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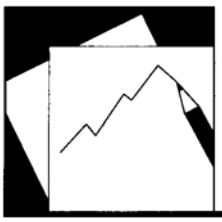

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Land Distribution and Financial System Development

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Abstract

Previous research has found that the depth of the financial sector is significantly associated with economic growth. The source of variation in financial depth across countries, however, has not been addressed as thoroughly. In this paper we establish empirically that initial land inequality is a significant predictor of financial depth, even while controlling for other predictors such as legal origin, ethnic fractionalization, and income inequality. To examine this relationship we have created a new measure of land distribution within countries that builds upon the work of Deininger and Squire (1998) by explicitly accounting for landlessness. Moreover, we show that this measure is not correlated with other commonly used instruments. Thus, this new measure of land inequality offers the potential for serving as a new instrument for financial development. Using financial development variables instrumented on our measure of land inequality indicates that the causal relationship between financial development and income levels may be weaker than previous research has suggested.

JEL Classification Numbers: E25, G18, O13, O16, O47

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I. INTRODUCTION

The importance of the financial system for economic growth has been well established. King and Levine (1993) found that overall financial depth and the amount of bank credit are closely correlated with post-war growth in a cross-section of countries. Levine and Zervos (1998) extended that work to show that stock market liquidity as well was associated with growth, even while controlling for the size of the banking sector. While establishing the close connection of finance and growth, neither of these studies dealt satisfactorily with endogeneity. Levine, Beck and Loayza (2000) addressed this issue by utilizing historic legal structure as an instrument for financial development and found a causal link running from finance to growth. Beck, Levine and Loayza (2000), using a dynamic panel method, confirmed this finding.[1]

While the literature has carefully documented the importance of the financial system for economic growth, less attention has been paid to the sources of variation in financial development across countries. Within this literature, the most commonly cited source is legal origin, which La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998) document as having a close connection to the nature of property rights and contract enforcement across countries.

A separate line of research has focused on the role of initial geographic factors on the origin of institutions. Acemoglu, Johnson and Robinson (2001) suggest that the mortality experience of early settlers determined the institutions implemented by colonizers. High mortality areas, such as those found in the tropical regions, were organized as extractive states that left a legacy of poor institutional control. Engerman and Sokoloff (1997) suggest that the type of agriculture available to early settlers in the Americas affected their choice of political structure and property rights. In places conducive to the production of plantation crops such as cotton or sugar, the colonies were organized with land and political power concentrated in the hands a small elite class who actively repressed the development of democracy and education. Easterly

[1] This summary is a very limited survey of this line of literature. For the latest review of the state of research on financial structure and economic growth, see Levine (2005).

and Leine (2003) find empirical support for the idea that initial geographic conditions are significant predictors of subsequent institutional quality. Work by Galor, Moav and Vollrath (2005) provides a theory of how initial land distribution led to variation in the provision of public education across countries that led to subsequent divergence in economic development.

None of this research, though, specifically addresses the development of the financial sector and its dependence on initial conditions. In this paper, we bring these lines of research together by examining the connection of land inequality and the development of the financial sector. We create a new set of data on the distribution of land within countries and show it to be significantly related to several measures of financial development. This relationship is robust when other initial conditions such as legal origin are controlled for and is robust as well when controlling for income inequality.

The connection between land inequality and finance is something that is suggested in several lines of research, primarily in the economic development literature. Both Bell (1998) and Besley (1998) review the general nature of credit markets in rural areas, highlighting the information problems. Borrowers in agricultural areas are costly to monitor, and if they do not own land or do not have secure title to their land, they no collateral with which to secure a loan. Programs that strengthen property rights for agricultural workers or land reforms which allocate land to previously landless workers are predicted to increase financial depth by bringing new borrowers into the market. Tomich, Kilbry and Johnston (1995) argue that unimodal (i.e., relatively equitable) land distributions are conducive to financial development, as they allow for the creation of larger financial intermediaries outside of the traditional sources of credit, landlords and merchants. Examining financial conditions in Brazil, Mexico, and the United States in the late 19th century, Haber (1991) finds evidence that concentrated wealth and political power restricted the availability of credit in Mexico, and to a lesser extent, Brazil. Binswanger, Deininger and Ray (1995) highlight that landowners have great incentives to limit the outside options of their workers,. This includes cutting them off from credit markets. Finally, Chakraborty and Ray (2005) have created a theoretical model of the development of financial systems that stresses the importance of the initial wealth distribution. In unequal distributions of

wealth the financial sector remains small due to the limited number of borrowers with sufficient collateral.

Our work provides cross-country support for these theoretical predictions. Interestingly, this connection is not as apparent when utilizing the existing land inequality data from Deininger and Squire (1998) (DS hereafter). In previous work (Erickson and Vollrath, 2004), we found no significant relationship of land inequality and several measures of financial depth when we used the DS data. We believe this has to do with the nature of their land distribution data. Our updated data series adds additional information to the measure of land inequality, allowing us to identify the relationship with finance.

This relationship allows us to examine causality in the income level and financial depth connection. Using land inequality as an instrument for financial depth, we show that both the size and significance of the coefficient on financial depth decline when compared to the results using legal origin as the instrument. This suggests some caution in asserting a strong causal role for financial development in raising income levels.

Finally, we consider the question of the potential endogeneity of land inequality. We demonstrate that our new measure of land inequality is uncorrelated with two popular instruments: settler mortality and crop/mineral dummies. This suggests land inequality as an additional source of exogenous variation for use in fundamental regressions.

The paper proceeds as follows. Section 2 discusses in more detail our new measurement of land inequality and the data utilized to create it. Section 3 then uses this new land inequality data to show the relationship between financial development and land inequality, tests its exogeneity and considers its potential for use as an instrument. Section 4 concludes.

II. MEASURING LAND INEQUALITY

The most commonly cited measure of land inequality is the DS data. This is constructed such that it captures inequality of landholdings over the population of holdings themselves, excluding

consideration of the landless. While informative in its own right, it fails to capture the inequality of landholdings across the population of persons who rely on land for their livelihood. We undertake in this section to expand their original inequality measure by utilizing data on the economically active population engaged in agriculture. Our goal is to create a measure of land inequality that incorporates both inequality of farm sizes (as DS do) and inequality in the actual number of farms over the agricultural population (as they do not).

A simple example shows why this update is potentially important. Imagine two countries, A and B, both of which have a population of ten people. In country A, each of the 10 people holds one-tenth of the land. The original DS measure of land inequality would give country A a Gini coefficient of zero - perfect equality. In country B, two of the people each hold one-half of all the land, while the remaining eight hold none. The original DS measure gives country B a Gini coefficient of zero as well. Essentially, their Gini coefficient does not incorporate the eight "holdings" of size zero, and so misses out on relevant data concerning the distribution of land within country B. Given the theoretical considerations, the fact that eight people in country B have no collateral would seem to be of great importance in the development of a financial system in country B. Our results highlight that in fact this new dimension of inequality is in fact important.

A. The Extent of Landholdings

Measuring the breadth of landholdings in a country requires two pieces of information. First, the number of actual landholdings. Second, the total number of potential landholdings. The first is relatively easy to obtain, while the second will require making assumptions regarding who within a population is a potential landholder.

The number of actual landholdings is obtained from the series of FAO Censuses of Agriculture conducted in rounds every ten years from 1950 to 2000. Each round collects the data from

individual country agricultural census reports[2]. It is from these reports that DS originally created their Gini coefficient for landholdings. In addition to the distribution of holdings by area, these reports contain simple counts of the number of holdings. For 220 of the 275 observations of the Gini coefficient provided by DS we have a matching observation of the number of holdings. For 42 of the DS Gini coefficients we did not obtain the number of holdings because they were from the 1950 round of the FAO Census and we are not able to obtain any relevant population data from prior to 1960. Finally, for 13 of the DS Gini coefficients we were not able to find a matching observation on number of holdings. Most of these are from the 1980 round of the FAO Census.

Since the publication of DS data from the 2000 round of the FAO Census has become available. From this we have obtained 43 additional observations of both the Gini coefficient on landholdings and the number of landholdings. In the work that follows, we will verify our results with both the original DS sample as well as an expanded sample that includes these new 43 observations.

The second series of data required is the total number of potential landholdings. We consider two different proxies for this number in an attempt to find a reasonable measure. The first proxy is the number of rural households within a country. It seems reasonable to suppose that the household is the landholding unit, and so the number of rural households is equal to the number of potential landholdings. To the extent that the actual number of landholdings is less than the number of households, then there exist landless households.

Household data by sector is available from the United Nations Demographic Yearbooks of 1987 and 1995. These yearbooks provide 45 observations of the number of rural households within a

[2] These individual reports do normally not actually correspond to the specific year of the FAO Census round. Thus the 1980 FAO Census contains data from individual reports that occur anywhere from 1975 to 1986. This variation in reporting dates is not consequential. Knowing the actual year in which each country census took place we can match it to correct year-specific population data.

country. Of these 45, we are able to merge 29 with an observation of the number of holdings in that country from the FAO census data.[3]

Table 2 displays the results of this exercise in the first column by showing the ratio of holdings to rural households. The average ratio for developing countries is 0.70, with one observation (Madagascar) showing more holdings than actual households. For developed countries the ratio is generally lower, with an average of only 0.38. This would indicate that rural landholdings are less equitably distributed within rich countries than within developing countries. That is, there are fewer landholdings available for a given number of rural households in rich countries.

The rural household data have several potential issues. First, rural households are not necessarily agricultural households, and vice versa.[4] This means we may be miscounting the number of potential landholders in a country. Consider the relatively low ratio of holdings to rural households in rich countries. It seems quite likely that part of the reason for the low values is that there are many households in rural areas that live there with no ties to the agricultural sector. This doesn't necessarily reflect a poor distribution of landholdings, though. Second, it isn't clear that we should presume that each rural household is a potential user of one landholding. Within an agricultural household there may exist several nuclear family units, each of which could be thought of a potential holder of land. Alternatively, it might be more correct to presume that each person over a certain age in a household could be a potential landholder. In both cases the number of rural households undercounts the potential number of landholders. Finally, the data on rural households is so limited it precludes any meaningful analysis of the cross-country data.

These concerns lead us to our second proxy for potential number of landholders. This is the economically active agricultural population (EAAP), obtained from the FAO. This is the

[3] We only matched observations between the UN household data and FAO holdings data if the observations took place within less than 6 years of each other. Adding further observations would require matching observations more than ten years apart in time.

[4] For example, a rural household could be involved in commerce or small-scale manufacturing. By the same token, households in areas classified as urban could work on truck farms.

intersection of estimates by the FAO of the economically active population and the agricultural population. The economically active population includes all employed and unemployed persons, as well as those who are self-employed or working unpaid for family enterprises. The agricultural population is defined as all persons who depend for their livelihood on agriculture, hunting, fishing, or forestry. It may over count the number of people who would be potential holders of land because its definition extends beyond strict agriculture.

We begin by making the simple assumption that each economically active agricultural person is a potential landholder. This has a more intuitive association than number of households. It also does not have the potential problems that the rural household data does. This is an estimate of the agricultural population, not the rural population. It does not depend on the household arrangements of the economically active population. Finally, it is available on a yearly basis for a wide number of countries, allowing us to proceed with a cross-country comparison.

In Table 2 we have constructed the ratio of number of holdings to the EAAP in the final column. For the developing countries, the average is 0.44 and for every country except Jordan the ratio of holdings to EAAP is lower than the ratio of holdings to rural households. Thus, the number of economically active agricultural workers is larger than the number of households. For the developed countries the average of holdings to EAAP is 0.71 and this is higher than the ratio of holdings to rural households except in Japan in 1975. In the rich countries, then, there are fewer economically active agricultural workers than there are rural households. This would to indicate the presence of rural households with no ties to agriculture, a phenomenon that seems likely to be more prevalent in the highly developed countries.

We will proceed with using the EAAP as our measure of the potential number of landholdings within a given country in a given year. Combining this with the data on number of holdings we can construct the holdings to EAAP ratio for 220 observations from the DS dataset on landholding inequality. Table 3 summarizes this data with averages given for each of seven regions and for the four rounds of FAO Censuses. From the table we note that the ratio of holdings to EAAP seems to be rising across the whole sample over time, indicating a greater

availability of landholdings to economically active agricultural workers. This trend holds for all the individual regions except Sub-Saharan Africa and South Asia.

Comparing this data on the breadth of landholding to the DS data on the concentration of holdings themselves there is an interesting juxtaposition. Those regions identified as having the most equitable distribution of landholdings by DS were Sub-Saharan Africa and East Asia. These regions have the lowest ratio of holdings to EAAP according our data. So while the holdings themselves show little variation in size, there are generally fewer holdings per worker than in other areas. In contrast those regions identified by DS with the worst distribution of agricultural holdings, Latin America and Eastern Europe, have some of the highest ratios of holdings to EAAP. In what is likely not a coincidence, the OECD countries tend to have both low inequality of landholding size according to DS as well as relatively high levels of holdings per EAAP.

This suggests that the holdings per EAAP measure is not simply a proxy for the DS landholding Gini. This can be seen more clearly in Figure 1, which plots holdings per EAAP against the DS landholding Gini. It is apparent from the figure that there is no clear relationship between the two measures of land inequality.

One item that does deserve mention is the fact that there are several observations of holdings per EAAP above one. In other words there are more holdings than economically active agricultural workers.[5] The number of holdings measured by the FAO is the number of operational holdings, and it is certainly not impossible that single agricultural workers may operate more than one holding. In the work that follows, we check the robustness of our results by excluding these observations, on the premise that it may indicate a faulty estimate of either the number of holdings or the EAAP. However, we find nothing that indicates the data quality of these countries is any different than the other members of the sample.

[5] In particular, there are twelve such observations. Spain (1989), Martinique (1989), Guadeloupe (1989), Italy (1982, 1990), Barbados (1961, 1989), Czechoslovakia (1970), Czech Republic (1990), and Malta (1960, 1969, 1979)

Therefore, the EAAP appears to be a decent measure of the potential number of landholders within a country and we proceed with the analysis of the role of land inequality by incorporating this measure of landholding into the existing Gini coefficient estimates.

B. The Modified Gini Coefficient

The derivation of a modified Gini is best begun by examining the measure employed by DS. Figure 2 shows the standard diagram used in the calculation of the Gini without the landless included.

The distribution of land by share is described by the Lorenz Curve. The landholding Gini of DS uses the distribution of number of holdings and area of holdings to create an estimate of the Lorenz curve. Having calculated the Lorenz curve, they then find the associated Gini coefficient. This Gini - G_{DS} - is defined, as according to Figure 2, as

$$G_{DS} = \frac{A}{A+B} \tag{1}$$

which can be conveniently rewritten as

$$G_{DS} = \frac{(A+B)-B}{A+B} \tag{2}$$

The area A+B is, given the normalizations in the diagram, simply equal to one-half. That results in the following equation for G_{DS}

$$G_{DS} = 1-2B \tag{3}$$

This G_{DS} measure the inequality of holding size over all holdings. We would like a modified Gini that measures the inequality of holding size over all potential landholders. What this means is that we need to rescale the Lorenz curve diagram to account for the fact that there are some number of landless people. This modified diagram is seen in Figure 3. The Lorenz curve is now flat from zero up to $1-\frac{\#Hold}{EAAP}$ which measures the share of potential landholders without land. From $1-\frac{\#Hold}{EAAP}$ to one, the Lorenz curve is identical to the one found in Figure 2.

The overall Gini coefficient, G_{OV} is then simply defined as

$$G_{OV} = \frac{A+C}{A+B+C} \tag{4}$$

Noting that $A+B+C$ is simply equal to one-half, after some algebra we can write

$$G_{OV} = 2(A+B)\frac{A+C}{(A+B)+C} \tag{5}$$

From (1) we have an expression for $\frac{A}{(A+B)}$ and by simple geometry we know that $C = \frac{1}{2} - (A+B)$. Substituting these into (5) we can write

$$G_{OV} = 2(A+B)G_{DS} + 1 - 2(A+B) \tag{6}$$

The area $(A+B)$ is equal to $\frac{1}{2}\left(\frac{\#Hold}{EAAP}\right)$ and that allows us to reduce (6) to the following expression

$$G_{OV} = \left(\frac{\#Hold}{EAAP}\right)G_{DS} + \left(1 - \left(\frac{\#Hold}{EAAP}\right)\right) \tag{7}$$

Equation (7) shows that the overall Gini coefficient can be viewed as a weighted average of G_{DS} and one. The weighting is based on our proposed measure of $\frac{\#Hold}{EAAP}$ and so the overall Gini is a simple modification of the existing landholding Gini of DS. Using our data we are able to calculate G_{OV} for each observation. It is this G_{OV} that we will use primarily in the following sections to address the influence of overall land inequality on economic development and growth.

Figure 4 plots G_{OV} against G_{DS}. As can be seen there is a general tendency for G_{OV} to be higher than G_{DS}, except for those twelve observations in which holdings per EAAP is actually greater than one. The adjustment to G_{DS} is stronger for those observations with an initially low G_{DS}, as expected.[6] The mean of G_{OV} is 0.81 with a standard deviation of 0.14. The mean of G_{DS} is 0.65 with a standard deviation of 0.17. The higher average value of G_{OV} is also associated with a smaller dispersion of observations than with G_{DS}. So variation in land inequality across countries is lower when we account for the landless, excepting several European countries in which $\frac{\#Hold}{EAAP} > 1$.

[6] To see this, note that if G_{DS}=1 then G_{OV} reduces to one as well. The number of landless people is meaningless in a case where all land is held by a single person (technically by a share of people that is of measure zero).

III. LAND INEQUALITY AND FINANCIAL DEVELOPMENT

Using our updated measure, we now address the question of whether land inequality exerts any influence on the development of the financial sector across countries. We have multiple observations of G_{OV} for many countries, however, we generally have only a single observation available for the financial variables. This leaves us with the issue of selecting exactly how to generate a G_{OV} observation. We follow Deininger and Squire in choosing to use the earliest available observation of land inequality as our base observation. We limit our observations to those countries for which the earliest observed G_{OV} comes from before 1980. We do this because we are interested in initial land inequality and its effect on financial development. In addition, because the financial variables are generally averages over the time frame of 1980-1995, this will give us some confidence that the regressions are not biased by endogeneity, although we return to that subject in more detail later.

In line with much of the other literature on the deeper sources of modern economic outcomes, we focus on the subset of countries outside of the original industrializing nations of Western Europe. This limits the sample to at most 54 countries, once the various sets of data are brought together.

A. Simple Connections: OLS Regressions

Our first step is to establish that there is in fact a connection between land inequality and financial development. To proceed, we need to define more clearly what is meant by financial development. Following Levine (97), we will focus on a broad measure of financial depth, namely the size of liquid liabilities relative to GDP. The measure of liquid liabilities varies from 8% (Zaire) to 168% (Japan). This data and all other data are described in more detail in the appendix, and summary statistics are available in Table 1.

The results of OLS regressions in Table 1 show a robust relationship of land inequality to financial depth. Column (1) shows the strong correlation of the G_{OV} measure developed in this paper to the liquid liabilities measure. This relationship is robust to the inclusion of controls for institutions in column (2) as well as further country characteristics in column (3). The size of this effect is substantial. Using the estimated coefficient on G_{OV} in column (3), a decrease in G_{OV} from Uruguay's value (0.93, or the 75th percentile) to Indonesia's value (0.81, or the 25th percentile) is associated with an increase in liquid liabilities as a percent of GDP of 0.17.

These results can be contrasted with those using the original G_{DS} measure, columns (4)-(6). In this case there is no apparent connection of financial depth and land inequality. The fact that the results differ so distinctly between the measures indicates that the additional inequality captured by our measure is highly relevant for the development of financial markets. Leaving aside the actual distribution of farm sizes, the number of farms relative to the size of the agricultural population appears to have a significant impact on financial depth. This provides some support for the theories that suggest that the availability of collateral is of importance for access to financial markets. It also suggests that reforms that allocate farms more widely could have positive effects on financial development.

Aside from the overall depth of the financial system, we also consider whether land inequality has had an influence on the type of financial system developed. To address this, we utilize three different measures of the financial system more specific than the liquid liabilities measure. The first is claims on the private sector by banks as a share of GDP. This captures the absolute size of the banking sector relative to the economy. In Table 5, column (1) we see that land inequality is negatively associated with the size of the banking sector. This matches with the previous result on liquid liabilities. As land inequality increases, the size of the banking sector, as well as the depth of the financial system in general, decreases.

Second, we use claims on the private sector by all financial institutions, also as a share of GDP. In column (2) of Table 5 we find that there is only a weakly negative relationship. So while claims by the banking sector are closely associated with land inequality, total claims are not.

This seems to indicate that land inequality is not closely associated with other forms of financial intermediation besides banks. **[Nope, this is public vs. private bank credit. LE]**

Finally, we use deposit bank assets relative to total financial assets in the economy. In column (3) of Table 5 we find a slightly significant positive relationship with land inequality. Putting all these results together, it appears that while land inequality keeps the size of the financial system small, it also skews that financial system more towards a bank-based system.

Table 5 also includes in columns (4)-(6) a replication of the previous results, but now using the G_{DS} measure of land inequality. In contrast to the results for liquid liabilities, this shows a similar pattern and significance as when G_{OV}. So while the overall depth of the financial system appears more related to inequality in the allocation of farms across the agricultural population, it appears that the distribution of land across farms has an influential role on the level of bank credit relative to the size of the economy.

One concern with the interpretation of these results is that the measure of land inequality is simply a proxy for income inequality. Thus, the results cannot be used to say definitively that land inequality matters for financial development. To address this, we include a Gini coefficient for income inequality from Deininger and Squire (1998) in the specifications. The results of this are in Table 6. The four columns of this table show regressions of the four different measures of financial development on G_{OV}, the Gini for income distribution, and the full set of controls used in prior regressions. Limited data means that the sample is now only 41 countries.

In column (1) the estimated coefficient on G_{OV} is no longer significant, but note that the point estimate matches quite closely with that from Table 4, column (3). So the introduction of income inequality has not materially impacted the size of the effect of land inequality on the level of liquid liabilities in the economy. Columns (2) and (3) show that controlling for income inequality actually highlights an even more powerful connection between land inequality and both the relative size of bank credit and the relative size of claims on the private sector. The point estimate on G_{OV} is much higher in these regressions than is found in Table 5 columns (1) and (2), respectively.

Interestingly, the point estimate for income inequality is found to be significantly positive in columns (2) and (3) of Table 6. Thus there is evidence that increases in income inequality are associated with more expansive financial systems. This positive connection is consistent with stories of development that suggest richer individuals have higher marginal propensities to save.

The final column of Table 6 shows that there is no significant relationship between bank deposits as a percent of total financial assets and land inequality, in contrast to the finding in Table 5, column (3). However, the limitations on the data mean that this regression includes only 32 data observations, limiting our ability to make any strong conclusions.

Overall, the OLS regressions show that G_{OV} has a significant relationship with overall financial depth across economies, with additional evidence that land inequality is associated with bank-based financial systems. This relationship is robust to the inclusion of legal origins and institutions in the specifications, two factors commonly associated with financial development in the literature. The evidence here does not indicate how land inequality may be influencing financial development, but points us towards the importance of studying the link between these two factors.

B. Endogeneity of Land Inequality

A general concern in this type of analysis is the possible endogeneity of the explanatory variables. In this case our main method of dealing with this is in the construction of the dataset. As noted previously, G_{OV} is taken as the earliest observed value from prior to 1980 for any given country. The financial variables we are using as dependent variables are averages over the period 1980-1995, so that G_{OV} is always observed prior to the dependent variable.

To further address the endogeneity of G_{OV} would require a valid instrument that plausibly has a causal effect on G_{OV} while having no effect on financial development. Naturally, there are not a plethora of candidates. Even so, the few potential instruments available all appear to be too weak to be useful. There are two primary candidates we have identified.

- Settler Mortality. This comes from the work of Acemoglu et al. (2001) and has been used often as an instrument for institutions themselves. Their premise is that the disease environment at the time of colonization is closely related to the type of institutions imposed by the colonizer. It seems possible that land inequality may have been similarly influenced, with countries with high mortality to settlers imposing high land inequality because they did not settle broadly. This relationship, though, is not borne out in the data. A simple regression of G_{OV} on the log of settler mortality for the existing sample results in an F-statistic of only 0.12, with a p-value of 0.73.

- Crop/Mineral Dummies. These were developed by Easterly and Levine (2003) as instruments and controls for regressions concerning institutional quality. Following the research of Engerman and Sokoloff (1997), it would seem plausible to think that there is a connection of land inequality to the type of agriculture and mining done. In places with endowments conducive to the production of plantation crops or point-specific mineral resources, ES conjecture that the elite would have instituted a severely unequal system of both property rights and political rights in order to maintain their control over the resources. Thus we might expect that the type of crops or minerals present in the economy determined land inequality. However, we have found no case in which a first-stage regression including the crop/mineral dummies as exogenous instruments provides a p-value for the F-test of less that 0.40. Any second-stage results based on this has essentially no meaning.

Without any clear instrument available, we fall back to the position that the temporal ordering of the independent and dependent variables provides a level of control for endogeneity that allows us to at least tentatively conclude that land inequality has a significant influence on the level of financial development within developing countries. While we cannot be entirely confident that this connection is causal, the results are consistent with the implications of development theory and the broader connections of finance and inequality outlined by Chakraborty and Ray (2005). Indeed, these findings point to the potential for land inequality to be used as an instrument in its own right.

C. Land Inequality as a New Instrument for Financial Depth

The work of Beck, Levine, and Loayza (2000) and Levine, Loayza, and Beck (2000) addressed the causality of financial intermediation on economic growth. Their methods were based on using the legal origins data from La Porta et al. (1997) as an instrument for financial depth in addition to dynamic panel methods. They conclude that there is a strong causal link running

from financial depth to economic growth. This paper has established land inequality as another potential instrument for financial depth. The question we now pose is whether the use of land inequality as the instrument for financial depth has any material impact on the connection between finance and economic development.

We address this question by looking at simple regressions of the log of income per capita in 1995 on different measures of financial depth. We use the level of income per capita as our dependent variable both because it is closely correlated with growth rates, and because it links this work with other research on the fundamental determinants of income levels (e.g. Acemoglu et al. (2001) and Easterly and Levine (2003)).

In comparing the use of legal origin and land inequality as instruments, we need to consider the purpose of instrumental variables in this situation. There is a clear positive relationship between financial depth and income levels across countries. For a visual example, consider Figure 5, which plots the log of GDP per capita against liquid liabilities as a percent of GDP. Alternatively, consider the first row of Table 7. Here, we present the estimated coefficient on three different financial variables in un-instrumented (OLS) regressions on log GDP per capita, without any other controls included. In each case, there is a highly significant, positive relationship.

This evidence, though, does nothing to prove whether an increase in financial depth would *cause* income to go up. To parse out the causal role of financial depth, it is necessary to use instrumental variables, which capture the exogenous variation in financial depth. Using these instruments in 2SLS regressions will potentially have two impacts: the size of the estimated coefficients and their significance. Often, 2SLS regressions are used to establish that the explanatory variable has a significant causal impact on the dependent variable. While we will examine any changes in the significance level of the financial variables, we focus more on the changes in the coefficient estimate obtained when using different instruments. These will indicate any changes in the strength of the finance and development link, aside from questions of significance.

To proceed, we regress log GDP per capita in 1995 on the various measures of financial depth, using different sets of instruments for finance. We do not include any other control variables in these regressions. The exclusion of other controls means that we are examining the reduced form relationship of finance and development, something we do because we are interested in how the coefficient on finance changes, not necessarily in the precise magnitude of the estimated coefficient.

Row 2 of table 7 shows the results of three different 2SLS regressions in which legal origin is used as the instrument for liquid liabilities as a percent of GDP, bank credit as a percent of GDP, and private credit as a percent of GDP. In each case, we see a highly significant causal relationship running from finance to income. For both liquid liabilities and bank credit, the coefficient has risen over the comparable OLS regression in row 1, indicating that the OLS regression underestimates the role of finance in creating income. For private credit, the coefficient falls, although only slightly, indicating that the OLS regression overestimated the causal role of finance on income.

Consider row 3, in which our land inequality Gini is used as the instrument for financial development. In each case the coefficient on the finance variable has fallen to one-third of the values in row 2. In addition, the significance of the finance variables has fallen well below the 10% significance level. Due to the small sample size, we can’t say that this shows finance has no causal affect on income levels. However, the severe drop in the estimated coefficients shows that the size of the impact that finance can have is much smaller than previously thought.

As an example, consider the predicted effect of a one standard deviation increase in liquid liabilities as a percent of GDP (i.e. an increase of 27%). According to the estimate in row 2, using legal origins as an instrument, this would imply a doubling of GDP per capita. However, when land inequality is used as an instrument, the same change in liquid liabilities would only imply income rising by 24%. This is a significant change in the size of the effect of finance on income levels.

Given these results, it is natural to ask what happens when both instruments are used. In row 4 of table 7 we present 2SLS regressions where both legal origin and land inequality are used as instruments for financial depth. In all three cases, the estimate is now significant again, but the coefficient size is smaller than the coefficient when only legal origin is used, and smaller than the OLS estimates. The conclusion holds that when land inequality is used as an instrument, the implied causal role of finance on income is reduced in size.

Including two instruments means that the regression is over-identified and this may be falsely inflating the role of the financial variables. We perform the Sargan test of over-identifying restrictions, and the results are presented below row 4 for each regression. In no case can we reject the use of the two instruments.

We find ourselves with two possible instruments for financial depth, yielding different answers as to the role of finance in income per capita. One possible reason for land inequality giving such a different estimate is that its power as an instrument is low, and that therefore the 2SLS estimates are misleading. Table 8 shows the first stage regression results for each financial variable under the three different instrument sets. Row 1 indicates that legal origin is a robust instrument, with the F-statistic of these regressions being high enough to indicate significance of the first stage regressions at well under 1%. Yet row 2 shows that the land inequality regressions in the first stage are just as strong, if not stronger. The R-squared of the two sets of regressions are comparable, with land inequality explaining a somewhat higher proportion of the variation in the financial variables.

Row 3 shows the first stage regression when both instruments are included, and this shows the higher R-squared expected, and a slightly lower F-statistic. There seems to be nothing in these first stage regressions to indicate a preference for one instrument over the other, as both have a significant ability to explain variation in financial depth.

The conclusion that can be drawn, though, from these regressions is that land inequality offers additional information on the exogenous variation in financial depth. From the second stage

results in table 7, we know that this additional information decreases substantially the estimated causal role of finance on income levels.

We cannot say that finance has no link to income levels, but the results here indicate that the effect may be more muted than previously thought. On a broader level, the results show that our newly created land inequality data offers a new source of information on the fundamental reasons for variation in income per capita across countries, and that this data may be useful as an instrument in other types of analysis.

IV. CONCLUSION

The role of financial markets in economic development has been highlighted at both the micro and macro levels many times. Research at the country level has generally used legal origins as an exogenous source of financial structure variation. This paper looks back to the economic development literature to identify a second source of variation in financial structure, the distribution of land within a country.

To address this connection empirically, we developed a new measure of land inequality by country. Our measure expands upon the previous work of Deininger and Squire by including an explicit accounting for the distribution of land over the available population, including the landless. This new measure of land inequality is found to be significantly associated with measures of financial depth, a link that is not apparent when using the original Deininger and Squire data. The estimates suggest a substantial practical significance to the role of land inequality as well. Moving from the 75th percentile of land inequality down to the 25th percentile is associated with an increase in liquid liabilities as a percent of GDP of seventeen percentage points. The same change in land inequality is also associated with an increase in private credit as a percent of GDP of nearly 28 percentage points. Both these changes are equivalent to a full standard deviation increase in financial depth for this sample.

We then consider the correlation between land inequality and two popular instruments used in cross-country regressions: settler mortality and crop/mineral dummies. Finding that land inequality is uncorrelated with either, we employ land inequality direclty as an instrument for

financial depth. We find that financial depth instrumented on land inequality implies a weaker effect of financial development on income levels than indicated by previous research.

APPENDIX

Income per capita in 1995. This is the real chain-weighted value of GDP per capita taken from the Penn World Tables.

Institutions. From Kaufman et al. (1999), this is the average value of six different institutional indicators: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption.

Liquid Liabilities. This is from Levinede and Demirguc-Kunt (2001) (LD hereafter). This is measured as the ratio of liquid liabilities to GDP, averaged over 1980-1995.

Deposit Bank Assets (MBD/F). From LD. Ratio of deposit money bank assets to total financial assets in the economy.

Bank Credit (BC/Y). From LD. Claims on the private sector by deposit money banks as a share of GDP averaged over 1980-1995.

Private Credit (CPS/Y). From LD. Claims on the private sector by deposit money banks and other financial institutions as a share of GDP, averaged over 1980-1995.

Legal origins. From La Porta et al. (1997). These are separate dummy variables coded on the structure of the legal system in a country. The separate categories are: British, French, Scandinavian, German, and Socialist.

Fractionalization. From Alesina (2003). These are indices that describe the change that two randomly selected people within the country share the same characteristic. The three separate indices are: religious, linguistic, and ethnic fractionalization.

Latitude. Absolute latitude of the centroid of the country.

Landlocked. Dummy variable that indicates whether the country is landlocked (coded to one) or not (coded to zero). The landlocked countries are: Austria, Czech Republic, Hungary, Lesotho, Luxembourg, Mali, Nepal, Niger, Paraguay, Switzerland, and Uganda.

Crop/Mineral Dummies. Taken from Easterly and Levine (2003). These are a set of dummy variables that indicate whether a particular crop or mineral is produced at all within a given country. The specific crops and minerals are: bananas, coffee, copper, maize, millet, rice, silver, sugar, rubber, and wheat.

Log of Settler Mortality. Taken from Acemoglu et al. (2001). This measures the mortality rate (deaths per 1,000) of European settlers at the time of their colonization of a given country. The log is taken due to the very high variation in this data.

Income Gini. Take from Deininger and Squire (1998). This is the average of the "high-quality" observations of income Gini for each country in their dataset.

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Figure 1. Landholding Gini Coefficient vs. Holdings per EAAP

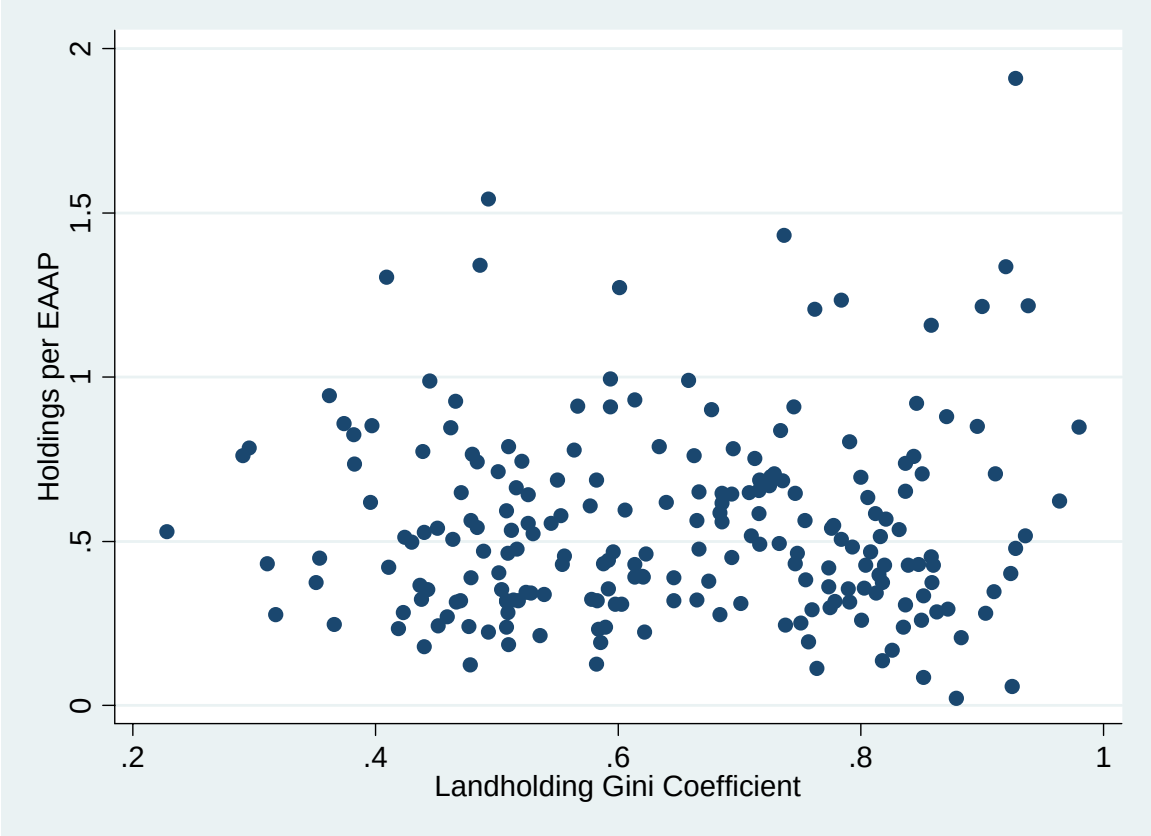

Figure 2. Gini Coefficient, Not Including Landless

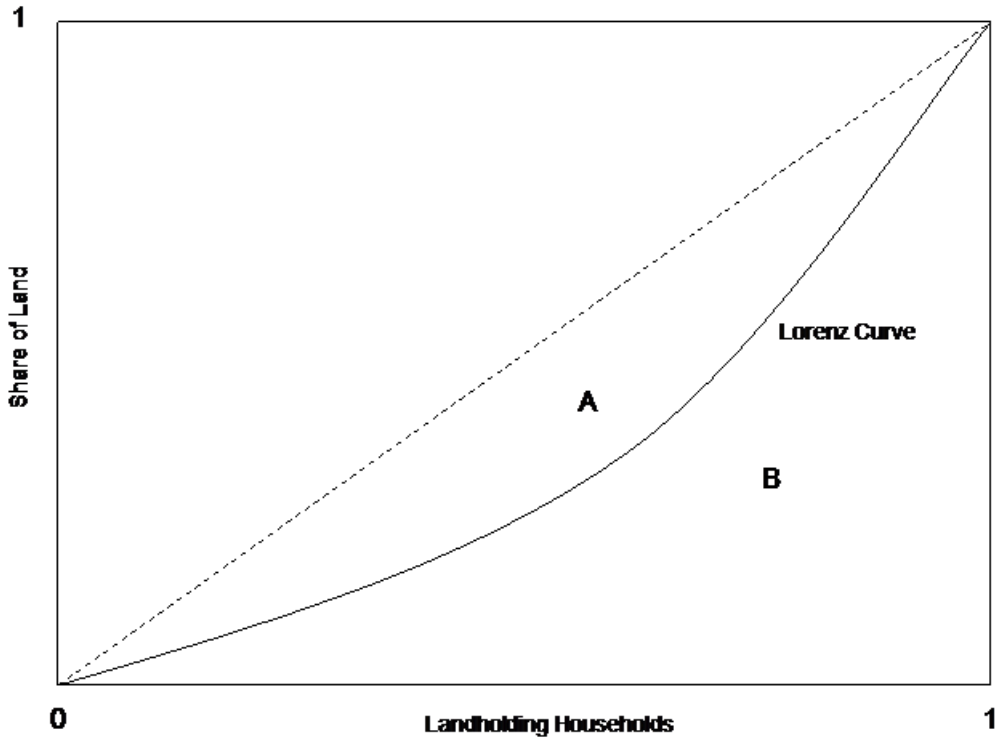

Figure 3. Gini Coefficient, Including Landless

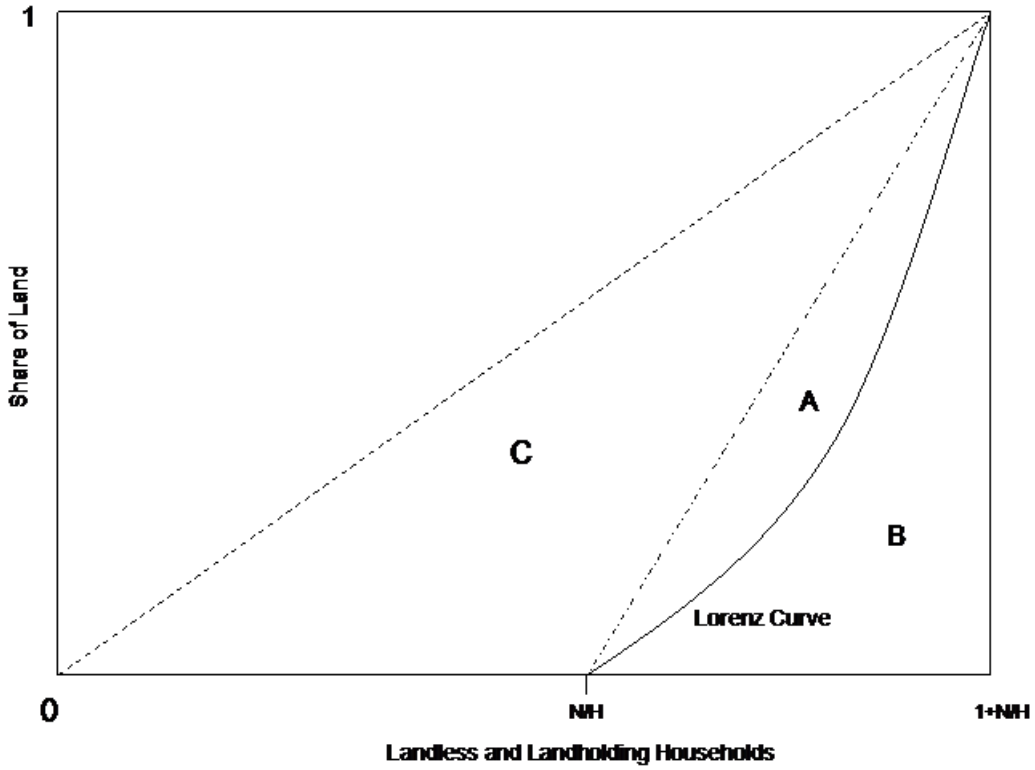

Figure 4. DS Landholding Gini Coefficient vs. Overall Land Inequality Gini

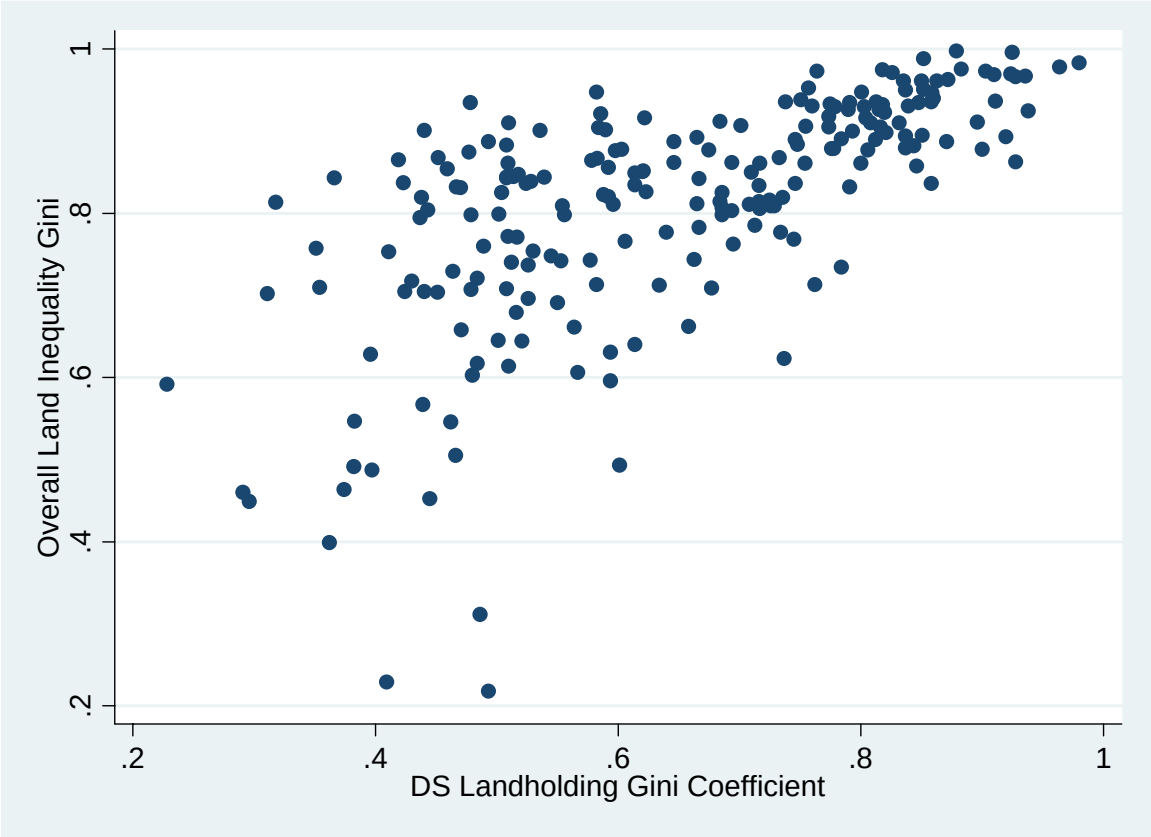

Figure 5. Log GDP Per Capita vs. Liquid Liabilities/GDP

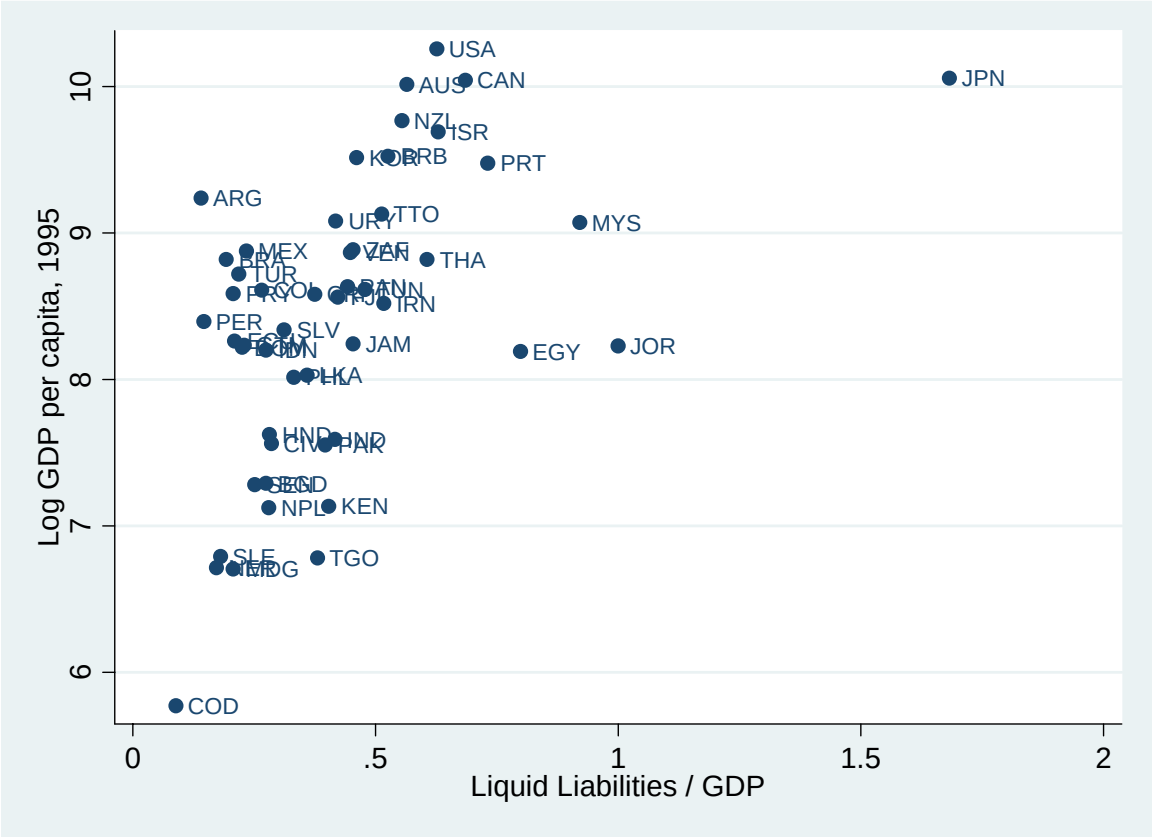

Table 1: Summary Statistics

Variable	Number	Mean	SD	Min	Max
G_{OV}	53	0.87	0.06	0.71	0.98
G_{DS}	53	0.69	0.16	0.32	0.94
Liquid Liabilities	53	0.42	0.27	0.09	1.68
Bank Credit/GDP	53	0.29	0.19	0.01	1.04
Claims Private Sector/GDP	53	0.39	0.31	0.01	1.69
Bank Deposits/GDP	37	0.6	0.12	0.31	0.82
Institutions	53	0.03	0.75	-1.98	1.53
Ethnic Fractionalization	53	0.48	0.26	0	0.91
Linguistic Fractionalization	53	0.38	0.32	0	0.9
Religious Fractionalization	53	0.41	0.26	0.01	0.86
Absolute Latitude	53	19.77	12.33	0	43.73
Income Gini	40	0.43	0.08	0.3	0.62

Table 2: Comparison of Actual Holdings to Different Measures of Potential Holdings

Country	Year	((Hold)/(# Rural HH))	((Hold)/(# EAAP))
Developing Countries			
Argentina	1980	0.34	0.26
Bangladesh	1981	0.54	0.23
Botswana	1991	0.75	0.36
Brazil	1980	0.74	0.33
Cyprus	1992	0.8	0.79
India	1981	0.91	0.39
Indonesia	1980	0.6	0.45
Israel	1983	0.79	0.59
Jordan	1979	0.49	0.62
Madagascar	1975	1.1	0.43
Namibia	1991	0.63	0.39
Nepal	1981	0.9	0.32
Pakistan	1980	0.45	0.21
Panama	1980	0.94	0.76
Philippines	1980	0.63	0.34
Poland	1978	0.7	0.53
Poland	1988	0.92	0.74
South Korea	1980	0.65	0.37
Uganda	1991	0.57	0.24
Uruguay	1985	0.64	0.36
Mean		0.7	0.44
Developed Countries			
Austria	1981	0.3	0.9
Canada	1986	0.15	0.58
Finland	1975	0.37	0.77
France	1975	0.35	0.76
France	1982	0.26	0.64
Japan	1975	0.79	0.51
Japan	1980	0.62	0.74
Japan	1985	0.5	0.82
Norway	1990	0.23	0.73
Switzerland	1990	0.14	0.54
Mean		0.38	0.71

Number of holdings is from FAO Agricultural Census (various years).
Number of rural households is from UN Population Yearbooks, vol. 39 (1987) and vol. 47 (1995).
Number of economically active agricultural population (EAAP) is from FAO.

Table 3: Decadal Means of Holdings per EAAP, by Region, 1960-1980

Region	1960	1970	1980	1990	All
Sub-Saharan Africa	0.337	0.0394	0.314	0.276	0.339
South Asia	0.351	0.427	0.355	0.292	0.352
East Asia / Pacific	0.375	0.4	0.416	0.542	0.41
Middle East & North Africa	0.434	0.308	0.468	0.308	0.416
Latin America	0.452	0.475	0.536	0.719	0.527
OECD and High Income	0.654	0.684	0.727	0.722	0.697
Eastern Europe	0.523	0.783	0.847	1.335	0.842
All	0.484	0.535	0.557	0.627	0.542

Regions are ordered by value in 1980.
Data are from authors' calculations described in text.

Table 4: Land Inequality and Financial Depth

	Dependent Variable: Liquid Liabilities / GDP					
Explanatory Variables 1/	(1)	(2)	(3)	(4)	(5)	(6)
G_{OV}	-1.74**	-1.36**	-1.44**			
	(2.39)	(2.17)	(2.06)			
G_{DS}				-0.23	-0.39	-0.4
				(0.75)	(1.48)	(1.22)
Institutions		0.18**	0.17*		0.22**	0.20*
		(5.05)	(3.25)		(4.46)	(3.89)
French legal origin			-0.07			-0.07
			(1.23)			(1.17)
Fractionalization 2/			0.32			0.03
			(0.81)			(0.99)
Absolute latitude			0.002			-0.002
			(0.77)			(0.51)
Landlocked			-0.08			-0.07
			(1.12)			(0.82)
Constant	1.95**	1.61**	1.85**	0.58**	0.69**	0.39**
	(2.99)	(2.88)	(2.66)	(2.5)	(3.47)	(2.23)
R^2	0.17	0.41	0.43	0.02	0.38	0.4
Observations	54	54	53	53	53	52

1/ Absolute values of robust t-statistics are given in parentheses.
* denotes significance at 10%, ** denotes significance at 5%.
2/ Test statistic and p-value of F-test for joint significance of ethnic, linguistic, and religious fractionalization is included.

Table 5: Land Inequality and Other Measures of Financial Structure

	Dependant Variables					
Explanatory Variables 1/	Bank Credit/ GDP (1)	Claims on Private Sector/ GDP (2)	Money Bank Deposits/ Assets (3)	Bank Credit/ GDP (4)	Claims on Private Sector/ GDP (5)	Money Bank Deposits/ Assets (6)
G_{OV}	-0.86**	-1.06	0.66*			
	(2.31)	(1.64)	(1.81)			
G_{DS}				-0.37**	-0.49	0.22
				(2.17)	(1.62)	(1.47)
Institutions	0.18**	0.22**	0.09**	0.19**	0.23**	0.09**
	(4.41)	(3.53)	(2.21)	(4.3)	(3.43)	(2.03)
French legal origin	-0.003	-0.09	-0.01	0.01	-0.07	-0.003
	(0.09)	(1.28)	(0.2)	(0.22)	(1.1)	(0.04)
Fractional-ization 2/	0.72	0.26	0.68	0.28	0.55	0.76
	(0.54)	(0.85)	(0.57)	(0.84)	(0.65)	(0.53)
Absolute latitude	-0.001	0	0	0	0	0
	(0.35)	(0.04)	(0.07)	(0.14)	(0.21)	(0.09)
Landlocked	-0.08	-0.07	-0.05	-0.08	-0.08	-0.06
	(1.82)	(0.99)	(0.98)	(1.29)	(0.82)	(0.8)
Constant	1.05**	1.35**	0.07	0.53**	0.73**	0.5
	(2.75)	(2.04)	(0.18)	(2.86)	(2.21)	(3.07)
R^2	0.58	0.54	0.27	0.58	0.55	0.23
Observations	53	53	38	52	52	37

1/ Absolute values of robust t-statistics are given in parentheses.
* denotes significance at 10%, ** denotes significance at 5%.

2/ Test statistic and p-value of F-test for joint significance of ethnic, linguistic, and religious fractionalization is included.

Table 6: Land Versus Income Inequality and Financial Development

	Dependent Variable:			
	Liquid Liabilities / GDP	Bank Credit / GDP	Claims on Private Sector / GDP	Money Bank Dep. / Assets
Explanatory Variables 1/	(1)	(2)	(3)	(4)
G_{OV}	-1.33	-1.43**	-2.31**	0.24
	(1.26)	(2.41)	(2.31)	(0.59)
Income Gini	0.08	0.62*	1.23**	0.09
	(0.17)	(1.77)	(2.49)	(0.33)
Institutions	0.17**	0.17**	0.24**	0.08*
	(2.48)	(3.45)	(3.48)	(1.83)
French legal origin	-0.16*	-0.07	-0.16*	-0.04
	(1.85)	(0.96)	(1.71)	(0.74)
Fractionalization 2/	1.16	0.50	0.03	2.54*
	(0.34)	(0.69)	(0.99)	(0.08)
Absolute latitude	-0.002	-0.001	-0.001	-0.001
	(0.46)	(0.45)	(0.26)	(0.6)
Landlocked	-0.17**	-0.08*	-0.05	-0.07
	(2.3)	(1.84)	(0.84)	(1.05)
Constant	1.79**	1.36**	1.99**	0.46
	(2.02)	(2.75)	(2.36)	(1.48)
R^2	0.42	0.57	0.61	0.21
Observations	41	41	41	32

1/ Absolute values of robust t-statistics are given.
* denotes significance at 10%, ** denotes significance at 5%.

2/ Test statistic and p-value of F-test for joint significance of ethnic, linguistic, and religious fractionalization is included.

Table 7: GDP Per Capita and Financial Depth, Instrumented on Land Inequality

2SLS Regressions on log GDP per capita, 1995

		Explanatory Variables: 1/		
Instruments		Liquid Liabilities /GDP	Bank Credit /GDP	Private Credit /GDP
1 None		1.94**	3.19**	2.12**
		(0.45)	(0.57)	(0.34)
2 Legal Origin		2.65**	3.8**	1.97**
		(1.21)	(1.58)	(0.77)
3 Land Gini		0.80	1.09	0.68
		(1.18)	(1.58)	(0.96)
4 Legal Origin		1.65*	2.23*	1.38**
Land Gini		(0.94)	(1.23)	(0.67)
Sargan OID	test statistic	1.88	2.32	1.78
	p-value	0.17	0.13	0.18

First Stage Regressions

		Endogenous Variable:		
Instruments		Liquid Liabilities /GDP	Bank Credit /GDP	Private Credit /GDP
1 Legal Origin	F-statistic	7.85	7.21	11.02
	p-value	<0.01	<0.01	<0.01
	R-squared	0.14	0.13	0.19
2 Land Gini	F-statistic	9.05	9.32	9.46
	p-value	<0.01	<0.01	<0.01
	R-squared	0.16	0.16	0.16
3 Legal Origin	F-statistic	6.90	6.74	8.55
Land Gini	p-value	<0.01	<0.01	<0.01
	R-squared	0.23	0.22	0.27

1/ Absolute values of robust t-statistics are given. **?????**

* denotes significance at 10%, ** denotes significance at 5%.