

# **The Colonial Origins of Inequality: The Causes and Consequences of Land Distribution**

E.H.P. Frankema

Groningen Growth and Development Centre  
University of Groningen

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## **Abstract**

The bi-polar distribution of land established during three centuries of colonial rule is still, after nearly two centuries of independence, one of the crucial underpinnings of persistent high levels of income inequality in Latin America. This paper assesses the Latin American colonial experience in a global comparative perspective. Using new and existing land inequality figures this paper studies the causes and consequences of colonial land distribution in an OLS regression framework. The two central questions addressed are 1) what explains the cross-country variation in land inequality at the end of the colonial period? 2) how does initial land inequality relate to current income inequality? It is argued that an assessment of the second question benefits from addressing the first question first. Understanding the determinants of land inequality improves our insight in the variety of paths and nature of economic inequality and distributive conflicts.

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*Keywords:* Latin America, colonial institutions, geography, factor endowments, land distribution, income distribution

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*Correspondence:* Ewout Frankema, Groningen Growth and Development Centre, [www.ggd.net](http://www.ggd.net), Faculty of Economics, University of Groningen, P.O.Box 800, 9700 AV, Groningen, The Netherlands, *e-mail:* [e.h.p.frankema@rug.nl](mailto:e.h.p.frankema@rug.nl), tel. +31 50 363 7190, fax +31 50 363 7337

## 1 Introduction

Current inequality literature calls for a broad view on economic inequality. This implies, among other things, that attention should be paid to the historical evolution of asset inequality in order to explain observed rigidities in the distribution of income (Atkinson 1997, Atkinson and Bourguignon 2000). This paper aims to contribute to this research agenda with an empirical analysis of the causes and consequences of land distribution using a new dataset of land inequality figures. Land inequality is a major factor in the evolution of economic inequality as it is the ultimate storage of wealth in pre-industrial societies. Since land usually depreciates at a slower pace than most other forms of human, physical and natural capital its value can be easily passed on from one generation to the next. Although the direct impact of land inequality on income inequality diminishes as the share of agriculture in total GDP declines, indirect effects of land inequality (and landowning elites) may generate long run consequences for the distribution of income.

The colonial heritage of land inequality is still, after two centuries of independence, a major pillar of persistent high levels of income inequality in Latin America (World Bank 2004). The Iberian colonial administration deliberately redistributed land from indigenous peasants to the Creole elite. For the Spanish Crown land was a convenient resource to reward the early colonists' efforts of conquest, conversion and settlement. With the creation of distinct Spanish and Indian estates the distribution of land also came to reflect a separation of political, juridical and administrative spheres. The institution of the *encomienda*<sup>1</sup> provided the large colonial estates (*latifundia*) (and the silver mines) with supplies of indigenous labour. In Brazil and the Caribbean large plantations were driven by imported African slaves producing tropical cash crops such as sugar, cocoa and coffee. The omni-present Catholic church further enhanced land inequality as large land holdings materialized its position as the supreme religious authority. In other words, land inequality was a core ingredient of the colonial order in Spanish America and Brazil (Bakewell 2004, Williamson 1992, Fernandez-Armesto 2003).

With the Latin American experience in mind, this paper aims to explore the colonial origins of land and income distribution in a global comparative perspective. The two central questions addressed are 1) what explains the cross-country variation in land inequality at the end of the colonial period? 2) how does initial land inequality relate to current income inequality? The answers to these questions may improve our understanding of the path-dependent characteristics of inequality and also may indicate to which extent the Latin American experience was a unique experience. As this paper relies on relatively scarce historical data, the empirical analysis is carried out in a simple OLS framework. The regression results are taken as a support of, rather than a clear cut demonstration of the economic historical analysis.

In section 2 the literature on the causes and consequences of land inequality is discussed. In section 3 a linear regression model is specified on the basis of the hypothesis derived from section 2. Section 4 discusses the land inequality data and

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section 5 the explanatory variables. In section 6 the results are presented and interpreted. In section 7 the consequences of initial land inequality for the nature of distributive conflicts and long run economic development are evaluated. Section 8 concludes.

## **2 Literature on the causes and consequences of land inequality**

### *2.1 The causes of land inequality: geography, factor endowments and colonial institutions.*

The historical determinants of land inequality addressed in literature can be categorized into three, mutually related, categories; 1) geographic and environmental endowments 2) factor endowments, i.e. the land-labour ratio, and 3) colonial institutions. I will discuss these factors in this order.

1) The feasibility to produce particular crops impacts on the distribution of land as it creates opportunities to realise scale economies. Testing the hypothesis of Engerman and Sokoloff that “*land endowments of Latin America lent themselves to commodities featuring economies of scale and the use of slave labour*”, Easterly concludes that a natural environment suitable to cash-crop production is associated with high levels of income inequality in the long run (Easterly 2002; pp. 3-4, Engerman and Sokoloff 1997). Cash crops such as coffee, cocoa, sugar, rubber and bananas are most efficiently produced on large estates. A coexistence of large estates focusing on the production of exportable cash-crops and small subsistence holdings concentrating on the production of food crops for the domestic market skews the distribution of land. (Leamer et. al. 1999, Easterly and Levine 2003). Countries with natural endowments (soil, climate) suitable to growing scale intensive cash crops are, therefore, likely to end up with higher levels of land inequality, *ceteris paribus*. Since tropical climates generally allow for a larger variety of cash crop production than temperate climates, the geographic location of a country will, indirectly, affect the distribution of land as well. A specialization in scale-neutral food crops has a moderating effect on land inequality: food crops such as wheat and maize were historically produced on plots of modest size whereas in particular rice was and still is produced on very small plots of land (Hayami and Ruttan 1985).

2) Relative factor endowments shape the cost-structure and organizational constraints of agricultural production. Land abundance is likely to invoke land biased, labour saving production methods favouring crops that use a lot of land and relatively little labour. The land-labour ratio may also influence institutional developments. Domar (1970) argues that in pre-modern agricultural societies, elites face the problem of recruiting sufficient labour to toil their soil. In land abundant countries landless labourers have an opportunity to start farming at the land frontier. In response, the landowning elite tends to develop coercive labour market institutions, such as serfdom, slavery or permanent debt peonage (Domar 1970, Demsetz 2000). An alternative strategy is to distribute (virgin) territories among the

elite or restrict access to land of certain groups (indigenous farmers or landless labourers). In labour abundant countries on the other hand, elites dispose of more opportunities to extract rents from taxes and trade margins without having to intervene directly into the land market. All these arguments support the hypothesis that low levels of population density create incentives to regressively redistribute land.

3) The evolution of colonial institutions can be considered as a response to the local endowments and environmental conditions discussed above and the specific objectives of the European motherland. One of the specific Iberian objectives was the conversion of Indians to Catholic faith in the light of the reformation struggles in Europe. The Iberian colonists were highly successful, as the Catholic Church became omni-present in colonial Latin America and its penetration into the daily practices of colonial citizens went much further than protestant missionaries were ever capable of. Lal (1998) points out, following Goody (1983), that the Catholic church devised specific inheritance laws in order to enlarge its landed estates and traded salvation and sacraments in return for (generous) gifts of its members. The extent of the church's estates were striking indeed (Van Oss 2003, Bakewell 2004). Countries in which the Catholic church has become a major institute can be expected to have comparatively high levels of land inequality.

Acemoglu et.al. (2001) point out that in areas unfavourable to colonial settlement, i.e. with a high disease incidence or violent resistance of natives, colonial institutions will be created in order to maximize the extraction of agricultural or mineral resources from a safe distance. Acemoglu et.al. show that rates of colonial settler mortality are strongly negatively correlated with current levels of property rights protection. Settler colonies in which institutions are moulded according to the purpose of capital and skill accumulation *within* the colony can be considered as an opposite model of colonisation.

Can land distribution be regarded as the result of a particular "extractive" or "developmental" colonial institutions? Engerman and Sokoloff (1997) argue that land inequality reflects the outcome of different paths of colonisation in British North America versus Spanish America. Agriculture in British North America became organized around a homogenous group of individual European farmers producing food crops (mainly wheat) on small to medium-scale farms. Contrary to the slave plantations in the Southern states, the relatively egalitarian distribution of land in the Northern States was part of a strategy to attract European settlers to the land frontier. In the setting of a typical "immigrant colony", such as British North America, "cooperative" institutions prevailed. The Iberian colonists on the other hand, formed a white minority elite in an ethnic heterogeneous society. Their main objective was to guarantee a steady supply of indigenous and slave labour. The deliberate redistribution of land was part of their strategy to vest and maintain control. Land inequality expressed the social and political relations between whites and non-whites and was clearly the result of "coercive" colonial institutions, containing strong extractive, but also some developmental aspects.

In areas where the local environment prohibited settlement the redistribution of land was less of an issue. In large parts of Sub Saharan Africa, the rates of colonial

settlement were considerably lower than in America. Settlers were also more concentrated in the coastal regions. The British, French, Belgian and Portuguese created institutions to extract rents via taxation and trade in slaves and natural resources with high margins (Young 1994, Manning 1988). Yet, the traditional rural institutions were largely preserved. Extractive colonial institutions were not devised to penetrate into the daily practices of agricultural production and did not intervene in the traditional distribution of land.<sup>2</sup> Indeed, African slaves were shipped across the Atlantic in order to work on American plantations, rather than being put to work on African plantations (Stavrianos 1981, Eltis 2000, Ayittey 2005). It can therefore be expected that rates of settler mortality are negatively related to land inequality.

## *2.2 From initial land inequality to current income inequality*

From a theoretical point of view initial land inequality has a direct and an indirect effect on income inequality. The direct effect runs via the distribution of agricultural income and the extent of this effect is positively related to the share of agriculture in GDP. In pre-industrial societies the distribution of land holdings has a more profound effect on income distribution than in mature industrial economies, whereas in the latter the indirect effect is probably more important: land inequality induces an unequal distribution of non-land assets and, as a consequence, a persistency of income inequality over time.

The far majority of cross-country studies including a land inequality variable concentrate on the inequality-growth rather than the land inequality-income inequality relationship. Empirical studies agree that initial land inequality is bad for growth and this result is stronger, more robust and certainly less contested than the conclusion that income inequality is bad for growth (Barro 2000, Easterly 2002, Helpman 2004). Using land gini's around 1960 Birdsall and Londono (1997) show that the initial distribution of land is significantly negatively related to long run economic growth.<sup>3</sup> In papers by Deininger and Squire (1998), Li, Squire and Zou (1998) and Deininger and Olinto (1999) this result is confirmed. The theoretical underpinning is that the poor (i.e. the landless) need collateral assets, of which land is of prime importance, to get access to the capital market. In a context of imperfect capital markets, initial land inequality can pose barriers to individual entrepreneurship or investments in human capital (Galor and Zeira 1993). If public policy fails to remove capital market imperfections this not only hampers growth however, but also leads to persistent asset and income inequality. In Hernando de Soto's *the Mystery of Capital* (2000) this argument is developed with specific attention for the case of Latin America. The theoretical arguments applied to the inequality-growth relationship include clear predictions for a positive land inequality-income inequality relationship.

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<sup>2</sup> Based on new estimates of historical national accounts for Africa Smits (2005) shows that, in spite of the excessive tax burden the agricultural GDP kept growing. In the long run however, and particularly after the severe shocks in terms of trade in the 1970's, continuous taxation became a burden for further agricultural development (Smits 2005).

<sup>3</sup> The authors do not reveal the source of their land distribution data, but I guess they use the Taylor and Hudson data.

Initial inequality in the distribution of assets such as land is likely to be more persistent in a context of concentrated political power. If the political and landowning elite are largely overlapping the elite may devise policies that suppress democratic accountability and social development in order to maintain the distributional status quo (Olson 2000, Bourguignon and Verdier 2000, Acemoglu and Robinson 2006). In the work of Engerman and Sokoloff it is convincingly demonstrated that in comparison to the USA and Canada the investment in public education and the extension of the franchise developed much more slowly in Latin America (Engerman, Haber and Sokoloff 2001, Mariscal and Sokoloff 2000). Galor, Moav and Vollrath (2003) find empirical evidence for a negative effect of land inequality on public education expenditures in a cross-state US analysis. In their cross-country studies Gylfason and Zoega (2002a, 2002b) report a positive relation between land and income inequality and a negative relation of both variables with secondary school enrolment rates.

Theory clearly predicts a negative relation between initial land inequality and growth and a positive relationship between land and income inequality, *ceteris paribus*. It is therefore surprising that Deininger and Squire (1998) find a correlation of historical land gini's (1960's) and current income gini's (1990's) of just 0.39. (see also Deininger and Olinto 1999). Gylfason and Zoega (2002ab) report an  $r$  of 0.33. The correlation-coefficients I estimated in section 6 are even lower ranging from 0.19 to 0.23. If theory is correct, land inequality obviously is not a necessary and/nor sufficient condition of income inequality. When addressing this problem from the perspective of responsive colonial institutions, some more attention to the distinction between "developmental" and "extractive" colonial institutions should be paid.

In the ideal type immigrant colony developmental institutions prevailed. And in the colonies with unfavourable settler conditions, colonists adhered to a type of rent seeking behaviour that may have suppressed the rural economy as a whole due to the burden of taxes, but extractive institutions did not intervene in the existing distribution of land. The deliberate redistribution of land from natives to colonists was part of a colonial policy with extractive and developmental objectives. The expropriation of land and the exploitation of forced labour served extractive purposes, but investments in the local economy in order to raise the profitability of agricultural production served developmental purposes. This threefold categorization is important when construction typologies of the historical evolution of economic inequality in former colonies. Current levels of income inequality in Latin America and Sub Saharan Africa are among the highest in the world but the nature of inequality differs distinctively.

The relation between favourable settler conditions and "developmental" institutions is ambiguous. In so far, land inequality results from favourable settler conditions and induces an unequal distribution and suboptimal accumulation of non-land assets, favourable settler conditions produce mixed institutions. Landowning elites have interests in extraction and development. Purely "extractive" colonial institutions become more effective in a context of traditional rural institutions that are no match for the predatory objectives of a superimposed state bureaucracy. In those areas where European colonists did not built up substantial stakes in the agricultural sector (as in large parts of Sub Saharan Africa) the road was

paved for a comprehensive repression of rural areas in favour of the political elite in urban centres (Ayittey 2005, Smits 2005).

### 3 A Linear Regression Model

The hypotheses discussed in the previous section can be specified in a simple cross-country OLS framework. The first equation considers the explanation of cross-country variation in post-colonial land inequality:

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon \quad [3.1]$$

where  $y$  refers to post-colonial land inequality,  $\alpha$  is a constant and  $\varepsilon$  is an error term. The vectors  $x_1$ ,  $x_2$  and  $x_3$  respectively capture the influence of geographic and environmental characteristics, factor endowments and colonial institutions on land inequality. The second equation considers the explanation of cross-country variation in current national income inequality levels:

$$z = \alpha + \delta_1 y + \delta_2 (y * g) + \delta_3 (m * r) + \delta_4 x_4 + \varepsilon$$

where  $z$  refers to current income inequality,  $\alpha$  is a constant and  $\varepsilon$  is an error term. The vector  $x_4$  refers to a set of control variables related to political institutions,  $y$  refers to land inequality,  $g$  represents the level of economic development, capturing the direct effect of land inequality on income inequality. The  $m$  and  $r$  respectively refer to a measure of mineral resource abundance and a measure of property rights protection.

### 4 National land inequality data in a global comparative perspective

Land inequality data are scarce. Taylor and Hudson (1972: pp. 267-269) present a dataset consisting of gini-coefficients of land distribution of 54 different countries in some year close to 1960. More recently Deininger and Squire (1998) used a dataset of 261 gini-coefficients of 103 different countries, of which so far 60 observations around the year 1960 have been published in a paper by Deininger and Olinto (1999: pp. 24). In both cases the data were derived from the *FAO World Census of Agriculture*.<sup>4</sup> The dataset I constructed for this paper is based on census data from the International Institute of Agriculture (IIA) and the FAO. The estimates of land inequality are presented in table A.1 (appendix) including the figures of Taylor and Hudson and Deininger and Olinto (T&H and D&O hereafter). The Frankema dataset consists of 186 observations for 105 different countries, including a considerable amount of pre-war estimates. The figures are expressed in gini- and theil-coefficients (correlation  $r = 0.98$ ). Table 1 presents the correlation between the three datasets and shows that the

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<sup>4</sup> This census has been initiated in 1924 by the International Institute of Agriculture (IIA) in Rome, the predecessor of the FAO. The census has been carried out each decade since the 1930's, with the exception of the 1940's.

D&O and Frankema data are stronger related than any of these two with the T&H data.

**Table 1: Correlation of three datasets of land gini's around 1960**

	Taylor & Hudson	Deiningering & Olinto	Frankema
Taylor & Hudson	1		
Deiningering & Olinto	0,79	1	
Frankema	0,78	0,90	1

Sources: Taylor and Hudson (1972: pp. 267-269), Deiningering and Olinto (2001: pp. 24), appendix table A.1

The Frankema figures are compiled according to decile distributions of the total number of land holdings<sup>5</sup> (farms), and the total amount of agricultural land, excluding communal pastures and forests. An example calculus is presented in the appendix table A.2. The concepts and definitions applied in the agricultural surveys of the FAO are rather consistent over time and across countries. In order to further improve the spatial and temporal comparability of the land inequality figures I implemented some extra criteria: circa 60 surveys with an incomplete coverage of agricultural land or an incomplete coverage of land holdings were excluded.<sup>6</sup> Around one-third of these were excluded because surveys did not make a distinction between communal land holdings and single private land holdings. Indeed, the estimated land gini's of socialist Eastern European countries in the 1970's and 1980's display extreme land inequality since private small-holders and communal holdings are both counted as individual farm holdings. In fact, these gini's do not properly reflect the inequality of "access" to land.<sup>7</sup>

The selected sample includes 111 country observations<sup>8</sup> for a year close to independence: for the majority of Asian and African countries this is an observation close to 1960; for non-colonised countries and most New World countries it is the earliest observation available. As temporal changes in land inequality remain

<sup>5</sup> "Land holding" refers to the disposable amount of land per farm, which is not the same as the land *owned* by the farmer. Land property is generally more unequally distributed than land holdings, depending on the share of land under tenure. The distribution of land holdings therefore serves as a lower benchmark of the ownership distribution. The distribution of land holdings itself is a clear analytical concept however, since it captures the "access" to land as a production factor. A limitation of both concepts is that differences in land quality are not taken into account and there is little that can be done to correct this.

<sup>6</sup> a) Some surveys only include cropland and exclude pastureland. Usually this sample bias applies to countries with a minimal share of pastureland or, countries in which pastures are part of communal estates and therefore not subject to a personal distribution measure. FAO statistics also provide statistics on crop and livestock production, which enables an evaluation of the validity of the surveys that are exclusively based on cropland. In Chad and Botswana the exclusion of pastures in the sample lead to a misrepresentation of livestock production and these countries are therefore excluded from the data set. Also Madagascar and Malawi are excluded because of incomplete coverage. b) In some cases farms are differentiated into traditional indigenous household holdings and European holdings, reflecting the traditional colonial categorisation of land holdings. Surveys taking only one category into account will underestimate actual land inequality. For this reason Zimbabwe and Tanzania a.o. are excluded. For Zambia (1960) and Congo (1990) one observation is rejected, yet an alternative observation is accepted.

<sup>7</sup> In the Deiningering and Olinto paper former socialist Eastern European countries are excluded, but in the study by Deiningering and Squire (1998) the East European land gini's are used in an inequality-growth analysis which undoubtedly impacts on the results.

<sup>8</sup> From Deiningering and Olinto (2001) I included figures for Bolivia, Madagascar, Mexico and Tanzania and from Taylor and Hudson (1972) I included figures for Luxembourg and Libya.



confined in most countries<sup>9</sup> and the pre-war figures precede most of the considerable structural changes in land distribution during the 20<sup>th</sup> century I regard this sample as the most reliable proxy of historical land inequality, given the data available. Historical evidence for Latin American countries suggests that land inequality did not fundamentally change during the 19<sup>th</sup> and 20<sup>th</sup> centuries, which is illustrated by the time-series data for Argentina, Brazil and Chile in table A.1. For the USA, Canada, Australia and New Zealand there are early observations available (respectively 1880, 1931, 1910 and 1910).<sup>10</sup>

Table 2 presents the descriptive statistics of the sample subdivided by 13 world regions. The descriptive statistics reveal some interesting stylized facts. First of all, the extraordinary high levels of land inequality observed in Latin American countries appear to be a coherent regional feature. The top twenty of the world's land inequality distribution contains no less than 16 Latin American countries! The intra-regional variation is, with the exception of the Caribbean islands, smaller than anywhere else in the world. The assertion that there is a "Latin" type of inequality (World Bank 2004) is indeed supported by a global comparison of land inequality. In Europe the countries with the most unequal distribution of land are Spain, Portugal and Italy. It is quite remarkable that land inequality in the former Iberian colonial motherlands is as high as in an average Latin American country.

The four East Asian countries are among the world's most egalitarian. Ranking the 111 country observations from low to high, South Korea ranks 2<sup>nd</sup>, Taiwan 9<sup>th</sup>, Japan 12<sup>th</sup> and China 20<sup>th</sup>. Except China, these East Asian countries are well known for having realised "growth with equity" and it is often argued that, by dismantling the power of landowning elites, land reforms have paved the way for a relatively equitable distribution of assets and income. The steep drop in the Taiwanese land gini (from 53.9 in 1920 to 39.0 in 1960, see Appendix table A.1) illustrates the impact of land reforms carried out under Japanese colonial rule (Fei, Ranis and Kuo 1979, Frankema and Smits 2005).

**Table 2: Descriptive Statistics of land gini's subdivided by 13 world regions.**

	Min	max	median	mean	st.dev	Cv	obs
South America	63.9	86.3	80.4	79.9	6.3	0.08	11
Central America	60.7	78.3	73.9	72.3	6.0	0.08	7
Caribbean	46.2	81.6	69.9	68.1	11.8	0.17	7
East Asia	30.7	43.8	39.5	38.4	5.5	0.14	4
South Asia	41.8	62.3	55.4	53.7	8.7	0.16	6
South East Asia	29.1	68.0	47.3	47.9	11.7	0.24	8
North Africa and Middle East	56.3	82.0	63.8	65.1	7.3	0.11	12

<sup>9</sup> Li, Squire and Zou (1998) concluded from an analysis of variance that over 90% of the variation in land inequality is due to cross-country variation and less than 10% due to within-country temporal variation.

<sup>10</sup> For the USA (independency 1776) and Canada (1867) I compared the figures with the inequality-index constructed by Adelman and Taft Morris (1988) for the year 1850. Land gini's of 47,0 (USA) and 48,7 (Canada) fit rather well into their conclusions on the wealth distribution of both countries. Perhaps the estimates are a little too high, almost certainly not too low. The 1880 USA estimate is derived from Galor, Moav and Vollrath (2003). The authors kindly provided me with their data.

South and East Sub Saharan Africa	36.8	83.5	66.7	62.7	17.4	0.28	12
West and Central Sub Saharan Africa	31.2	68.1	45.2	45.2	9.1	0.20	14
Western Offshoots	47.0	78.6	61.1	61.9	16.4	0.26	4
Western Europe	47.0	79.1	63.4	63.9	10.1	0.16	14
Eastern Europe	39.2	60.0	52.4	51.0	9.5	0.19	4
Scandinavia	42.1	63.3	47.2	49.3	7.5	0.15	8
<b>World</b>	<b>29.1</b>	<b>86.3</b>	<b>60.0</b>	<b>59.7</b>	<b>15.0</b>	<b>0.25</b>	<b>111</b>

**Notes:** **East Asia:** China, Japan, Korea. Rep, Taiwan; **South Asia:** Bangladesh, India, Iran, Nepal, Pakistan, Sri Lanka; **South East Asia:** Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam. **North Africa & Middle East:** Algeria, Cyprus, Egypt, Israel, Iraq, Jordan, Kuwait, Libya, Morocco, Syria, Tunisia, Turkey; **East & South Sub Saharan Africa:** Botswana, Ethiopia, Madagascar, Mauritius, Mozambique, Kenya, Lesotho, Reunion, South Africa, Swaziland, Tanzania, Zambia; **West & Central Sub Saharan Africa:** Burkina Faso, Cameroon, Central African Rep., Cote d'Ivoire, Ghana, Guinea, Liberia, Mali, Niger, Senegal, Sierra Leone, Togo, Uganda; **Western Offshoots:** Australia, Canada, New Zealand, USA; **Western Europe:** Austria, Belgium, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Switzerland, UK; **Eastern Europe:** Czechoslovakia, Estonia, Latvia, Lithuania, Poland, Romania, Slovenia, Yugoslavia.

Perhaps the most remarkable stylized fact is the clear intra-regional difference in Africa. North Africa and the Middle East boast relatively high levels of land inequality. The distribution of land in Kenya, Tanzania, Zambia and South Africa is highly unequal, while in Mali, Burkina Faso, Cote d'Ivoire, Niger and Senegal land gini's are considerably lower than the world's average of 59.7. In many, mostly West and Central African countries land inequality appears to be confined, and taken as a region it is among the most egalitarian in the world.

## 5 The explanatory variables

This section addresses the variables and data included in the land inequality regression and, subsequently, the income inequality regression. In table A.3 and A.4 (appendix) the descriptive statistics and pairwise correlations of the two sets of variables are presented.

### 5.1 The determinants of land inequality: Geographic and environmental characteristics

In literature several proxies for the feasibility of tropical cash crop production are used. One of those is the mean annual temperature (MEANTEMP) (McArthur and Sachs 2001). Easterly (2002) applies a variable capturing "land use" (percentage share of land yielding a specific crop) and "land suitability" (percentage share of land suitable to growing a specific crop). Since the use of land may be endogenous to the distribution of land, the exogenous land suitability indicator is preferable. The FAO provides data on land suitability for a.o. bananas, rice and sugarcane (BANANAS, RICE, SUGAR). For COFFEE, COCOA and RUBBER there is only land use data. The land use data are translated into a dummy of land suitability under the following condition: if a country devotes over 1% of their total agricultural land to one of these crops during the post-war years and also has a historical record as a net exporter of one of these crops (Mitchell 2003), the dummy is set at 1. A CASHCROP DUMMY distinguishes a more selective group of countries with a clear natural advantage in

cash crop production. The dummy is set at 1 if countries dispose of, at least, 10% of land suitable to the production of one or more of the mentioned cash-crops, excluding rice (which is expected to yield the opposite effect).

#### *Factor endowments*

Population density is included by taking the log of population per square kilometre of productive land (LNPOPDENSE). For most New World countries the year 1700 or 1800 is inserted, whereas for African countries and most Asian countries the year 1900 is chosen. Square kilometres of agricultural area are from Taylor and Hudson (1972: pp. 303-305) and population estimates for 1700, 1800 and 1900 are from McEvedy and Jones (1978).

#### *Colonial institutions*

The hypothesis that European colonial rule has interfered in the distribution of land is accounted for by a dummy variable (EURCOL DUMMY) with a value 1 for each former European colony. The special conditions in the Iberian colonies, i.e. the institutions of the *encomienda* and *latifundia*, and the ethnic or racial oriented social order dominated by a Creole elite, are accounted for by another dummy variable (IBERCOL DUMMY). The log of historical settler mortality rates is included as a proxy for settler conditions of colonial settlement (LNSETMORT). The data are taken from Acemoglu et.al. (2001). For countries that have not been subject to European colonial settlement the mortality rate is set at zero. The impact of the Catholic church on the distribution of land is covered by inserting the log of the percentage share of Catholics (LNCATHOLICISM) in a year close to 1965 (Taylor and Hudson 1972).

### *5.2 The determinants of income inequality*

#### *The direct and indirect effect of land inequality*

Income inequality figures are derived from the World Income Inequality Database (UNU/WIDER WIID version 1.0). The sample consists of high-quality gini-coefficients with a national coverage for the latest year available in the period 1987-1998 for 95 countries.<sup>11</sup> The land inequality variable (LANDGINI) is represented by the land gini's discussed above (section 4). The log of GDP per capita in 1990 (LNGDPPC) (Maddison 2003) is included as an interaction term to separate the direct effect from the indirect effect of land inequality on income inequality.

#### *Control variables*

Isham et.al. (2003) provide point-source estimates of mineral resource abundance as the percentage share of one or two minerals dominating national exports. Mineral resources include crude petrol, gas, coal, ferrous and non-ferrous metals, ivory,

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<sup>11</sup> These are the criteria: income gini's are preferred over expenditure gini's, net income over gross income estimates and household income over personal income. For ca. half of the countries only expenditure gini's are available for the 1990's, which are increased with 5 percentage points to correct for potential underestimation of actual income inequality. I did not correct for gross to net income or personal to household income. In case there was more than one observation to choose from the average is calculated and included. Additionally included countries are: Argentina and Uruguay with an urban income gini, Barbados with an income gini for 1979, Switzerland, Trinidad and Tobago and Cyprus with a low-quality income gini, and finally Mozambique with an income gini derived from the CIA (2005) World Fact Book, ([www.cia.gov/cia/publications/factbook/](http://www.cia.gov/cia/publications/factbook/)).

diamonds, pearls and wood.<sup>12</sup> The variable is specified in log and denoted as LNMINERALS. To account for the combined effect of mineral resource abundance and extractive institutions, the risk of expropriation (RISKEXPROP) is included as an interaction term, following Acemoglu et.al. (2001). The data are derived from the PRS Group International Countries Risk Guide (ICRG) for the year 1990. The impact of the political system on the distribution of income is further covered by a measure of democratic accountability (DEMOCRACY), from the ICRG for the year 1990; and a dummy variable capturing the equalizing impact of (former) socialist rule in East European countries, China and Cuba etc. (SOCIALIST DUMMY).

## 6 Results and interpretation

It should be pointed out in advance that a regression analysis based on the scattered data sources and rough proxy variables that are applied in this paper serves to illustrate rather than to demonstrate the validity of the formulated hypotheses. The regression results moreover only reveal contemporaneity, the causal relations are based on historical accounts, not on the estimates presented in this section.

Table 3 reports ordinary least square regressions of land inequality. The signs of most variables are consistent and confirm expectation. Regression 1 to 9 show that the cash crop dummy is consistently positive, rice negative, population density negative, both colonial dummies are positive, settler mortality is, indeed, negative and Catholicism is positive. Yet, the mean annual temperature variable has the opposite sign and is insignificant (1). Excluding the cash crop dummy and mean annual temperature, the individual crop variables neither yield a significant result, while bananas and cocoa even present the opposite sign (2).

The hypothesis that countries with substantial sources of land suitable to the production of cash crops have a more unequal distribution of land cannot be rejected at the 90% confidence level, yet the suggestion that tropical climates are better fit to the production of agricultural commodities subject to economies of scale polarizing land distribution can. Suitability to rice production yields lower levels of land inequality, but that result is not robust to changes in the composition of the equation or the dependent variable (from gini to theil in 9).

**Table 3: OLS Regressions; dependent variable is post-colonial land inequality**

	Gini 1	Gini 2	Gini 3	Gini 4	Gini 5	Gini 6	Gini 7	Gini 8	Theil 9
Meantemp	-0,003 (-0,00)								
Bananas		-0,013 (0,57)							
Cocoa dummy		-0,007 (0,04)							
Coffee dummy		0,041 (0,04)							

<sup>12</sup> Three observations for Guinea, Guyana and Libya were included on the basis of UN Trade Statistics.

Rubber dummy		0,021							
		(0,05)							
Sugar		0,007							
		(0,35)							
Cashcrop dummy	0,120	0,078		0,071	0,102	0,093	0,090	0,081	
	(0,04)***	(-0,04)**		(0,03)**	(0,03)***	(0,03)***	(0,04)**	(0,04)*	
Rice	-0,130	-0,192		-0,199	-0,220	-0,391	-0,178	-0,211	
	(0,11)	(0,10)*		(0,10)**	(0,10)**	(0,09)***	(0,10)*	(0,13)	
lnPopdense	-0,011	-0,012	-0,011		-0,016	-0,012	-0,016	-0,012	
	(0,01)	(0,01)*	(0,01)		(0,01)**	(0,01)*	(0,01)**	(0,01)	
Eurcol dummy	0,133	0,106	0,128	0,115	0,127	0,025	0,116	0,147	
	(0,07)**	(0,06)***	(0,06)**	(0,06)*	(0,06)***	(0,03)	(0,06)*	(0,07)*	
Ibercol dummy	0,104	0,096	0,122	0,115		0,068	0,148	0,189	
	(0,05)**	(0,04)**	(0,04)***	(0,04)***		(0,04)*	(0,04)*	(0,05)***	
lnSetmort	-0,032	-0,028	-0,032	-0,025	-0,028		-0,034	-0,037	
	(0,01)**	(0,01)**	(0,01)***	(0,01)**	(0,01)**		(0,01)***	(0,02)**	
lnCatholicism	0,026	0,024	0,026	0,025	0,034	0,024		0,027	
	(0,01)***	(0,01)***	(0,01)***	(0,01)***	(0,01)***	(0,01)***		(0,01)**	
C	0,642	0,636	0,652	0,636	0,512	0,675	0,649	0,749	0,366
	(0,05)***	(0,09)***	(0,08)***	(0,08)***	(0,03)***	(0,08)***	(0,09)***	(0,08)***	(0,10)***
<hr/>									
<i>R-squared</i>	0,10	0,54	0,56	0,52	0,53	0,52	0,48	0,51	0,61
no. Obs	91	78	79	79	86	79	92	79	73

Notes: All regressions are OLS. Standard errors between parentheses. Dependent variable of regressions 1 to 8 is a Gini-coefficient of land distribution; in regression 9 a Theil-coefficient. Significance-levels are reported as \*\*\* < 1%, \*\*< 5% and \* < 10%. For details on the dependent and explanatory variables see section 3 and 4.

The effect of relative factor endowments, i.e. the ratio of people to agricultural land, appears to be negative. Land abundant countries are on average characterised by higher levels of land inequality than densely populated countries. The results are not robust however, the null-hypothesis cannot be rejected at the 90% confidence level in regressions 2, 4 and 9.

The colonial institutional variables reveal more convincing results. Former European colonies display significantly higher levels of land inequality and this effect is even stronger for former Iberian colonies. The significance of the Iberian colony dummy supports the view that typical “Latin” colonial institutions such as the *encomienda* and the *latifundia*, and the ethnic/racial stratification of colonial society were strongly related to a bi-polar distribution of land. It is noteworthy however that the European colony dummy is only significant when controlled for settler mortality rates (7). The log of settler mortality rates as a proxy for settler conditions is consistently negative and significant at the 95% if not at the 99% confidence level (4 and 8). Only in settler colonies the colonial administration intervened in land markets. The hypothesis that the presence of the Catholic church has contributed to land inequality cannot be rejected. In all regressions (except 8 and 9) the spread of Catholicism is positively related to land inequality at a 99% significance level. It should be noted that this effect appears to be very strong, even when the ultimate control variable, the Iberian colony dummy, is included.

In sum, a typical “land unequal” country at the start of its independence is a land abundant Catholic country, whose geographic conditions support the production of cash crops more than the production of rice, which has comparatively favourable settler conditions and a minority elite of Iberian settlers in control of a subjugated labour force. Such a description indeed comes remarkably close to an “average” Latin American country. This impression arises from a global sample (covering all regions) including a dummy for Iberian colonies. Whether either geography, or endowments, or colonial institutions “rule” is not so relevant, since colonial institutions were formed in response to settler conditions (in a broad sense), profit opportunities and the objectives of European mother countries. What can be concluded at this intermediate stage of the analysis is that the large variety of land inequality in former colonies suggests that alternative colonial strategies have had substantially different implications for the sources of (persistent) economic inequality.

Let’s now turn to the consequences of land inequality for income inequality. The correlation-coefficients of early post-colonial land inequality figures and current income inequality figures (1990’s) are presented in table 4. The results range from 0,19 (land gini) to 0,23 (land theil). Excluding the Sub Saharan African countries from the sample, the second column in table 4 shows that the coefficient rises with approximately 0.3 points to 0,49-0,52. This is indeed a remarkable observation. As the far majority of Sub Saharan African countries represent low income agricultural societies one would expect the direct effect of land inequality on income inequality to be comparatively large, yet the high levels of income inequality observed in Sub Saharan Africa do not correspond to relatively low levels of land inequality in large parts of the region.

Apparently, the link between unfavourable settler conditions, extractive institutions and high income inequality does not run via high land inequality. On the contrary. One of the key arguments of this paper is that the absence of a colonial heritage of powerful landowning elites may imply that extractive institutions can be formed in order to squeeze rural surpluses by land or income taxes or price manipulation, disadvantaging the rural population in favour of the politically more influential urban population (Krueger, Schiff and Valdez 1991, Cheru 2002). This is a crucial distinction with the evolution of inequality in Latin American societies, where land inequality is an important source of economic inequality and large estate holders have vested interests in the agricultural sector.

**Table 4: Correlation of land and income inequality (pairwise)**

	INCOME GINI 1990’s	INCOME GINI 1990’s excl. West & Central African countries
LANDGINI	0,19	0,49
LANDTHEIL	0,23	0,52
no. observations	95	76

**Table 5: OLS Regressions; dependent variable is income inequality 1990's**

	1	2	3	4
Landgini	1,042 (0,13)***		0,657 (0,15)***	
Landgini*lnGDPpc	-0,234 (0,03)***		-0,136 (0,04)***	
Landtheil		1,631 (0,24)***		0,834 (0,27)***
Landtheil*lnGDPpc		-0,404 (0,06)***		-0,198 (0,07)***
lnMinerals*Riskexprop			0,158 (0,07)**	0,171 (0,08)**
Democracy			-1,938 (0,75)**	-2,399 (0,71)***
Socialist dummy			-11,873 (4,70)**	-12,825 (4,74)***
C	31,127 (3,20)***	37,573 (1,68)***	39,522 (3,95)***	47,156 (3,03)***
<i>R-squared</i>	0,44	0,37	0,60	0,59
no. observations	93	87	78	72

Notes: All regressions are OLS. Standard errors between parentheses. Dependent variable of regressions 1 to 4 is a Gini-coefficient of income distribution. Significance-levels are reported by \*\*\* < 1%, \*\* < 5% and \* < 10%. For details on the dependent and explanatory variables see section 3 and 4.

The OLS regressions of income inequality are presented in table 5. All the signs are as expected, and moreover, all included variables prove to be significant at the 95% confidence level. The land inequality variable in gini's and theil's are consistently significant at a 99% confidence level. Indeed, the relation between initial land inequality and subsequent income inequality appears to be very strong when controlling for political institutions and mineral resource endowments. The regression results also fully support the distinction between a direct effect and indirect effect of land inequality on income inequality. The direct effect of land inequality, captured by including the interaction term (log of GDP per capita), is smaller in more developed economies. Including the interaction term increases the significance and explanatory power of land inequality considerably. The nature of the political system (democratic, socialist) and the quality of institutions (risk of expropriation) are important explanatory variables in their own right. The R-squared increases from 0.37-0.44 in regression 1 and 2 to 0.59-0.60 in regression 3 and 4 when these variables are included.

The relevance of the political institutions for the distribution of income is, of course, not a new nor a very surprising outcome. As Acemoglu and Robinson (2006) argue, political institutions are strongly related to distributive conflicts (Acemoglu and Robinson 2006). The lesson that can be drawn from this analysis is rather that, countries with comparable "levels" of inequality, may largely differ in the "sources" of inequality and the "nature" of their respective distributive conflicts. The regression results support the view that land inequality has a long lasting positive

impact on income inequality, but that we should take it as a specific source of inequality, and not use it as a comprehensive proxy for historical levels of inequality. Land inequality, as a source of income inequality, plays an important role in the long run path of distribution and development. The question that now remains is in which respects land inequality and landowning elites make a difference?

## **7 The consequences of land inequality: distributive conflicts and development**

In their recent *The Economic Origins of Democracy and Dictatorship* (2006) Acemoglu and Robinson argue that distributive conflicts between “elites” and “citizens” play a key role in the development of political institutions. In their formal analyses the authors depart from a historical situation in which the elite (initially) disposes of greater political and economic power than the majority of common people (citizens). Consequently they study the various paths societies can follow in the transfer of power from the elite to the citizens, that is, the various paths of democratisation. One of the variables in this process is the source of income of the elite. In the light of this simple dual framework, one can ask what the specific consequences for the nature of distributive conflicts are if the elites are primarily “landowning elites”, facing a majority of citizens that are poor landless labourers or small subsistence holders. So the attempt is to make up a balance of the consequences of land inequality for long run development using some additional considerations raised by this paper’s discussion of “developmental” and “extractive” colonial institutions. The consequences are divided in a category hampering development and a category supporting development.

### *Hampering development*

1) The issue of the persistent effects of land inequality on non-land assets has already been raised in section 2.2. In a context of capital market imperfections initial land inequality leads to underinvestment and an unequal distribution in non-land assets, particularly human capital. Public investments in education may correct this negative development effect. However, public education expenditures require public revenues implying a redistribution of income from the landowning elite to landless citizens. And besides, in land abundant countries, landowning elites have a special interest in a steady supply of cheap unskilled labour. Both factors indicate that the landowning elites have incentives to oppose public educational expansion (Galor and Zeira 1993, Mariscal and Sokoloff 2000, Galor et.al. 2003)

2) In a pre-industrial economy land inequality may hamper industrialization via the demand side. If the gains of agricultural productivity increases or export expansion (for instance during the golden age in Latin America between 1870-1914) are adversely distributed to the landowners at the expense of the landless labourers, the purchasing power of the landless poor remains limited and reduces the growth of middle class demands for basic industrial products. In a pre-industrial society land inequality may therefore lead to suboptimal consumer demand spillovers (Kay 2001, Murphy et.al. 1989).



3) Land is a specific source of income for the elites. In comparison to elites whose sources of income are based on physical and human capital, landowners may have extra reasons to *oppose* institutional changes leading to a transfer of power to the majority (i.e. democratisation). Acemoglu and Robinson mention three differences (2006: pp. 32): Land is easier to tax than other assets; social and political instability may be more damaging to owners of physical and human capital (relying on cooperation in the workplace and the trading process); and landowners may have different preferences of economic institutions (related to coercive labour market institutions) than the majority (see also Engerman and Sokoloff 2005).

#### *Supporting development*

1) The landowning elite has a specific interest in the development of the agricultural (exports) sector. The elites can insist on growth enhancing public investments in physical and commercial infrastructure. If the landowning aristocracy is in the exclusive position to decide, circumventing problems of collective action of majority rule, it may raise the effectiveness of public investments and potential spill over effects (Johnson 1991).

2) In comparison to elites whose sources of income are exclusively based on their position in a predatory state bureaucracy, landowners may have extra reasons to *support* a process of democratisation. If the elites' income exclusively depends on rent seeking behaviour backed by the monopoly on coercive power (violence) its economic and political position are inextricably intertwined. In such a context political concessions to the majority come at extremely high costs, which is likely to result in an "all or nothing" game (i.e. armed conflicts). The political and economic position of a landowning elite can, in principle, be separated if a credible and sustainable protection of their property rights is negotiated. This creates an opening for the development of participative political institutions and urban entrepreneurship. The adverse long run effect of extractive colonial institutions is, indeed, that it has destroyed the basis for such cooperation among contesting social (or ethnic) groups.

3) The presence of a powerful landowning elite will, in the course of a democratisation process, prevent an outright squeeze of rural citizens through taxes and food price manipulation in favour of the politically more influential urban citizens. If elites have a stake in the rural, where they hold lands and organize their labour force, as well as the urban economy, on which they depend for commercial and transport services and supplies of industrial products, there is a geographic balance of interests. Without a counteracting force, the roots of long run economic development that grow in the fertile soil of a certain base level of agricultural prosperity, may fall prey to a rent seeking urban elite operating under short-run horizons.

## 8 Conclusion

In this paper a new dataset of land inequality is introduced in order to explore the causes and consequences of land distribution in a global comparative perspective. The two central questions addressed are 1) what explains the cross-country variation in land inequality at the end of the colonial period? 2) how does initial land inequality relate to current income inequality? The main argument of this paper is that post-colonial levels of land inequality are largely determined by the response of colonists to local endowments (land, people, climate and soil) and settler conditions (disease environment, local resistance). An account of the colonial origins of inequality provides some crucial insights in the long run consequences of land distribution for economic inequality in general and the nature of distributive conflicts in particular.

On the determinants of land inequality the following can be concluded. The suitability of colonial land to the production of scale intensive tropical cash crops enhanced the deliberate redistribution of land only in so far these geographic conditions were complemented by favourable settler conditions (disease environment and resistance of natives) and a guaranteed supply of indigenous or imported (slave) labour. In response to these local conditions and the specific objectives of the European colonial powers a varied pattern of colonial institutions evolved. This institutional variety can be evaluated on the basis of its relative extractive or developmental content. With respect to the regressive redistribution of land from natives to settlers a threefold categorization appears to be most practical.

1) Extractive institutions prevailed in areas with unfavourable settler conditions (large parts of Sub Saharan Africa, in particular Central and West Africa). In these areas colonists did not intervene directly into the production process, but concentrated their rent seeking efforts on collecting taxes, engage in the trade and exploitation of natural resource. Consequently, little direct intervention in land markets and traditional rural institutions took place.

2) In regions with favourable settler conditions colonists became directly involved in the production process and the factor markets. In settler colonies without suitable conditions to produce cash-crops using indigenous labour or slave labour, the cultivation of land for food crops mainly depended on European immigration (British North America). In these areas the creation of developmental institutions reflected an interest of settlers to attract immigrants to the land frontier, to accumulate capital and skills and to evenly distribute resources such as land in line with a rather homogenous social order.

3) In settler colonies where the cultivation of cash crops was feasible European colonists directed their efforts at guaranteeing a stable supply of indigenous or African slave labour to work the land (and silver mines) (large parts of Latin America and the Caribbean). In these areas coercive institutions such as slavery and serfdom were evolved to control the labour force and reflect the heterogeneous social order. The unequal distribution of land formed a fundamental part of such a colonial strategy.

On top of these determinants there are clear indications that specific Iberian colonial institutions contributed to high land inequality in Latin America. More than

in any other region the Catholic church acquired the status of supreme religious authority. The accumulation of land was part of a deliberate policy of the church to express and consolidate this unique position. And second, in Spain and Portugal landownership was the exclusive and ultimate key to social mobility and the acquisition of (noble) titles, more than in other European motherlands. Indeed, in the land inequality figures of both mother countries the traits of medieval feudalism are still visible.

What about the consequences of land inequality for long run distribution and development? Controlling for the level of economic development it turns out that the impact of land inequality has to be separated in a direct effect (the share of rural inequality in total inequality) and an indirect effect related to path dependent effects of initial land inequality on the distribution of non-land assets. Given the great weight of the rural sector in low developed, one would expect that the relation between land and income inequality would be strongest in Sub Saharan African countries. The empirical analysis presented in this paper points out the opposite however.

This surprising conclusion reveals an important difference between the colonial heritage of West and Central Africa versus Latin America. Both regions are characterised by persistent high levels of income inequality and contain large territories of land suitable to the production of cash crops. In Latin America a powerful landowning elite developed under three centuries of colonial rule. During the first wave of globalisation in the last quarter of the 19<sup>th</sup> century this elite was able to consolidate and probably even enhance its position, as the agricultural export sector expanded. West and Central African income inequality in the second half of the 20<sup>th</sup> century rather appear to be based on a systematic squeeze of the predominantly rural population in favour of a predatory urban elite. The roots of this inequality must be searched in the weak protection of property rights in newly created (colonial) nation states. Both regions share a burden of distributive conflicts that are characteristic of countries with “disproportional” levels of economic inequality. Those in power want to hold on to what they have and feel threatened by demands for democratic accountability. However, the incentives that shape the attitude and actions of the elites in both regions differ fundamentally.

A landowning elite not only derives income from the extraction of rents, but also from the accumulation of capital and investments complementary to agricultural production. If landowners see opportunities to defend their stakes in economic development and are able to negotiate credible and sustainable protection of property rights, they may be willing to lift their bans on institutional change, their bans on a transfer of power to other social groups. They may also allow for the development of an urban class of entrepreneurs competing for (scarce) sources of cheap labour. If the stakes of the elite are primarily vested in the consolidation of a predatory bureaucracy, the economic and political position of the elite are maximal overlapping. In this context a transfer of power or the development of new sectors pose such a severe threat to the distributive status quo, that the elites are willing to bear the very high costs of violent repression and armed conflicts.

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## Appendix

**Table A.1: The distribution of land holdings by country, 20<sup>th</sup> century**

	year	Frankema gini	Frankema theil	Taylor & Hudson gini	Deiningering & Olinto gini
1	Algeria	1930	59,6		
2	Algeria	1973	63,5		
3	Argentina	1914	80,3		
4	Argentina	1947	80,6		
5	Argentina	1960	81,4	86,7	85,6
6	Argentina	1988	81,4		
7	Australia	1910	73,4		
8	Australia	1924	67,6		
9	Australia	1960	82,0	88,2	85,3
10	Australia	1971	80,5		
11	Austria	1930	68,4		
12	Austria	1960	67,1	70,7	68,8
13	Austria	1990	61,2		
14	Bangladesh	1960			41,8
15	Bangladesh	1977	41,7	0,138	
16	Barbados	1961	81,6	0,795	
17	Barbados	1989	84,8	0,804	
18	Belgium	1930	75,9		
19	Belgium	1959	60,0	60,4	
20	Belgium	1970	57,8		
21	Bolivia	1960			76,8
22	Brazil	1920	78,0	0,592	
23	Brazil	1960	78,7	84,5	84,1
24	Brazil	1985	80,2	0,632	
25	Burkina Faso	1993	39,1	0,112	
26	Cameroon	1972	40,7	0,120	
27	Canada	1931	48,7	0,183	
28	Canada	1961	52,6	0,212	55,1
29	Central African Rep.	1974	33,8	0,082	
30	Chile	1927	83,7	0,746	
31	Chile	1965	86,5	0,823	
32	Chile	1997	84,1	0,752	
33	China	1997	43,8	0,179	
34	Colombia	1960	80,5	86,4	82,9
35	Colombia	1988	74,3	0,493	
36	Congo, dem. rep (Zaire)	1970	53,2	0,261	
37	Cote d'Ivoire	1974	41,5	0,128	42,3
38	Costa Rica	1963	73,9	78,2	80,6
39	Cyprus	1960			62,0
40	Cyprus	1985	59,8	0,289	
41	Czechoslovakia	1921	63,3	0,329	
42	Denmark	1919	52,2	0,204	
43	Denmark	1933	47,5	0,176	
44	Denmark	1959	44,2	45,8	43,0



45	Denmark	1989	42,8	0,138		
46	Dominican Republic	1960	74,5	0,542	80,3	
47	Ecuador	1954	80,4	0,671	86,4	84,0
48	Ecuador	1974	77,2	0,552		
49	Egypt	1915	73,0	0,538		
50	Egypt	1930	70,3	0,485		
51	Egypt	1961	63,3	0,343	67,4	54,9
52	El Salvador	1961	78,3	0,624	82,7	82,1
53	Estonia	1925	42,1	0,126		
54	Ethiopia	1977	42,4	0,135		
55	Finland	1929	39,2	0,091		
56	Finland	1959	33,8	0,084	35,1	49,4
57	France	1930	62,9	0,317		
58	France	1963	50,2	0,187		54,4
59	France	1988	54,6	0,226		
60	Gabon	1974	40,2	0,133		
61	Germany	1907	70,4	0,433		
62	Germany	1925	70,5	0,431		
63	Germany, fed. rep	1960	52,4	0,211	66,8	55,4
64	Germany, fed. rep	1971	49,4	0,178		
65	Ghana	1970	53,0	0,226		
66	Greece	1971	47,0	0,166		45,4
67	Greece	1993	53,9	0,226		
68	Guadeloupe	1969	60,0	0,323		
69	Guatemala	1950			86,0	
70	Guatemala	1964	77,0	0,601		85,3
71	Guinea	1989	45,2	0,151		
72	Guyana	1989	63,9	0,399		
73	Haiti	1971	46,2	0,170		
74	Honduras	1952	70,6	0,461	75,7	76,5
75	Honduras	1993	65,3	0,420		
76	India	1960	56,6	0,294	52,2	61,4
77	India	1986	57,9	0,252		
78	Indonesia	1963	52,7	0,265		55,5
79	Indonesia	1973	47,1	0,202		
80	Indonesia	1993	45,4	0,180		
81	Iran	1960			62,5	62,3
82	Iran	1988	67,7	0,375		
83	Iraq	1958	82,0	0,673	88,2	72,6
84	Ireland	1930	55,3	0,234		
85	Ireland	1960	57,5	0,254	59,4	
86	Israel	1970	69,8	0,468		80,0
87	Italy	1930	71,5	0,471		
88	Italy	1960	62,0	0,345	73,2	74,3
89	Italy	1990	73,3	0,500		
90	Jamaica	1961	75,7	0,580	77,0	80,3
91	Japan	1909	40,0	0,126		
92	Japan	1930	39,0	0,118		
93	Japan	1960	39,8	0,108	47,0	43,2
94	Japan	1980	50,3	0,139		
95	Japan	1995	51,1	0,205		
96	Jordan	1983	64,3	0,348		67,7
97	Kenya	1960	76,2	0,589	69,2	75,0
98	Kenya	1974	63,1	0,374		
99	Korea, rep.	1961			38,7	34,0
100	Korea, rep.	1970	30,7	0,078		
101	Korea, rep.	1990	37,2	0,103		
102	Kuwait	1970	72,5	0,456		
103	Laos	1998	38,2	0,107		
104	Latvia	1925	50,4	0,191		
105	Lesotho	1960	38,1	0,123		
106	Lesotho	1990	41,1	0,144		

107	Liberia	1971	68,1	0,441		
108	Libya	1960			70,0	
109	Lithuania	1930	44,0	0,144		
110	Luxembourg	1950			63,8	
111	Madagascar	1960				80,4
113	Malaysia	1960	68,0	0,454	47,3	64,0
114	Mali	1960	45,1	0,156	47,7	47,8
115	Malta	1960	50,2	0,189	47,8	
116	Mauritius	1930	74,2	0,659		
117	Mexico	1960			69,4	60,7
118	Morocco	1962	57,7	0,263		
119	Mozambique	1999	36,8	0,108		
120	Myanmar	1993	46,3	0,163		44,3
121	Nepal	1971	54,2	0,280		
122	Netherlands	1921	66,2	0,310		
123	Netherlands	1930	56,8	0,249		
124	Netherlands	1959	55,7	0,236	57,9	50,5
125	New Zealand	1910	78,6	0,589		
126	New Zealand	1918	77,6	0,525		
127	New Zealand	1930	76,2	0,527		
128	New Zealand	1960	69,6	0,437	73,4	76,4
129	New Zealand	1972	71,2	0,468		
130	Nicaragua	1963	75,9	0,528	80,1	
131	Niger	1980	31,2	0,070		
132	Norway	1929	60,0	0,282		
133	Norway	1959	36,2	0,098	67,6	39,1
134	Pakistan	1961	44,7	0,166	65,0	55,6
135	Pakistan	1989	55,0	0,244		
136	Panama	1960	69,9	0,429	73,5	80,4
137	Panama	1990	82,2	0,655		
138	Paraguay	1961	86,3	0,849		85,7
139	Paraguay	1991	84,9	0,803		
140	Peru	1961	85,4	0,818	93,3	92,3
141	Peru	1994	81,1	0,714		
142	Philippines	1950	48,2	0,220		
143	Philippines	1960	48,8	0,195	53,4	56,0
144	Philippines	1991	54,7	0,238		
145	Poland	1960	51,1	0,204	46,5	
146	Portugal	1968	75,6	0,554		71,8
147	Portugal	1989	73,5	0,527		
148	Puerto Rico	1930	69,9	0,469		
149	Puerto Rico	1959	70,7	0,468	73,8	
150	Puerto Rico	1987	73,4	0,504		
151	Reunion	1972	63,4	0,377		
152	Romania	1930	43,3	0,183		
153	Saudi Arabia	1972	74,2	0,513		
154	Senegal	1960	46,7	0,162		49,3
155	Senegal	1998	47,8	0,173		
156	Sierra Leone	1970	42,4	0,131		
157	Singapore	1973	29,1	0,081		
159	Slovenia	1991	56,2	0,236		
160	South Africa	1927	62,8	0,323		
161	South Africa	1960	64,3	0,336	70,0	
162	Spain	1960	79,1	0,610	79,7	84,5
163	Spain	1989	80,2	0,636		
164	Sri Lanka	1961	62,3	0,358		65,7
165	Swaziland	1971	83,5	0,776		
166	Sweden	1919	57,3	0,246		
167	Sweden	1961	48,8	0,182	50,6	45,6
168	Switzerland	1929	54,3	0,230		
169	Switzerland	1969	50,4	0,192		50,0
170	Syria	1971	64,3	0,338		

171	Taiwan	1920	53,9	0,227		
172	Taiwan	1960	39,0	0,136	46,3	
173	Tanzania	1960				79,0
174	Thailand	1963	44,4	0,145	46,0	42,6
175	Thailand	1993	44,7	0,154		
176	Togo	1961	45,2	0,150		
177	Togo	1970	51,0	0,206		
178	Trinidad and Tobago	1963	69,1	0,446	69,1	
179	Tunisia	1961	61,6	0,314		64,6
180	Turkey	1927	56,3	0,256		
181	Turkey (in deunums)	1960	60,8	0,294	59,2	59,5
182	Turkey	1991	58,5	0,274		
183	Uganda	1963	48,1	0,176		54,9
184	Uganda	1991	57,4	0,277		
185	UK (England and Wales)	1921	62,6	0,308		
186	UK (Scotland)	1925	64,6	0,327		
187	UK (Northern Ireland)	1925	58,9	0,269		
188	UK	1960	68,7	0,399	72,3	67,7
189	UK	1993	64,4	0,340		
190	Uruguay	1937	77,5	0,563		
191	Uruguay	1960	79,1	0,591	82,6	81,3
192	USA	1910	57,1	0,253		
193	USA	1930	60,1	0,305		
194	USA	1959	67,7	0,411	71,0	73,1
195	USA	1987	71,9	0,456		
196	Venezuela	1956			90,9	91,7
197	Venezuela	1961	85,7	0,819		
198	Vietnam (South)	1960	56,2	0,253	58,7	
199	Vietnam	1994	47,4	0,184		
200	Yugoslavia	1950			43,7	
201	Zambia	1971	69,9	0,476		

Sources: Institut International d'Agriculture (IIA), *International Yearbook of Agricultural Statistics 1932-1933*, Rome; Various issues of the decennial FAO, *Report on the World Census of Agriculture*, Rome; Taylor, C.L., Hudson, M.C. (1972) *World Handbook of Political and Social Indicators*, 2<sup>nd</sup> edition, Yale University Press: New Haven, London; Deininger, K., Olinto P. (1999) Asset distribution, inequality, and growth, *World Bank Policy Research Working Paper No. 2375*

**Table A.2: Calculation example of a gini- and theil-coefficient of land distribution (Chile 1965)**

The gini- and theil-coefficients of land distribution are compiled from tables that have divided the total number of farm-holdings into land size classes, measured by hectares per holding. From these tables a decile distribution can be obtained. The decile distribution is imputed into the formula for the gini- and theil-coefficient.

	number of holdings	total area in hectares	Average size per holding
less than 1 ha	51.000	22.000	0,43
1 to 2 ha	34.699	46.100	1,33
2 to 5 ha	43.761	138.500	3,16
5 to 10 ha	33.076	230.300	6,96
10 to 20 ha	29.976	413.800	13,80
20 to 50 ha	29.360	911.900	31,06
50 to 100 ha	14.785	1.022.500	69,16
100 to 200 ha	9.164	1.261.500	137,66
200 to 500 ha	6.998	2.167.500	309,73
500 to 1000 ha	3.156	2.143.400	679,15
1000 ha and over	3.324	22.286.230	6704,64
<b>total</b>	<b>259.299</b>	<b>30.643.730</b>	<b>118,18</b>

	Decile distribution of holdings	Decile distribution of land	Distribution in percentages
1st decile	25930	11185	<b>0,000365</b>
2nd decile	25930	11957	<b>0,000390</b>
3rd decile	25930	34450	<b>0,001124</b>
4th decile	25930	67543	<b>0,002204</b>
5th decile	25930	82788	<b>0,002702</b>
6th decile	25930	180544	<b>0,005892</b>
7th decile	25930	310357	<b>0,010128</b>
8th decile	25930	615528	<b>0,020087</b>
9th decile	25930	1243425	<b>0,040577</b>
10th decile	25930	28085952	<b>0,916532</b>
<b>Total</b>	<b>259300</b>	<b>30643730</b>	<b>1,00</b>

Source: FAO, *Report on the World Census of Agriculture 1960*, Table 1.4, 2.3 and 2.10; pp. 26, 42 and 55 respectively

**Gini-coefficient:**  $(\sum_{j=1} \sum_{k=1} n_j n_k |y_j - y_k|) / (2n^2 * 1/n) = 17,3 / 20 = 86,5$

**Theil-coefficient:**  $\sum_{i=1} s_i (\log s_i - \log (1/n)) = 0,823$

$n$  = amount of decile shares = 10

$s_i = s_j = s_k$  = the share of land of the  $i$ th decile of holdings in total land (listed in bold, last column)

$(\sum_{j=1} \sum_{k=1} n_j n_k |s_j - s_k|) =$  sum of differences of the percentage distribution = 17,3

**Table A.3: Descriptive statistics of variables explaining land inequality**

	MIN	MAX	MEDIAN	MEAN	ST.DEV	OBS
MEANTEMP	-0,200	29,300	22,500	19,613	7,426	91
BANANAS	0,000	0,126	0,000	0,015	0,029	97
COCOA DUMMY	0,000	1,000	0,000	0,171	0,379	105
COFFEE DUMMY	0,000	1,000	0,000	0,276	0,449	105
RUBBER DUMMY	0,000	1,000	0,000	0,067	0,251	105
SUGAR	0,000	0,330	0,000	0,020	0,044	98
CASHCROP DUMMY	0,000	1,000	0,000	0,295	0,458	105
RICE	0,000	0,574	0,008	0,092	0,147	101
LNPOPDENSE	3,731	14,581	9,774	9,831	1,874	95
EURCOL DUMMY	0,000	1,000	1,000	0,686	0,466	105
IBERCOL DUMMY	0,000	1,000	1,000	0,219	0,416	105
LNSETMORT	0,000	7,986	4,180	2,960	2,362	84
LNCATHOLICISM	0,000	4,605	2,639	2,428	1,841	105

	MTP	BAN	COC	COF	RUB	SUG	CCR	RICE	POPD	EURC	IBEC	STM	CATH
MEANTEMP	1,00												
BANANAS	0,35	1,00											
COCOA_DUMMY	0,37	0,33	1,00										
COFFEE_DUMMY	0,40	0,47	0,57	1,00									
RUBBER_DUMMY	0,27	0,14	0,08	-0,08	1,00								
SUGAR	0,31	0,53	0,42	0,47	0,13	1,00							
CASHCROP_DUMMY	0,42	0,72	0,48	0,44	0,25	0,61	1,00						
RICE	0,46	0,45	0,50	0,44	0,18	0,27	0,41	1,00					
LNPOPDENSE	0,03	-0,21	-0,14	-0,26	0,20	-0,15	-0,10	-0,05	1,00				
EURCOL_DUMMY	0,71	0,36	0,31	0,37	0,10	0,31	0,39	0,36	-0,28	1,00			
IBERCOL_DUMMY	0,25	0,47	0,37	0,60	-0,14	0,52	0,46	0,17	-0,41	0,36	1,00		
LNSETMORT	0,77	0,41	0,47	0,57	0,10	0,32	0,48	0,51	-0,23	0,90	0,37	1,00	
LN_CATHOLICISM	-0,09	0,36	0,20	0,34	-0,18	0,28	0,32	0,08	-0,40	0,07	0,54	0,02	1,00

**Table A.4: Descriptive statistics of variables explaining income inequality**

	MIN	MAX	MEDIAN	MEAN	ST.DEV	OBS	LNDGI	LNDTH	GDPPC	MINR	EXPRR	DEM	SOC
LANDGINI	0,291	0,863	0,620	0,601	0,152	105	1,00						
LANDTHEIL	0,070	0,849	0,294	0,339	0,203	97	0,96	1,00					
LNGDPPC	2,721	4,366	3,595	3,586	0,487	100	0,22	0,24	1,00				
LNMINERALS	0,000	4,554	0,000	1,098	1,772	103	0,24	0,28	-0,22	1,00			
RISKEXPROP	2,200	10,000	6,800	6,864	2,219	91	-0,06	-0,02	0,80	-0,40	1,00		
DEMOCRACY	1,000	6,000	3,000	3,520	1,572	90	0,16	0,13	0,76	-0,26	0,69	1,00	
SOCIALIST DUMMY	0,000	1,000	0,000	0,095	0,295	105	-0,28	-0,27	-0,03	-0,20	-0,05	-0,14	1,00