1493.14)	747.08 (170.53)	1220.5 (319.20)	1549.9 (405.55)	210.26 (67.98)	1528.1 (456.1)
Machinery	424.58 (1396.67)	1807.6 (652.52)	235.55 (95.98)	351.66 (68.97)	121.61 (22.72)	153.60 (36.50)	34.64 (10.00)	90.49 (31.64)
Agro-industry (% of GDP)	2.14 (6.19)	2.15 (0.35)	7.74 (5.27)	0.81 (0.08)	1.79 (0.39)	2.79 (1.11)	0.90 (0.20)	0.34 (0.06)
Diversity of land tenure systems	2.98 (0.92)	3.38 (0.21)	2.87 (0.21)	3.11 (0.18)	3.17 (0.23)	2.92 (0.26)	2.62 (0.17)	2.87 (0.13)
Rights recognition	3.14 (0.97)	3.52 (0.19)	2.96 (0.27)	3.20 (0.24)	3.19 (0.24)	2.99 (0.27)	3.03 (0.17)	2.50 (0.50)
Land tenure policies	3.05 (0.86)	3.64 (0.18)	2.77 (0.22)	3.25 (0.19)	2.98 (0.21)	2.99 (0.24)	2.74 (0.14)	3.00 (0.36)
Rights security	2.65 (0.85)	3.38 (0.15)	2.31 (0.24)	2.71 (0.17)	2.55 (0.20)	2.56 (0.24)	2.37 (0.14)	2.63 (0.12)
N	**145**	**23**	**18**	**26**	**21**	**14**	**38**	**5**

Variables	All	Low HDI	Middle HDI	High HDI	Very high HDI
Employment in agriculture (% of total employment)	25.45 (24.01)	61.56 (5.33)	33.36 (2.59)	17.00 (2.62)	4.19 (0.49)
Agriculture value added (% of GDP)	14.50 (13.25)	28.13 (1.97)	15 (1.29)	7.53 (0.86)	4.69 (1.97)
Agriculture value added per worker (US$)	8008.7 (13,446.69)	432.88 (50.20)	1720.7 (228.35)	4665.2 (676.11)	27,838 (2896.14)
Agriculture exportation share (% of exports)	5.26 (9.72)	12.11 (2.73)	3.51 (0.64)	2.70 (0.57)	2.16 (0.39)
Urban bias	19.02 (17.56)	31.95 (2.37)	19.43 (2.30)	15.13 (3.56)	2.89 (1.53)
Fertilizer consumption	1398.4 (3111.93)	225.73 (56.85)	972.25 (185.06)	1268.7 (294.01)	3588.3 (1086.72)
Machinery	424.58 (1396.67)	32.33 (9.48)	131.89 (18.33)	290.89 (59.33)	1483.3 (511.31)
Agro-industry (% of GDP)	2.14 (6.19)	0.51 (0.09)	1.13 (0.19)	1.98 (0.53)	4.94 (2.20)
Rights diversity of land tenure systems	2.98 (0.92)	2.62 (0.16)	2.86 (0.16)	3.20 (0.16)	3.35 (0.19)
Rights recognition	3.14 (0.97)	2.91 (0.18)	2.90 (0.17)	3.20 (0.20)	3.57 (0.16)
Land tenure policies	3.05 (0.86)	2.64 (0.14)	2.87 (0.13)	3.10 (0.17)	3.64 (0.15)
Rights security	2.65 (0.85)	2.30 (0.14)	2.47 (0.13)	2.57 (0.16)	3.30 (0.15)
N	**145**	**40**	**37**	**30**	**33**

(*continued*)

Table 9.8 (continued)

Variables	All	Industrialized countries	Emerging countries[a]	Developing countries	Less developed countries
Employment in agriculture (% of total employment)	25.45 (24.01)	15.05 (2.86)	19.16 (2.69)	29.74 (4.32)	65.38 (6.32)
Agriculture. value added (% of GDP)	14.50 (13.25)	7.44 (1.34)	10.12 (0.99)	15.79 (2.51)	30.54 (2.45)
Agriculture value added per worker (US$)	8008.7 (13,446.69)	18,820 (2731.19)	4465.2 (1097.95)	5750.8 (2250.8)	295.63 (29.36)
Agriculture exportation share (% of exports)	5.26 (9.72)	2.95 (0.51)	2.88 (0.52)	4.56 (0.82)	14.39 (4.17)
Urban bias	19.02 (17.56)	6.64 (1.87)	17.83 (2.54)	23.58 (2.26)	29.86 (3.12)
Fertilizer consumption	1398.4 (3111.93)	2020.1 (683.85)	1497.3 (220 .12)	1624.9 (749.33)	200.86 (71.06)
Machinery	424.58 (1396.67)	1233.5 (409.94)	196.17 (40.57)	140.64 (36.10)	18.48 (8.23)
Agro-industry (% of GDP)	2.14 (6.19)	1.74 (0.27)	1.13 (0.13)	4.92 (2.24)	0.66 (0.22)
Rights diversity of land tenure systems	2.98 (0.92)	3.27 (0.17)	3.05 (0.13)	2.92 (0.18)	2.63 (0.19)
Rights recognition	3.14 (0.97)	3.35 (0.19)	3.11 (0.15)	3.18 (0.20)	2.91 (0.19)
Land tenure policies	3.05 (0.86)	3.47 (0.16)	3.04 (0.14)	3.06 (0.15)	2.61 (0.16)
Rights security	2.65 (0.85)	3.12 (0.14)	2 .66 (0.13)	2.55 (0.18)	2.23 (0.14)
N	**145**	**39**	**43**	**34**	**29**

[a]Emerging countries are those that have been considered as such by at least one of the following institutions: Boston Consulting Group, BNP Paribas, IMF or Standard and Poor's

Data sources: Author's calculations on data collected from World Bank, WDI, CEPII, FAO, National census and IFPRI; for details, see Table 9.6

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