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Causes and Consequences of Land Distribution**

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## **Abstract**

The colonial heritage of high land inequality in Latin American countries is still, after nearly two centuries of independence, one of the crucial underpinnings of its persistent high levels of income inequality. This paper assesses the colonial strategy of land redistribution in a global comparative perspective using new and existing land inequality figures 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 age? 2) how does initial land inequality relate to current income inequality? The main conclusions of the paper are that geography and factor endowments play a less decisive role than often argued in literature. And second, controlling for regional fixed effects, initial land inequality explains a substantial part of the present cross-country variation in current income inequality.

JEL Classification Numbers: N30, N50, O15, P51

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

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## 1 Introduction

In order to explain the observed rigidities in the distribution of income recent inequality literature has paid renewed attention to the historical evolution of asset inequality (Atkinson and Bourguignon 2000). This paper analyses the causes and consequences of the historical evolution of land inequality, employing a new dataset of land inequality figures. Land inequality is widely regarded as a key determinant of persistent asset inequality and institutional rigidity (Engerman and Sokoloff 1997, Galor et.al. 2003, North et. al. 2000).

In Latin America the colonial heritage of land inequality has gradually transformed in persistent high levels of income inequality during the 20th century (World Bank 2004). For the Spanish Crown land was a convenient resource to reward the early colonists' efforts of conquest, conversion and settlement. Land was deliberately redistributed from indigenous peasants to the Creole elite. The institution of the *encomienda* provided the large estates (*latifundia*) (and silver mines) with the necessary supplies of indigenous labour. With the establishment of distinct Spanish and Indian estates the policy of land distribution was also directed to separate the political, juridical and administrative spheres, creating a pervasive social dualism. In Brazil and the Caribbean this dualism was primarily shaped by the establishment of a plantation economy driven by African slave labour. The Catholic church materialized its position as the supreme religious authority by acquiring large estates. In other words, land inequality formed a core ingredient of the colonial institutional matrix (Bakewell 2004, Williamson 1992, Fernandez-Armesto 2003).

With the Latin American experience in mind, this paper explores two questions: 1) what explains the cross-country variation in land inequality at the end of the colonial age? 2) how does initial land inequality relate to current income inequality? Exploring these questions may improve our understanding of the path-dependent characteristics of inequality and may also indicate to which extent the Latin American experience was a unique experience. As this paper relies on scarce historical data, the empirical analysis is carried out in a simple OLS framework. The regression results serve to illustrate, rather than demonstrate, the validity of the hypotheses derived from historical analysis.

The paper is structured as follows. In section 2 the literature on the causes and consequences of land inequality is discussed. Section 3 introduces the land distribution data (gini and theil coefficients) and evaluates these figures in a global comparative perspective. Section 4 presents the two multivariate regression models and the included variables. In section 5 the results are presented and interpreted. In section 6 the long run consequences of initial land inequality are evaluated. Section 7 concludes.

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

### 2.1 *The causes of land inequality: colonial institutions in response to local factor endowments and the objectives of the European motherlands.*

The extent of land inequality developed during the colonial age is the result of the interaction between local conditions and overseas objectives. Literature has paid specific attention to the feasibility of settlement and exploitation in various regions of the world. Local conditions relate to the nature of land endowments (soil, climate, location), the relative quantity of land and labour endowments (land-labour ratios, population density), the local disease environment and the comparative resistance of the native population to colonial occupation. When the local conditions meet the objectives of the colonial motherland, institutional development takes place as a response process. This brief overview of literature aims to discuss these institutional responses.

1) 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 sugar, tobacco, coffee, cocoa, rubber and bananas can be efficiently produced on large estates employing cheap coerced labour. 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). Since tropical climates allow a larger variety of cash-crop production than temperate climates, the geographic location of a country may indirectly affect the distribution of land. A specialization in scale-neutral food crops has a moderating effect on land inequality. Before the introduction of modern agricultural technologies (motorized) food crops such as wheat and maize could be efficiently produced on plots of modest size, while rice crops could be grown on even smaller plots of land (Hayami and Ruttan 1985).

The variety in land endowments induced different paths of colonisation in British North America, mainland Spanish America and the sugar plantation economies along the coast of Brazil and the Caribbean islands. Agriculture in British North America became organized around a homogenous group of white European farmers producing food crops (mainly wheat) on small to medium-scale farms. Contrary to the slave plantations in the Southern states, the egalitarian distribution of land in the Northern States fitted into a strategy to attract European settlers to the land frontier. In Spanish America on the other hand the main objective was to guarantee a steady supply of mineral resources (silver, gold, diamonds) to the Iberian Peninsula employing native labour. The British, French, Dutch and Portuguese plantation economies arose along with the Trans-Atlantic slave trade in the mid 17<sup>th</sup> century. In both cases a white minority elite held absolute authority in an ethnic heterogeneous society. The redistribution of land was part of a strategy to vest and remain in control.

2) Apart from the nature of land endowments, the relative quantity of land and labour also shapes the potential efficiency of the rural economy. Land abundance invokes labour saving production methods and favours crops that use land intensively. The land-labour ratio also shapes 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, in particular in the context of the colonial society.

3) Acemoglu et.al. (2001) argue that in areas unfavourable to colonial settlement, i.e. with a high disease incidence or fierce native resistance, colonial institutions will be created in order to maximize the extraction of resources from a distance. As a result the path of institutional development was characterised by weak property rights protection and a political context supporting rent seeking behaviour. In regions favourable to colonial settlement institutions were moulded according to the motherland with the purpose to accumulate capital and skills, enhancing economic growth during the age of independence. Settler mortality rates appear to be significantly correlated with present-day risks of expropriation.

In Sub Saharan Africa the rates of colonial settlement were considerably lower than in the America's and also more concentrated in the coastal regions. The colonial powers created institutions to extract rents via taxation (head tax) and trade in slaves and natural resources with high margins (Young 1994, Manning 1988). Since settlers did not directly interfere with the daily practices of agricultural production on a large scale, the traditional rural institutions were left in tact however. 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). High rates of settler mortality may have prohibited the redistribution of land.

4) The conversion of Indians to Catholicism was a specific objective of Iberian colonial policy As a result of the strong pact between Rome and the Iberian monarchies against the backdrop of the Reformation in Europe, the Catholic church gained omni-presence in Iberian American society. The penetration of the regular and secular orders into the daily life of Amerindians went much further than Protestant missions 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 concentration of land in the hands of the Catholic church' may indeed have had a significant impact on the distribution of land (Van Oss 2003, Bakewell 2004).

## *2.2 The relation between initial land inequality and current income inequality*

Land is the most important production factor and source of wealth in the pre-industrial economy. Since land generally depreciates at a much slower pace than most other forms of human, physical and natural capital and can, in principle, be accumulated without limitation, inequality can be easily passed on from one generation to the next in rural societies. 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. Indirect effects consist of institutional rigidities enhancing the perpetuation of land inequality into several types of non-land asset inequality.

Literature generally focuses on the (land) inequality-growth rather than the land inequality-income inequality relationship. Several empirical studies have revealed that initial land inequality is bad for growth. This result appears to be stronger, more robust and less contested than tests showing 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 and this is confirmed by papers of Deininger and Squire (1998), Li, Squire and Zou (1998) and Deininger and Olinto (1999).

One of the major theoretical underpinnings of this empirical observation is that land is an important collateral asset to get capital market access. 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, 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.

Initial land inequality also enhances persistent inequality in a context of concentrated political power. If the political and landowning elite are largely overlapping policies that suppress democratic accountability and social development in order to preserve the distributional status quo are likely to prevail (Olson 2000, Bourguignon and Verdier 2000, Acemoglu and Robinson 2006). In comparison to the USA and Canada public education investments and franchise extensions lagged far behind 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 and 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 in cross-country analyses.

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 (2002a and 2002b) report an  $r$  of 0.33. The correlation-coefficients estimated in section 5 are even lower ranging from 0.19 to 0.23. If land inequality indeed is an important determinant of (persistent) income inequality, there will be some important conditional variables which need to be included in a multivariate analysis.

### 3 Land inequality in a global comparative perspective

Land distribution 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). The data are derived from the *FAO World Census of Agriculture*.<sup>1</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 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	Deininger & Olinto	Frankema
Taylor & Hudson	1		
Deininger & Olinto	0,79	1	
Frankema	0,78	0,90	1

Sources: Taylor and Hudson (1972: pp. 267-269), Deininger 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>2</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>3</sup> Around one-third of these were excluded because surveys did not make a distinction between communal land holdings and single private land

1 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.

2 "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 is a clear analytical concept as 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.

3 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.



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>4</sup>

The selected sample includes 111 country observations<sup>5</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 confined in most countries<sup>6</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>7</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 all land gini's 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 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).

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<sup>4</sup> In the Deininger and Olinto paper former socialist Eastern European countries are excluded, but in the study by Deininger and Squire (1998) the East European land gini's are used in an inequality-growth analysis which undoubtedly impacts on the results.

<sup>5</sup> From Deininger 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.

<sup>6</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>7</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.

**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
South & East Africa	36.8	83.5	66.7	62.7	17.4	0.28	12
West & Central 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.

#### 4 A multivariate regression analysis.

The hypotheses discussed in section 2 are specified in a simple cross-country OLS model. The first equation considers the explanation of cross-country variation in post-colonial land inequality:

$$y = \alpha + \beta_1 x_1' + \beta_2 x_2' + \varepsilon$$

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

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

where  $z$  refers to current income inequality,  $\alpha$  is a constant,  $\varepsilon$  is an error term,  $y$  refers to land inequality,  $g$  represents the level of economic development, capturing the direct effect of land inequality on income inequality. The  $m$  refers to a measure of the dominance of mineral resources in exports and vector  $x_4$  represents regional fixed effects.

##### 4.1 The determinants of land inequality: endowments and institutions

Several proxies for the feasibility of tropical cash-crop production can be used. One rough variable is the mean annual temperature (MEANTEMP) (McArthur and Sachs 2001). Easterly (2002) applies variables of “land use” (percentage share of land *yielding* a specific crop) and “land suitability” (percentage share of land *suitable* to the cultivation of a specific crop). Since the use of land may be endogenous to the distribution of land, the land suitability indicator is preferable. The FAO provides data on land suitability for a.o. bananas, cotton, maize, rice, sugarcane and wheat. For coffee, cocoa, rubber and tobacco only land use data is available. Land use data are transformed into dummies of land suitability. If a country devotes over 1% of their agricultural land to one of these crops and has a historical record as a net exporter of one of these crops (Mitchell 2003), the dummy is set at 1. Cash crops (bananas, coffee, cocoa, cotton, rubber, tobacco and sugar) are expected to yield a positive effect, food crops (maize, rice and wheat) are expected to yield a negative effect. The crops are also included as an aggregate measure: the CASHCROP aggregate includes bananas, cotton and sugar and the FOODCROP aggregate includes maize, rice and wheat. The land labour ratio is approximated by the log of population per square kilometre of agricultural land in the early colonial period (LNPOPDENSE). For most New World countries the year 1700 or 1800 is used. For African countries and most Asian countries the year 1900 is used. 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).

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*, the authoritarian political and stratified social order 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).

#### *4.2 The effect of land inequality on income inequality in a regression with fixed effects*

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>8</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.

To control for other sources of inequality a variable is included which captures the impact of mineral resource dominance in exports. 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, diamonds, pearls and wood.<sup>9</sup> The variable is specified in log and denoted as LNMINERALS. Regional fixed effects are accounted for by including dummy variables for Latin America, Sub Saharan Africa, Asia and (former) Socialist countries.

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8 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/)).

9 Three observations for Guinea, Guyana and Libya were included on the basis of UN Trade Statistics.

## 5 Results and interpretation

A spatial regression analysis employing scattered data, rough proxy variables and large time lags cannot do much more than illustrate rather than to demonstrate the validity of the historical analysis. The analysis may give a plausible indication however which are the most fruitful paths for further research. In table A.3 and A.4 (appendix) the descriptive statistics and pair-wise correlations of the variables are presented. Table 3 reports ordinary least square regressions of land inequality.

The hypothesis that tropical climates are related to land inequality can not be sustained. The mean annual temperature variable does have a positive sign but is completely insignificant (1). Moreover, none of the food or cash crop variables yields a significant result (2). Although the aggregate cash crop and food crop variable have the predicted signs, positive and negative respectively, both variables are insignificant. 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 sustained on the basis of this analysis and this does not have to come as a great surprise. Large parts of West and Central Sub Saharan Africa are suitable to the production of cash crops but do not reveal high levels of land inequality. Land abundant countries are clearly characterised by higher levels of land inequality than densely populated countries. The sign is consistent but the coefficient is not robust. The null-hypothesis cannot be rejected at the 90% confidence level in most regressions, except 6 and 8.

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*, had an inherent enhancing effect on land inequality, apart from the colonies endowments structure. Controlled by the European colony dummy, the redistribution of land under Iberian colonial rule indeed appears to be a distinctive element of its colonial policy.

Settler conditions also seem to make a substantial difference. The log of settler mortality rates, as a proxy for settler conditions, is consistently negative and significant at a 95%-99% confidence level. In colonies with favourable settler conditions average land inequality is higher. It is, moreover, noteworthy that the European colony dummy is only significant when controlled for settler mortality rates (7). This evidence indeed suggests that the conditions of settlement are an ultimate cause of land inequality which probably also have been decisive in shaping the nature of long run income inequality in different regions.

**Table 3: OLS Regressions; dependent variable is the land inequality (gini-coefficient) observation closest to the year of independence.**

	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Theil
	1	2	3	4	5	6	7	8	9
Meantemp	0,002 (0,003)								
Bananas		-0,524 (0,71)							
Cotton		-0,056 (0,59)							
Sugar		0,784 (0,71)							
Cocoa dummy		0,004 (0,04)							
Coffee dummy		0,036 (0,03)							
Rubber dummy		-0,014 (0,05)							
Tobacco dummy		0,010 (0,03)							
Maize		0,165 (0,45)							
Rice		-0,171 (0,11)							
Wheat		-0,04 (0,16)							
Cash crop aggregate			0,125 (0,20)		0,125 (0,20)				
Food crop aggregate			-0,086 (0,07)		-0,105 (0,06)				
InPopdense	-0,011 (0,01)	-0,004 (0,01)	-0,005 (0,01)	-0,011 (0,01)		-0,016 (0,01)**	-0,012 (0,01)	-0,015 (0,01)**	
Eurcol dummy	0,146 (0,07)**	0,176 (0,07)**	0,148 (0,06)**	0,128 (0,06)**	0,115 (0,06)**	0,163 (0,06)***	0,013 (0,03)	0,138 (0,06)**	0,138 (0,06)**
Ibercol dummy	0,103 (0,04)**	0,083 (0,05)*	0,113 (0,04)***	0,122 (0,04)***	0,120 (0,04)***		0,097 (0,04)**	0,181 (0,04)***	0,138 (0,04)***
InSetmort	-0,040 (0,01)***	-0,039 (0,01)***	-0,035 (0,01)***	-0,032 (0,01)***	-0,034 (0,01)**	-0,032 (0,01)**		-0,038 (0,01)***	-0,031 (0,01)***
InCatholicism	0,030 (0,01)***	0,027 (0,01)***	0,028 (0,01)***	0,026 (0,01)***	0,029 (0,01)***	0,039 (0,01)***	0,024 (0,01)***		0,026 (0,01)**
C	0,602	0,561	0,588	0,636	0,527	0,656	0,630	0,733	0,509
<i>R-squared</i>	0,53	0,58	0,55	0,52	0,54	0,45	0,35	0,46	0,49
no. Obs	75	76	76	79	81	79	95	79	84

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.

Finally, the presence of the Catholic church also appears to have contributed to land inequality. The spread of Catholicism is positively related to land inequality at a 95%-99% confidence level. This effect is maintained even when the ultimate control variable, the Iberian colony dummy, is included. The rapid diffusion and sustained omni-presence of the Catholic church further supports the

view that the objectives of the Iberian mother countries have played a decisive role, apart from the local conditions the Iberian settlers were confronted with.

In sum, a typical “land unequal” country at the start of its independence is a land abundant Catholic country, which has comparatively favourable settler conditions and specific Iberian institutions. Such a description indeed comes remarkably close to the “average” Latin American country. This impression arises from a global sample (covering all regions) including a dummy for Iberian colonies. The nature and structure of factor endowments do not play a decisive role, but provided a context in which redistribution of land was more or less likely to take place. The West African conditions to produce cash crops such as sugar were probably comparable to those in the Caribbean and Brazil, but Europeans could not enforce access into this area as easy as in Latin America. The objectives of European mother countries were therefore really constrained by settler conditions in general, local endowments were important in second instance.

In areas 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 did not affect the existing distribution of land. The 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. Current levels of income inequality in Latin America and Sub Saharan Africa are among the highest in the world but the characteristics and sources of inequality differ distinctively.

Let’s now turn to the consequences of land inequality for income inequality. Table 4 presents the correlation-coefficients of early post-colonial land inequality figures and current income inequality figures (1990’s). The results range from 0,19 (land gini) to 0,23 (land theil). Excluding the Sub Saharan African countries from the sample (second column) shows that the coefficient rises with approximately 0.3 points to 0,49-0,52. Since the far majority of Sub Saharan African countries are low-income rural countries 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 its relatively low levels of land inequality.

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

	Income Gini 1990’s	Income Gini 1990’s excl. West & Central Africa
Land Gini	0,19	0,49
Land Theil	0,23	0,52
no. observations	95	76

**Table 5: OLS Regressions with regional fixed effects: dependent variable is income inequality in the 1990's**

	1	2	3	4
Landgini	1,042 (0,13)***		0,394 (0,014)***	
Landgini*lnGDPpc	-0,234 (0,03)***		-0,094 (0,037)**	
Landtheil		1,631 (0,24)***		0,572 (0,25)**
Landtheil*lnGDPpc		-0,404 (0,06)***		-0,146 (0,06)**
lnMinerals			0,031 (0,03)	0,036 (0,03)
Asia			4,486 (2,3)***	4,576 (2,2)**
Latin America			12,19 (2,2)***	12,17 (2,6)***
Sub Saharan Africa			11,97 (2,8)***	13,28 (2,5)***
Socialist			-4,800 (2,4)***	-4,653 (2,4)**
C	31,27	37,57	33,55	35,16
<i>R-squared</i>	0,44	0,37	0,66	0,65
no. Obs	93	87	92	86

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.

Apparently the link between unfavourable settler conditions, extractive institutions and high income inequality does not run via high land inequality. 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. African extractive institutions are often directed at squeezing rural surpluses by land or rural income taxes or agricultural price manipulation, disadvantaging the rural population in favour of the politically more influential urban population (Krueger, Schiff and Valdez 1991, Cheru 2002).

The results of the fixed effects OLS regressions of income inequality are presented in table 5, including the landgini and the landtheil. The relation between initial land inequality and subsequent income inequality appears to be very strong when controlling for mineral resource exports and regional fixed effects (3 and 4). A change in the landgini of 10 percentage points (3) translates into a rise of the income gini by 3.9 points. If Brazil would have the Canadian level of land inequality (a landgini of 0.49 in stead of 0.78), the model predicts that Brazil's income gini would decline with 11 percentage points to 0.47 in stead of 0.58. The regression results also support the relevance of 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. The regression results support the view that land inequality has a long lasting positive impact on income inequality, but the example of Sub Saharan Africa (table 4) shows that we should consider it as a specific rather than a comprehensive proxy for historical levels of inequality. The remaining question is in which respect land inequality makes a difference?



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

In their recent book *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. The authors presume an initial state in which the elite (initially) disposes of greater political and economic power than the majority of common people (citizens). Consequently, the various paths societies follow in the transfer of power from the elite to the citizens (i.e. democratisation) are analysed. One of the determinants of 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. The consequences may be divided into those obstructing development and those supporting development.

### *Obstructing development*

1) The issue of the persistent effects of land inequality on non-land assets has already been raised in section 2. In a context of capital market imperfections initial land inequality leads to underinvestment in and an unequal distribution of non-land assets, particularly human capital. Public investments in education may compensate for suboptimal investments in and access to schooling. However, public education expenditures require public revenues which induces a redistribution of income from the landowning elite to landless citizens. Besides, in land abundant countries, landowning elites have a special interest in a steady supply of cheap unskilled labour. Therefore, landowning elites have several reasons to oppose the expansion of public education (Galor and Zeira 1993, Mariscal and Sokoloff 2000, Galor et.al. 2003).

2) In a pre-industrial economy land inequality may obstruct 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. The more the growth of middle class demand for basic industrial products is reduced, the harder it is to generate economies of scale. In a pre-industrial society land inequality may therefore lead to suboptimal consumer demand spillovers depressing the rise of domestically oriented basic industries (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) than landowners; and landowners may have different preferences of economic institutions (related to coercive rural 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. Elites insist on necessary public investments in physical and commercial infrastructure needed to

expand their business. These investments generate spillover effects. If the landowning aristocracy is in the exclusive position to decide, many problems of collective action are circumvented and the effectiveness of public investments and potential spill over effects increase (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 a 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) Related to the former argument, 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 sector (where they hold their assets, derive their labour force and have an important social role/standing), 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 such balancing forces, 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.

## 7 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:

- 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, and engage in the trade and exploitation of natural resources and slaves. 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 relative 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 evolved to control the labour force and economically reinforce a fundamentally heterogeneous social order. The unequal distribution of land formed a cornerstone 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 large weight of the rural sector in low developed countries, 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 abundant endowments 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 is based on a systematic squeeze of the rural majority population in favour of a small predatory urban elite. This type of inequality is rooted in the weak protection of property rights in unstable independent “states without nations”. Both regions carry the burden of “disproportional” levels of economic inequality. Those in power want to hold on to what they have and feel threatened by demands for accountability. Yet, the incentives shaping the attitude and actions of the elites in both regions differ fundamentally.

A landowning elite not only derives income from rent extraction, but also from the accumulation of capital and investments in agricultural enterprise. 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 and 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 poses 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	Deininger & Olinto gini
1	Algeria	1930	59,6	0,326		
2	Algeria	1973	63,5	0,327		
3	Argentina	1914	80,3	0,648		
4	Argentina	1947	80,6	0,648		
5	Argentina	1960	81,4	0,667	86,7	85,6
6	Argentina	1988	81,4	0,645		
7	Australia	1910	73,4	0,489		
8	Australia	1924	67,6	0,376		
9	Australia	1960	82,0	0,651	88,2	85,3
10	Australia	1971	80,5	0,612		
11	Austria	1930	68,4	0,408		
12	Austria	1960	67,1	0,386	70,7	68,8
13	Austria	1990	61,2	0,314		
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	0,544		
19	Belgium	1959	60,0	0,276	60,4	
20	Belgium	1970	57,8	0,255		
21	Bolivia	1960				76,8
22	Brazil	1920	78,0	0,592		
23	Brazil	1960	78,7	0,608	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	0,644	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	0,495	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	0,141	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*

$$\text{Gini coefficient} = \frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2n^2 \mu} = 0,865$$

Where  $x_i$  and  $x_j$  are the percentage shares of land of  $n$  deciles ( $n = 10$ ) and  $\mu$  is  $1/n$ .

$$\text{Theil coefficient} = \sum_{i=1}^n p_i (\ln p_i / \ln x_i) = 0,823$$

Where  $p_i$  is the  $i$ th share of farms and  $x_i$  is the  $i$ th share of land of  $n$  deciles ( $n = 10$ )

**Table A.2: Calculation of Gini- and Theil-coefficient of land inequality (Chile 1965)**

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

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

**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
COTTON	0,000	0,263	0,000	0,023	0,052	97
SUGAR	0,000	0,330	0,000	0,020	0,044	98
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
TOBACCO DUMMY	0,000	1,000	0,000	0,257	0,439	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

	MNTP	BAN	COT	SUG	COC	COF	RUB	TOB	MAI	RIC	WHE	POPD	EUR	IBR	SETM	CATH
MEANTEMP	1,00															
BANANAS	0,35	1,00														
COTTON	0,31	-0,04	1,00													
SUGAR	0,31	0,53	-0,04	1,00												
COCOA DUMMY	0,37	0,33	0,04	0,42	1,00											
COFFEE DUMMY	0,40	0,47	0,07	0,47	0,57	1,00										
RUBBER DUMMY	0,27	0,14	-0,02	0,13	0,08	-0,08	1,00									
TOBACCO DUMMY	0,01	0,06	-0,11	-0,02	-0,04	-0,02	0,02	1,00								
MAIZE	0,27	0,00	0,83	-0,04	0,01	0,03	-0,03	-0,06	1,00							
RICE	0,46	0,45	0,21	0,27	0,50	0,44	0,18	0,01	0,17	1,00						
WHEAT	-0,52	-0,21	-0,20	-0,28	-0,25	-0,32	-0,16	-0,06	0,09	-0,31	1,00					
LNPOPDENSE	0,03	-0,21	-0,04	-0,15	-0,14	-0,26	0,20	-0,02	-0,15	-0,05	0,00	1,00				
EURCOL DUMMY	0,71	0,36	0,26	0,31	0,31	0,37	0,10	0,02	0,20	0,36	-0,54	-0,28	1,00			
IBERCOL DUMMY	0,25	0,47	-0,06	0,52	0,37	0,60	-0,14	0,06	0,01	0,17	-0,13	-0,41	0,36	1,00		
LNSETMORT	0,77	0,41	0,36	0,32	0,47	0,57	0,10	-0,07	0,32	0,51	-0,52	-0,23	0,90	0,37	1,00	
LNCATHOLICISM	-0,09	0,36	-0,06	0,28	0,20	0,34	-0,18	0,00	0,04	0,08	0,25	-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

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