

Inequality and Democratization

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Scholars continue to grapple with the impact of economic development on democratisation; prominent recent research has focused on the effects of economic inequality. Acemoglu and Robinson (2001, 2006) argue that democratisation is likelier when inequality is at middling levels, while Boix (2003) suggests that democratisation is likelier when inequality is low. Both assume that democratisation is a function of autocratic elites' fear of the extent to which a future median voter would redistribute under different levels of inequality. Drawing on contractarian political theory, we suggest that democratisation is instead a function of demands by rising economic groups for protection from the state. This alternative approach suggests that land and income inequality impact democratisation differently, and generates counterintuitive predictions about the relationship between income inequality and democratisation: Autocracies with unequal *land* distribution are *less* likely to democratise, while autocracies with high *income* inequality are *more* likely to democratise.

1. Introduction

Recent research on the origins of democracy continues to scrutinise the core idea behind modernisation theory, that economic development somehow generates pressure to liberalise non-democratic regimes. While some have sought to dismiss this hypothesis once and for all,¹ others find renewed support for the argument's fundamental claim. In particular, recent books by Daron Acemoglu and James Robinson and Carles Boix have offered new theoretical twists on long-established arguments.² Both sets of authors shift the theoretical focus from the effect of the *level* of wealth to that of the *distribution* of wealth on elites' incentives to block democratisation. Boix predicts that inequality and democratization are negatively related, while Acemoglu and Robinson predict an inverted U-shape relationship between inequality and democratization: transitions are likeliest at moderate levels of inequality, with autocracy likelier at the lowest and highest levels of inequality. These books have helped explain regime change by identifying how economic inequality impacts dilemmas of commitment and credibility underlying interactions between social groups.

In this paper we build on these efforts to connect economic inequality to democratisation. However, we begin from fundamentally distinct theoretical premises. Both Boix and Acemoglu and Robinson assume that regime change is driven by autocratic elites' fear of the relative costs of redistribution under democracy: When inequality is high, elites have more to fear from the future median voter. In contrast, when inequality is low, the median voter will demand less redistribution. In our view regime change is not a function of autocratic elites' fear that the poor and middle classes would expropriate their assets under democracy. It is instead a function of disenfranchised yet rising economic groups' struggles to obtain credible commitments against

expropriation of *their* income and assets by the autocratic elite. This suggests transitions are often a function of intra-elite conflict, rather than of a monolithic elite's fear of the poor.

This argument draws on classic insights from contractarian political theory and the neo-institutional theory of the state, particularly works by North and Weingast, and Olson.³ It also leverages a theoretically more nuanced view of the economy and inequality. We argue that theories of democratization should take account of differential growth rates across economic sectors, thereby distinguishing between inequality in fixed assets such as land, predominantly owned by the ruling elite in autocracy, and inequality produced by growing sectors like industry, which often obtains to rising economic groups who lack political representation under autocracy. Our argument thus highlights the political tensions following from the emergence of groups whose political power does not match their economic power. This distinct theoretical starting point suggests that income and land inequality impact democratisation differently. Specifically, land *equality* and income *inequality* should both positively effect democratisation. Though these predictions clash with the expectations of Acemoglu and Robinson and Boix, quantitative analysis supports our approach.

The next section reviews recent scholarly efforts to specify the relationship between economic inequality and democratisation, and explains how our theoretical approach differs. We then develop a formal model of regime change that distinguishes among types of inequality and the incentives facing three groups of political actors. The fourth section provides a broad series of empirical tests, using two inequality datasets and a variety of measures of democratic transitions. We find consistent support for a negative relationship between land inequality and democratisation and a positive relationship between income inequality and democratisation.

2. Democratisation: Demand for Redistribution or Demand for Protection?

Two important recent books have reexamined the relationship between inequality and democratisation. Building on Meltzer and Richard's theory of redistributive politics, and earlier work by Acemoglu and Robinson, Carles Boix suggests that under autocracy elites fear the threat of redistribution less when the future median voter under democracy has an income similar to their own.⁴ Thus, under conditions of equality elites have little to fear from liberalisation. Boix also suggests that democratisation is more likely when elites hold mobile assets since they can shield their wealth from the threat of taxation. Boix's theory boils down to the proposition that elites democratise when the threat to their assets from redistribution by the poor is low.

Daron Acemoglu and James Robinson agree with Boix regarding asset-specificity, but hypothesize that a more complex relationship between inequality and democratization exists: the relationship takes the form of an 'inverted-U'.⁵ Like Boix, Acemoglu and Robinson (henceforth A&R) argue that under conditions of inequality elites fear redistribution and choose to repress rather than democratise. Yet in contrast to Boix, A&R argue that democratisation is also unlikely under conditions of equality, in this case because there is little *demand* for economic redistribution. They therefore predict that at "middling" levels of inequality the probability of democratisation will be highest. In such situations, the rich and other classes compromise. Elites are under some pressure to liberalise, yet because the poor do not pose the same redistributive threat as they would under very high inequality, the elite accept the moderate levels of redistribution that accompany democratisation rather than pay the cost of repression under continued autocracy.

Our theoretical understanding of the relationship between inequality and democratisation differs in two key ways from both Boix and A&R: (1) in terms of which social actors are driving

regime transitions and expropriating from each other; and (2) in terms of the nature of economic inequality. First, Boix and A&R assume that regime change is driven by autocratic elites' evaluation of their expected losses from redistribution under democracy. We suggest that this approach has things backwards. In our view, democratization is best understood as a struggle on the part of disenfranchised groups to obtain credible commitments against expropriation of *their* income and assets by incumbent elites. This argument draws on classic insights from contractarian political theory and from what scholars today call the neoclassical theory of the state.

Ever since Thomas Hobbes, political theorists have noted the need for a "Leviathan" to resolve the potential problem of predation by one private party against another. Of course, these same theorists understood that the Leviathan could itself become the predator. For example, both James Madison and John Stuart Mill expressed concern about the tension between effective government and limited government, inferring that a government powerful enough to control citizens would also threaten citizens' liberty.

Contemporary scholarship draws upon these insights to make fundamentally similar points. Thus Douglas North's "neoclassical theory of the state" and Mancur Olson's conception of the state as a "stationary bandit" both begin from a similar premise: a government powerful enough to enforce contracts between citizens and prevent violations of property rights is also a potential threat to those same contracts and property rights.⁶ Under autocracy, governments frequently set up institutions that deny citizens' rights - to life, liberty, *and* property. Olson writes, "History provides not even a single example of a long and uninterrupted sequence of absolute rulers who continuously respected the property rights of their subjects," while democracies are "the only societies where individual rights to property and contract are

confidently expected to last across generations”.⁷ North thus famously suggested that democratisation is a story of the struggle to gradually extend third-party enforcement of contracts and property rights in order to “eliminate the capricious capacity of a ruler to confiscate wealth, and to develop third-party enforcement of contracts”.⁸ More generally, autocracies cannot credibly commit *not* to expropriate citizens’ wealth.

The question remains how democratisation comes about. For North, although economic exchange typically involves agreements reached within the existing set of political institutions, democratisation occurs because occasionally “the players find it worthwhile to devote resources to altering the more basic structure of the polity to reassign rights”.⁹ When self-interested socio-economic actors seek to change the rules of the game, by changing the regime itself, the outcome depends on changes in the relative bargaining strength of the relevant actors—a process we detail below.¹⁰ Most simply, rising economic groups’ newfound wealth improves their ability to successfully change the regime so as to prevent expropriation.

This approach differs fundamentally from those of both Boix and A&R: here, democratisation is not about whether the median voter is going to soak the rich; it is about whether *all* citizens, but particularly rising economic groups, can obtain impartial protections against violations of contracts and property rights. Democracy is a way to “prevent significant extraction of social surplus by the leader”;¹¹ democratization occurs when rising economic groups have more to lose from expropriation under autocracy, and when their new wealth makes them a greater political threat.

The second key difference of our approach has to do with how we conceptualize economic inequality. Both Boix and A&R treat inequality homogeneously. That is, neither differentiates the political impact of land inequality versus income inequality. This distinction is

critical, because societal inequality can result from an unequal distribution of a fixed resource like land, or it can result from the growth of new economic sectors. Differential growth rates between a relatively stagnant agricultural sector and a growing industrial sector, for example, often increase income inequality, *holding the distribution of land constant*. And if land and income inequality have different effects on democratisation, then neither Boix's nor A&R's theories provide adequate bases for understanding the relationship between macro-economic change and macro-political change.

Why might income and land inequality have different political effects? We agree that land inequality should be negatively associated with democratisation. Since land is more or less fixed in supply, high land inequality means the elite will be wary of higher taxation or even expropriation of their fixed asset under democracy.¹² Yet we depart from conventional wisdom by suggesting that income inequality, not equality, generates pressures for autocracies to liberalise. This is because historically, the onset of sustained economic development has tended to increase overall economic inequality, largely because it has increased inequality in the nonagricultural sectors of the economy.¹³ Economic development under autocracy often means that new but politically disenfranchised economic groups grow in size and wealth—groups that have relatively more to lose and that desire the safeguards of contracts and property rights that democracy provides.

Two contrasting historical examples are illustrative. First, consider China in 1880. At that time the vast majority of China's 370 million citizens were poor, and equally so. Only a tiny slice of society – approximately two percent of the population – could be considered middle or upper class, and very little intra-group inequality existed among commoners.¹⁴ One might reasonably consider Imperial China a highly inegalitarian society. However, China at this time

had a Gini coefficient of income inequality of 0.24, an extraordinarily low figure in comparative perspective. China may have been inegalitarian, but it was an extremely equal society in terms of income distribution.

Now consider the UK in 1867, the year of Disraeli's Second Reform Act. At a similar point in history, the UK was both far wealthier on a per capita basis than China and far more unequal. The UK's Gini coefficient of income inequality that year was 0.51, well above the world historical average. By 1867 the UK was the world's most industrialised economy, with a highly differentiated occupational structure and with well-established urban middle classes. In contrast, China was deep in a centuries-long economic funk.¹⁵ Moreover, far greater inter-group inequality of incomes existed in the UK than in China. The very wealthy landed elite continued to earn a disproportionate share of national income, but the middle classes were far outdistancing the truly poor. The UK democratised in the latter half of the 19th century; China has yet to democratise. This pattern is not solely cross-sectional. Sweden, a contemporary paradigm of equality, experienced a rapid growth in inequality in the late nineteenth century, with its Gini increasing from .44 to .491 (its historical peak) and pay ratio variation increasing by over forty percent.¹⁶ Yet, Sweden democratised during this time period, holding its first democratic election in 1911. Modern Swedish equalization of incomes occurred *after* democratisation.

The question thus turns on the *source* of increasing income inequality – hence the need to differentiate the economy into sectors and explain why different sectoral growth rates can have different political effects. Land inequality may well retard democracy. However, economic development under autocracy has typically meant that while many remain mired in poverty, many are also growing far wealthier, producing greater income inequality. These new wealthy classes of citizens are more eager, willing and able to fight to protect their interests. In contrast,

relatively low levels of income inequality are associated with fewer demands for political change. We now turn to developing these theoretical intuitions formally, to more precisely set out the causal logic of our claim.

3. A Model of the Political Effects of Land and Income Inequality

Once we understand that high levels of real-world income inequality are commonly associated with the emergence of a sizeable middle class that is outdistancing the impoverished, and that expropriation of their wealth is just as much a threat under autocracy as democracy, the argument that inequality reduces the probability of democratisation – whether in general, as per Boix, or past some “middling” threshold, as per A&R - falls apart.¹⁷

The key distinctions between our model and those of A&R and Boix are (1) we assume that autocracies can be more expropriative than democracies-- charging higher expected taxes and providing fewer public goods; and (2) inequality can differ both within and across sectors of the economy. These different assumptions generate unexpected theoretical insights in terms of the relationship between economic inequality and democratisation. Specifically, we show that transitions to partial and full democracy are more likely to follow from increased income inequality that derives from industrial sector growth. That is, under autocracy the growth of an urban middle class is both associated with inequality *and* with pressures for democracy. We present a full formalisation of our argument in the Appendix.

We consider an economy with two sectors: agriculture and industry. A change in aggregate societal inequality could come from three sources: (a) a change in the distribution of land, holding the amount of land constant; (b) a change in the distribution of the proceeds (“income”) from industrial production, holding the level of industrial production constant; or (c) a change in the relative productivity of the industrial versus the agricultural sector, due to

technological innovation in industry, for example. In the last case, the level of industrial output relative to agricultural production increases, meaning those who derive income from industry accrue relatively more income: we call this differential sector growth ‘inter-sectoral inequality’.

We add further structure to this economy by dividing society into three groups, in descending order of initial wealth: a landed Elite who comprise a small proportion of the overall population but who control a disproportionately large share of the land; a Bourgeoisie who comprise a somewhat larger proportion of the overall population, who control little land but who obtain a disproportionately large share of industrial output; and the Masses who comprise the vast majority of the population and who receive disproportionately small shares of income from both land and industrial output. Given this setup, societal inequality could increase in three ways. First, land inequality could increase, resulting in greater societal inequality by enriching the landed Elite at the expense of the Bourgeoisie and Masses. Second, holding the level of industrial production constant, the proceeds from industrial production could accrue increasingly to the Bourgeoisie at the expense of the Masses. And third, the industrial sector could grow relative to the land sector, making both the Bourgeoisie and Masses better off in absolute and relative terms but increasing overall inequality because the Bourgeoisie take a disproportionate share of the proceeds from industrial production relative to the Masses.

This two-sector/three-group model has advantages over the models of Boix and A&R. First, it offers the opportunity to consider inter-sectoral intra-elite competition, which is downplayed in both Boix and A&R.¹⁸ Second, the model allows us to separate out the effects of land inequality from inequality generated by industrial production. Such a set-up is closer to the situation in real-world economies, allowing us to examine the economic underpinnings and political impact of the emergence of rising urban industrial middle sectors.

To examine the political effects of changes in different types of inequality, we formally develop a game played between the landed Elite (with income Y_E) whom we assume control political decision-making under autocracy, and the Bourgeoisie (with income Y_B) who take over political decision-making under partial democracy. This leaves the Masses politically inert in this basic setup, though their income level Y_M remains of import. Historically, intra-elite competition has been fundamental in regime change, particularly towards partial democracy.¹⁹ Doing so also allows us to focus analytically on the issue of the growth of new economic forces and their concern with expropriation, the core of our theory. Nonetheless, we extend the model to the case of full democracy at the end of this section.

Figure One Here

The extensive form of this game is laid out in Figure One. The game tree begins in an autocratic regime with the decision of the landed Elite whether to grant partial democracy, which would grant political rights to the Bourgeoisie. We assume under autocracy that taxation is purely predatory: the Elite takes for itself a share t_A of the income of the other two groups (Y_B and Y_M) and there is no public goods spending. We can think of t_A either as an actual tax rate or as the expected level of total expropriation, which occurs with some probability $q \in [0,1]$. Under autocracy the Elite receive $U_E(t_A) = Y_E + t_A(Y_B + Y_M)$ and the Bourgeoisie receive $U_B(t_A) = (1 - t_A)Y_B$. Under partial democracy the Bourgeoisie set a flat tax t_P on all citizens and spend the proceeds on a public good g , which each group values at $V_J(g)$. Thus partial democracy means taxation is at least minimally progressive. Lizzeri and Persico argue that rising urban economic groups derive disproportionate benefits from public goods spending.²⁰ Accordingly, we assume that $V_B(g) \geq V_E(g)$. The budget constraint is $g = t_P Y$, where Y equals average income. Consequently, if

the Elite choose to grant partial democracy each group's utility can be defined as $U_E(t_p) = (1 - t_p)Y_E + V_E(t_p Y)$ and $U_B(t_p) = (1 - t_p)Y_B + V_B(t_p Y)$.

If the Elite choose not to grant partial democracy, then an autocratic regime remains in place and our attention moves to the decision of Bourgeoisie whether to accept continued autocracy. If the Bourgeoisie does not rebel, autocracy continues. The Bourgeoisie can also choose to rebel. Rebellious is costly for both the Bourgeoisie and the Elite, costing respectively c_B and c_E . The Bourgeoisie wins a rebellion with probability p_B , in which case they institute partial democracy; the Elite win with probability $1 - p_B$, in which case autocracy continues. The probability of the Bourgeoisie defeating the Elite depends on their relative overall income: thus $p_B = p_B(Y_B, Y_E)$, which is increasing in its first term and decreasing in its second term. If the Bourgeoisie rebels then each group receives its expected utility from fighting minus its cost.

With the model established, we can now examine how changes in the inequality parameters of (a) land inequality, (b) industrial inequality, and (c) inter-sectoral inequality affect two political decisions: (by backwards induction) first, the decision of the Bourgeoisie whether to rebel; and second, the Elite's decision--given a rebelling Bourgeoisie--whether to grant partial democracy or not. We begin with the decision of the Bourgeoisie whether to rebel. Simply put, increases in land inequality reduce the expected utility of rebellion, while increases in industrial inequality and/or inter-sectoral inequality increase the expected utility of rebellion.

Bourgeois rebellion is less likely under increased land inequality because land inequality increases the relative wealth of the landed Elite vis-à-vis the Bourgeoisie, in turn lowering the probability that the Bourgeoisie would prevail in rebellion. We call this the *probability effect*. In addition, because the Bourgeoisie is relatively poorer under high land inequality, it has less income to be expropriated. Hence, the benefits to the Bourgeoisie of setting taxes at their

preferred rate are also smaller under high land inequality. We call this the *taxation effect*. Combining these two effects, the Bourgeoisie is less likely to rebel and force regime change under high land inequality.

In contrast, growing inequality within the industrial sector (holding the size of the industrial sector constant as well as land inequality constant) not only means that the Bourgeoisie grows wealthier relative to the Masses but that the Bourgeoisie grows relatively wealthier compared to the Elite. This improves the Bourgeoisie's probability of winning a rebellion. A relatively wealthier Bourgeoisie due to growing industrial inequality also makes setting tax rates at their preferred level more attractive.²¹

Finally, if the industrial sector grows more rapidly than the agricultural sector we also see greater likelihood of Bourgeois rebellion, for three reasons: the *probability effect*--industrial growth enriches the bourgeoisie, increasing their probability of victory; the *taxation effect*--a richer bourgeoisie prefer to set their own tax level rather than face autocratic taxation / expropriation; and a *public goods effect*--industrial growth increases average incomes through the rising incomes of both the Bourgeoisie and the Masses, which for a given level of taxation, increases the supply of public goods. Since the bourgeoisie benefit disproportionality from public goods, following Lizzeri and Persico's logic, this further incentivizes rebellion.

Assuming that the Bourgeoisie chooses to rebel, the Elite faces the decision of whether to fight to maintain autocracy or peacefully grant partial democracy. Thus, peaceful transition to partial democracy is also possible. In fact, the effects of land inequality, industrial inequality, and inter-sectoral inequality are all qualitatively similar to those for the Bourgeoisie's choice whether to rebel. For high land inequality, granting partial democracy is less likely since the Elite is more likely to prevail in a rebellion and they lose more by paying taxes under partial democracy.²² For

increased industrial inequality the situation reverses. Here the Elite is more likely to grant partial democracy since (a) they are more likely to lose the rebellion that occurs if they maintain autocracy; and (b) higher industrial inequality reduces the Bourgeoisie's preferred tax in partial democracy, thus making partial democracy less costly for the Elite. Finally, increased inequality due to differential inter-sectoral growth rates also makes granting partial democracy more likely since the Elite is more likely to lose the rebellion; the Bourgeoisie's preferred tax rate in partial democracy becomes lower; and greater overall societal income due to industrial growth means higher public goods provision, which the Elite benefit from, albeit less than do the Bourgeoisie.²³

The model obtains similar though slightly weaker results if we examine the case of transitions from autocracy to "full" democracy. In this case, a joint Bourgeoisie-Mass rebellion against the Elite results in the Masses controlling political decision-making. The chances of victory against the Elite are higher than if the Bourgeoisie fights alone. However, since the Masses' preferred tax rate is higher than that of the Bourgeoisie, the Bourgeoisie faces a trade-off. They are more likely to end autocracy but the resulting regime type is less to their liking than partial democracy. In any case, the Bourgeoisie remain more likely to support rebellion, even with full democracy as the outcome, when land inequality is low and industrial and inter-sectoral inequality are high, as long as they value public goods highly and taxes under autocracy are high.

Overall, our model suggests that increased industrial-sector inequality (between Bourgeoisie and Masses) as well as increased societal inequality that results from relatively faster growth of the industrial sector both increase the chances of a peaceful (Elite-granted) or a violent (Bourgeoisie rebellion) transition to partial or full democracy, and that land inequality reduces the chances of this transition. This set-up, which highlights intra-elite political competition, is historically more accurate than an elite/masses "median voter" models that both

Boix and A&R develop, which do not differentiate between the industrial bourgeoisie and a landed elite. The bottom line for our theoretical model is that when a politically disenfranchised Bourgeoisie grows relatively wealthier, they have stronger incentives to demand at least partial democracy. Our theory and empirical predictions differ from Boix's and A&R's by connecting a growing Bourgeoisie to increased income inequality, and in thus associating income inequality with democratization. This result follows from our model as well as from the fact that in real-world economies, when an industrial Bourgeoisie grows in size and wealth relative to the Masses, both industrial-sector *and* overall societal income inequality *increase*. Autocracies with growing Bourgeois classes—the UK in 1867 but not China in 1880--*tend not to be equal societies*, historically, since most of the population still remains mired in poverty. Hence when autocracies experience increased income inequality, holding land inequality constant, this tends to emerge from the rise of new economic groups that lack political representation.

4. Testing the Argument

Our model implies that land and income inequality have different political effects on the likelihood of regime transition. In this section we test these propositions on different measures of democracy, using a variety of estimation techniques and two different sources of data on income inequality. Few empirical explorations of the impact of inequality on democratisation exist, particularly for the pre-1950 era. Boix, for example, uses actual income inequality data for only the 1950-1990 period. For earlier eras he directly measured only land inequality and used proxies for income inequality. A&R rely on case studies and do not conduct quantitative tests.

We test our argument against three different measures of democracy: the dichotomous measure Boix employed, a trichotomous measure used by Epstein *et al.*, and three variants of the

twenty-one point Polity scale employed by Acemoglu *et al.*²⁴ For income inequality, we use Bourguignon and Morrisson's (BM) dataset that covers 55 countries going back to the early 19th century, and Babones and Álvarez-Rivadulla's (BAR) broader post-WWII era dataset.²⁵

We recognize that using income inequality does not directly distinguish industrial from inter-sectoral inequality. However, the model predicts very similar effects of intra-sectoral industrial inequality and inter-sectoral (overall) income inequality. Holding land inequality constant, using an aggregate measure of income inequality consequently operationalises the joint effect of industrial inequality and inter-sectoral inequality.

For land inequality we start with Vanhanen's *Family Farms* measure, which Boix uses.²⁶ This is operationalised as the "area of family farms as a percentage of the total area of holdings".²⁷ A family farm employs no more than four people and the family owns and cultivates the land. From this we created a *Rural Inequality* measure, which is more precise. *Family Farms* is based on the proportion of all cultivable land worked by families. Yet this leaves open the possibility that most of the rural population does not live on a "family farm," even if families farm most of the cultivable land. Even with a high proportion of family farms, the relative density of the rural population in areas *not* farmed by families might be high.

Thus for any level of family farms, higher rural population density is positively associated with higher rural inequality, as more labourers (e.g. peasants, serfs, migrant workers) toil on the proportion of land families do not farm. Simply put, we adjust the *Family Farms* measure by the relative size of the rural population. Our *Rural Inequality* variable is thus calculated as $(1 - \text{Family Farms})(1 - \text{Urbanisation})$, where *Urbanisation*, taken from Vanhanen, is the percentage of urban inhabitants as a proportion of the national population. As *Rural Inequality* variable increases, we expect the probability of democratisation to decline.

As further controls—and again following Boix—we use Vanhanen’s measure of *Educational Attainment*, the average of the percentage of literate adults and the number of students per 100,000 population; we also control for per capita income in 1990 US dollars, from Angus Maddison’s estimates.²⁸

Given overlaps in Vanhanen’s data and the BM data, our first tests cover 1850-1993, while the tests using Babones and Álvarez-Rivadulla’s data cover 1955-2004. Following Boix, we linearly interpolated all independent variables to fill in the time-series. In what follows we test our argument using the dichotomous, trichotomous, and continuous operationalisations of democracy, and then compare our results against both Boix’s and A&R’s expectations.

4.1 Democracy as a Dichotomous Dependent Variable

In this section we test our theory on a dichotomous measure of democracy, as did Boix. Przeworski *et al.* initially developed and employed this measure; we use Boix and Rosato’s classifications of countries as democratic or not, which extend back to 1800.²⁹ They defined a country as democratic if 50% or more of adult males have the vote; a regime transition occurs when a country expands the franchise anywhere beyond this threshold. Table One presents a series of models estimating the effect of various variables of interest on the probability of a democratic transition. Models A and B use the dynamic probit estimation technique (with robust standard errors), employed by both Przeworski *et al.* and Boix. This technique estimates the probability of a transition from autocracy to democracy (and vice versa) in a given year.³⁰ For each model readers can ignore the coefficients on the interacted terms, which are only relevant for democratic consolidation or collapse.³¹ Models A and B add respectively a quadratic time trend and year dummies to account for time dependence, with year dummies also picking up

‘waves of democratization’. Both income inequality and land inequality variables are signed in the direction we predict--respectively, positive and negative--and are statistically robust.

Table One Here

Probit coefficients are difficult to interpret in terms of substantive effects, so Table Two presents the simulated impact of different levels of income and land inequality on the probability that an autocracy will democratise in a given year, holding the other variables at their means. The effects are substantively very large: moving from the 3rd to the 97th percentile on the Gini index makes democratisation between four and six times more likely, and a similar increase in Rural Inequality makes democratisation between eight and twelve times less likely. These findings suggest that even moderate changes in inequality are likely to have a substantial impact, since the model results reflect probabilities of regime change in a given year and such changes tend to aggregate over time.

Table Two Here

We check the robustness of these results by employing an alternate estimation technique: *gompit*, which assumes that the probability of democracy is structured as a rare event. Gompit is closely related to the complementary log-log model, and (unlike the probit model) can be estimated using country fixed effects. Models C and D in Table One thus employ *gompit* with, respectively, a quadratic time trend and year dummies; Models E and F add country dummies. We note that such stringent controls are rarely employed in cross-national empirical research on democratization; neither Boix nor Przeworski *et al.* includes country fixed effects.

Even given these rather stringent controls, which remove all cross-national variance and focus only on within-country changes in inequality, the results largely hold. In Models C and D, both income and rural inequality remain statistically significant at the one percent level, and both

remain significant at the five percent level in Model E. However, the introduction of both year and country dummies in Model F renders *both* inequality variables insignificant, though they remain in the predicted direction. It is unclear whether this result is due to the massive reduction in the number of cases (by a third) when country fixed effects are entered (due to states with no change in the dependent variable dropping out) or whether the introduction of these particular controls has a substantive meaning. However, other than Model F, all the models indicate a robust and substantive impact of both income and land inequality on democratisation as hypothesised earlier.³² It is also important to note that in no case do our findings support the conventional wisdom associating income *equality* with transitions to democracy.

4.2 Democracy as a Trichotomous Dependent Variable

In this section we examine the possibility that our theoretical mechanism might not apply equally across all kinds of democratic transitions. Our formal model suggests that partial democracy might give the Bourgeoisie the best possible protection against Elite expropriation of their wealth. To explore whether the positive effect of income inequality holds for transitions from autocracies to full or only to partial democracies (and to see whether inequality also impacts transitions from partial to full democracies) we must employ different measures of the dependent variable.

Here we use the trichotomous measure of full autocracy, partial democracy, and full democracy, developed by Epstein *et al*, who derive it from the POLITY score: autocracies are countries that score between -10 and 0; partial democracies are countries that score between 1 and 6; and full democracies are those that score between 7 and 10.³³ This operationalisation permits the use of the dynamic Markov switching model, which estimates the effects of inequality on the probability of switching between any two of these three regime types.³⁴ Using

coefficient estimates from our regression models, we construct a 3x3 table showing the effects of inequality on transitioning between these three states. Tables Three (a) and (b) are transition matrices estimating the effects of changes in (a) income inequality and (b) land inequality.³⁵

Tables Three (a) and (b) Here

The results reveal that both income and land inequality only drive transitions from full autocracies, and indicate that full autocracies are more likely to transition to partial democracies than to full democracies. A shift from the 3rd to the 97th percentile on the GINI coefficient increases the probability of transitioning from full autocracy to partial democracy by 12%, but only increases the chance of transitioning to full democracy slightly. A similar increase in Rural Inequality increases the chances of transitioning to a partial democracy from autocracy by 19%, but has little substantive effect on transitioning to a full democracy.

These predicted probabilities are larger than those found when we measured transitions dichotomously. This fact, combined with the smaller chance of moving directly to full democracy, suggests that economic inequality has a greater political impact on the likelihood of regime change in relatively more autocratic societies—that is, when citizens are relatively more concerned about constraining the arbitrary exercise of state authority--rather than on removing the last vestiges of authoritarian rule. This result supports our theoretical focus on inter-elite competition. Finally, we find no statistically significant effect of either income or land inequality on transitions out of either partial or full democracy to any other regime type, which suggests that the effects of inequality are unidirectional: Once property-rights protection is achieved, decreases in inequality do not mean reduced demand for protection.

4.3 Democracy as a Continuous Dependent Variable

We conclude our analysis of the BM data using the twenty-one point Polity scale, and with a continuous variable we move to using linear techniques. This also lets us employ country fixed effects, which help isolate the effects of *changes* in inequality from the *level* of inequality in states more broadly. Fixed effects control for time-invariant attributes of states that might be correlated with both inequality and the propensity to democratise. We also use a pooled Prais-Winston regression to estimate both between- and within-country effects of inequality.

We use three different versions of Polity as our dependent variable. Following Acemoglu *et al.* we not only use the basic Polity measure but also use two variants, what they call *MaxPolity* and *MinPolity*.³⁶ *MaxPolity* is the maximum of the lagged Polity score and the current Polity score. Consequently, *MaxPolity* ignores declines in democracy, coding any decline as stasis. In turn, *MinPolity* is the minimum of the lagged Polity score and the current score, thus ignoring increases in democracy. Using these variables allows us to mimic the structure of the Markov switching model while employing a linear variable.

Table Four presents two models for each version of the dependent variable—one using fixed effects and one that uses Prais-Winston regressions. Models A and B use the raw Polity scores. Model A shows a borderline significant effect for the income inequality variable even in the presence of country fixed effects. This result implies sizeable long-run effects of inequality (calculated using the lagged dependent variable): a 0.1 shift in the Gini coefficient or the rural inequality measure produces changes of 1.92 and 0.72 points respectively in the Polity index. Model B, which incorporates between-country effects, presents larger and significantly more robust effects of income and land inequality.³⁷

Table Four Here

Models C and D show that the effects of income inequality grow more robust when we use *MaxPolity* – that is, if we remove cases of democratic decline/collapse from the analysis. Income inequality is statistically significant in both Models, though land inequality suffers in robustness slightly. The substantive impact of income inequality is very large here – a change in Gini of 0.1 leads to a long-term increase of 4.9 points in the Polity score – a full quarter of the scale. These results strengthen the notion suggested above that the effects of income inequality are unidirectional: the demand for protection from the state matters most in autocratic states.

Finally, as in our earlier estimations, we find little evidence that increased income inequality destabilises democracies. Model E shows no effect of either income or land inequality on *MinPolity*, though Model F does find a negative effect of land inequality, suggesting increased land inequality could hasten democratic collapse. Overall, the impact of both income and land inequality on democratisation appears robust to a continuous measure of the dependent variable and an array of stringent tests, and provides additional evidence that the positive impact of income inequality on regime transitions holds only for autocracies.

4.4 Tests Using More Recent Inequality Data

We now test our hypotheses using the Babones and Álvarez-Rivadulla (BAR) dataset. This dataset includes more than twice as many countries as the BM dataset, making it more useful for the postwar era. In what follows we replicate the earlier analysis of both binary and continuous measures of regime type.³⁸ However, our expectations differ somewhat for this time-period. In the post-WWII era, analysis of Polity scores shows that relatively fewer transitions to partial democracy occurred than in the pre-WWII era. Most transitions shifted from full autocracy to full democracy, or from partial democracy to full democracy. Given the results of our formal model, we have reason to believe that the relationship between both income and land

inequality should be weaker in the more recent historical period. Strong statistical results would thus provide powerful confirmation of our theoretical claim. Table Five presents results.

Table Five Here

Models A and B use probit and the dichotomous measure of democracy. Income inequality has a positive effect while rural inequality has a negative effect. However, using this measure of the dependent variable the results are somewhat less robust than with the BM data: the Gini indicator is statistically significant at the ten percent level but rural inequality is not significant. Nonetheless, these results still lend no support to either Boix's or Acemoglu and Robinson's arguments.

Turning to the continuous measure of democracy using Polity (Models C through F), with the exception of Model D the predicted effects of both income and land inequality hold up. Model D adopts a highly stringent specification that includes year *and* country dummies. This reduces the robustness of the results, yet even here the coefficients are signed in the expected direction. Models E and F are specified like Models C and D but exclude country dummies, thereby accounting for *between-* as well as *within-*country changes. Here we see highly robust estimates for income inequality and rural inequality.

Finally, Models G and H add a series of time-invariant variables often thought to correlate with autocracy or democracy: world region, oil exporter status, Muslim majority population, and communist experience. Despite inclusion of these controls, the coefficients on both inequality measures in both models remain significant, although less robust. These results strongly suggest that income and land inequality have powerful independent political effects, regardless of other attributes. Despite our expectations that results would be weaker for the more

recent time-period, we still find reasonably robust relationships between income and land inequality and democratisation.

4.5 Testing for Acemoglu & Robinson’s “Inverted-U”

Our theory is essentially linear: higher levels of income inequality and lower levels of land inequality should increase the probability of democratisation. Our empirical tests of this theory stand in sharp contrast to Boix’s expectations of a *negative* effect of inequality generally considered. However we have yet to directly test Acemoglu and Robinson’s expectation that the relationship between inequality and democracy takes the form of an inverted-U. We operationalise their hypothesis using a quadratic specification of both income and land inequality, and test the argument on several measures of the dependent variable, using both income inequality datasets. Table Six repeats the dynamic probit model tested in Models A of Table One (BM) and Table Five (BAR), and the fixed-effects models using the Polity score in Model A of Table Four (BM) and Model C of Table Five (BAR).³⁹ In each case, we add the quadratic terms for income and land inequality.

Table Six Here

In none of the cases is either squared term statistically significant at the five percent level. Only in the case of the dynamic probit model is the quadratic specification statistically significant at the ten percent level, and then only for income inequality, not land inequality. Theoretically, it is not obvious why land inequality should not matter for A&R’s theory while income inequality should. In any case, the linear model offers a much superior fit. Analysis of model-fit diagnostics strengthens the case for our linear model: The linear model always has lower values on the Akaike and Bayesian Information Criteria of model fit, and likelihood-ratio tests always suggest accepting the linear over the quadratic model.

To illustrate the different predictions of the linear and quadratic models, Figures Two (a) and Two (b) compare the predicted probabilities and 95% confidence intervals of democratisation (using the probit specification) at different levels of income inequality for the linear and quadratic models, using both datasets (Models A, B, E and F).⁴⁰ In the linear model the confidence interval is narrow and always supports a monotonically increasing probability of democratisation with respect to inequality. In contrast, the confidence interval in both quadratic models shows much greater uncertainty. In fact, at a Gini of 0.53 or above, although the probability of democratisation is decreasing, the confidence interval is so wide that statistically, the results could support an increasing *or* decreasing probability of democratisation.

Figures 2a and 2b Here

Moreover, it is critical to note the estimated location of the inflection point - the spot at which A&R's "inverted-U" begins its downward slope. A&R's theory suggested that countries with "middling" levels of inequality should have the *highest* probability of democratising. Yet the results in Table Six suggest that the predicted probability of democratisation using the quadratic function continues to increase well past the mean value of Gini - up to approximately 0.53, which is in the 75th percentile for autocracies. This means that autocracies with fairly high levels of inequality have *higher* probabilities of transitioning to democracy than autocracies with "middling" levels of inequality, a puzzling result for A&R's theory. Even at a GINI of 0.55 - the 97th percentile of the distribution for autocracies - the probability of transitioning to democracy in the quadratic model is almost exactly the same as at the average for autocracies, 0.46. Empirical tests reveal that autocracies with "middling" levels of inequality - of either land *or* income - do *not* have higher probabilities of democratising than autocracies with high levels of inequality. We thus find no empirical support for the key prediction of A&R's theory.

5. Conclusion

For decades, scholars have debated modernisation theory's fundamental hypothesis linking economic development to the emergence of democracy. More recently, scholars have sought to specify the relationship between the distribution of wealth and democratisation. We suggest that recent debates on this question, with Boix and Acemoglu and Robinson at the forefront, have taken a problematic theoretical turn. We begin from different premises, and consequently derive fundamentally different conclusions. Democratisation is not about whether the median voter is going to soak the rich; it is about whether citizens can obtain impartial protections from the state against expropriation. This notion draws inspiration from classics of political philosophy as well as recent political-economy scholarship, especially the work of North and Weingast, and Olson.

Our argument and findings speak to 'modernisation theory' hypotheses that relate economic growth to 'endogenous democratisation.' Aggregate country-wealth does not drive democratisation. Rather, the distribution of the fruits of development matters. Equality of landholding plus inequality of income leads to democracy; departing from this pattern should lead to alternate political outcomes. Land equality combined with income inequality is precisely the scenario that gives rise to greater demands for credible commitments on the part of the state. As ever-larger groups of citizens come to hold assets or earn more income, they will seek insurance against expropriation or violations of contracts.

Our empirical results call into question the skepticism of Przeworski *et al.* regarding the importance of inequality for regime change, yet also challenge the theories of both Boix and A&R. Both Boix and A&R rely on a model of redistributive politics derived from Meltzer and

Richard (MR). MR's model is problematic primarily because of its lack of empirical support regarding the degree of redistribution under democracy.⁴¹ In addition, the MR model constrains taxation to be progressive, even though there is no reason to believe that autocracies are so constrained in how they tax or spend. Indeed, incumbent autocratic elites often impose regressive taxation—on other (rising) elites--and keep the proceeds. The MR model therefore makes overly restrictive assumptions on who can expropriate from whom.

Moreover, both Boix and A&R focus on the intentions of the autocratic elites as constituting the “supply” side of democracy. Yet the MR model was designed for application in existing democracies, meaning that the model assumes the supply of regime type as given. This makes the appropriateness of the MR model for a study of transitions to democracy somewhat dubious; one must assume that incumbent elites have internalised the MR median-voter model in their valuation of the benefits of democracy versus autocracy. In the spirit of scholars with different methodological predilections, our approach gives relatively greater weight to the “demand” side of democratisation, focusing on the decisions of non-incumbent elites—principally, a rising Bourgeoisie--who stand to benefit from regime change due to reduced threat of expropriation.⁴²

This theoretical focus highlights the fact that the political implications of inequality can differ across economic sectors. Distinguishing the political impact of the societal distribution of different sorts of economic assets makes it possible to reconcile, in a more satisfactory way than existing approaches to “endogenous democratisation” permit, modernisation theory's emphasis on economic growth with a focus - à la Barrington Moore - on political struggles between competing elites.

Inequality and Democratisation: Appendix

This appendix sets out (a) a model of a three group, two-sector economy, and (b) the political game between the Bourgeoisie and Elite over partial democratisation. We consider a country with two sectors - land and industrial goods - and three groups: the landed Elite (E); the Bourgeoisie (B), and the Masses (M), with total population normalised to one. The Elite have $\beta=\sigma_E$ of the population, the bourgeoisie have $(1-\beta)\pi=\sigma_B$ and the masses have $(1-\beta)(1-\pi)=\sigma_M$. The land sector is fixed to a size of one and the Elite control a share γ of the land, with the remaining $1-\gamma$ split between the Bourgeoisie and the Masses according to their population shares, defined by π . Since for fixed population shares an increase in γ implies more land going to the Elite we can define γ as *land inequality*. The industrial sector is variable in size, and produces k industrial output, distributed only between the Bourgeoisie and the Masses, respectively with shares of ϕ and $1-\phi$, where ϕ represents *industrial inequality*. Growth in the industrial sector – an increase in k or *intersectoral inequality* – will accrue disproportionately to the Bourgeoisie provided $\phi > \pi$, which we assume holds. Individuals in the Elite consequently earn $\gamma/\sigma_E = Y_{Ei}$ and the Elite as a whole earn $\gamma=Y_E$. Individuals in the Bourgeoisie earn $[(1-\gamma)\pi+\phi k]/\sigma_B = Y_{Bi}$ and the group earns $(1-\gamma)\pi+\phi k=Y_B$. Individuals in the Masses earn $[(1-\gamma)\pi+(1-\phi)k]/\sigma_M = Y_{Mi}$ and the group earns $(1-\gamma)\pi+(1-\phi)k=Y_M$. Finally, we define *overall inequality* I as the average income of the Elite and Bourgeoisie over the average income of the Masses, extending the procedure Acemoglu and Robinson use as their proxy for inequality to the case of three groups.⁴³

$$I = \left(\frac{Y_E + Y_B}{\sigma_E + \sigma_B} \right) \bigg/ \left(\frac{Y_M}{\sigma_M} \right) = \frac{Y_E + Y_B}{Y_M} \frac{\sigma_M}{\sigma_E + \sigma_B} = \frac{\gamma + \pi(1-\gamma) + \phi k}{(1-\pi)(1-\gamma) + (1-\phi)k} \frac{\sigma_M}{\sigma_E + \sigma_B}$$

Taking the derivative of I w.r.t. land inequality, industrial inequality, and intersectoral inequality:

$$\frac{\partial I}{\partial \gamma} = \left(\frac{1 + k(\phi - \pi) + \gamma(1 - \pi)}{Y_M^2} \right) \frac{\sigma_M}{\sigma_E + \sigma_B} > 0$$

$$\frac{\partial I}{\partial \phi} = \left(\frac{k(1+k)}{Y_M^2} \right) \frac{\sigma_M}{\sigma_E + \sigma_B} \geq 0$$

$$\frac{\partial I}{\partial k} = \left(\frac{\phi + (1-\gamma)\pi - \gamma}{Y_M^2} \right) \frac{\sigma_M}{\sigma_E + \sigma_B} > 0$$

The effect of increased land inequality is unequivocally to increase inequality and the effect of increased industrial inequality is to increase overall inequality provided $k > 0$. The effect of intersectoral inequality depends on the other parameter values: it increases overall inequality provided industrial inequality is sufficiently high: $\phi > \gamma + \pi(1-\gamma)$. We assume that this inequality holds, that is, growth in the transition from agriculture to industry is inequality increasing.⁴⁴

Under autocracy, the Elite controls decisionmaking and the other two groups are excluded from power. We assume that an autocratic regime cannot credibly commit not to set a high, expropriating tax rate of t_A - the Elite will take an expected rate t_A of the income of the other two groups - and there is no public spending. Consequently, the tax system is regressive. We assume that t_A is bounded at some upper value $\bar{t}_A < 1$, whereafter the Bourgeoisie and Masses are able to evade taxes and since the Elite's utility is increasing in the tax rate, their optimal choice $t_A^* = \bar{t}_A$. Conversely, we assume that any partially or fully democratic system must have a minimally progressive tax system and that it will spend tax proceeds on public goods g . Total taxes are tY where Y is average income and this is spent fully on g . Each member of a group receives $V_{Ji}(g)$ in benefit from the public good, where $V'_{Ji}(g) > 0$ and $V''_{Ji}(g) < 0$ and where we assume that $V_{Mi}(g) = V_{Bi}(g) \geq V_{Ei}(g)$, that is the Masses and Bourgeoisie value public goods at least as much as the landed Elite. The Bourgeoisie in partial democracy maximises their individual utility: $\max U_{Bi}(t_p) = (1-t_p)Y_{Bi} + V_{Bi}(t_p Y)$, setting their preferred tax rate such that the marginal benefit of public goods equals their income relative to the mean: $V'_{Bi}(t_p^* Y) = Y_{Bi}/Y$.

We now consider the game between the Elite and the Bourgeoisie laid out in Figure One. We first consider the Bourgeoisie's decision whether to rebel. The Bourgeoisie win a rebellion with probability $p(Y_B, Y_C)$, which is strictly increasing in its first argument and decreasing in its second argument. If they win they impose Partial Democracy and if they lose Autocracy remains. Both sides pay a cost of fighting, respectively c_B and c_E . (we assume the cost for the Masses is higher than their individual income, hence they will not rebel alone). The Bourgeoisie rebel if the expected utility of rebellion R_i for each member is greater than zero, where:

$$\begin{aligned} R_i &= p_B [U_{Bi}(t_P) - U_{Bi}(t_A)] - c_{Bi} \\ &= p_B [(1 - t_P)Y_{Bi} + V_{Bi}(g) - (1 - t_A)Y_{Bi}] - c_{Bi} \\ &= p_B [(t_A - t_P)Y_{Bi} + V_{Bi}(t_P Y)] - c_{Bi} \end{aligned}$$

We take the derivative of this function with respect to γ , ϕ , and k and use $V'_{Bi}(t_P^* Y) = Y_{Bi}/Y$.

$$\begin{aligned} \frac{\partial R_i}{\partial \gamma} &= \frac{\partial p_B}{\partial \gamma} [(t_A - t_P)Y_{Bi} + V_{Bi}(g)] - p_B \left[\frac{\pi}{\sigma_B} (t_A - t_P) \right] \\ \frac{\partial R_i}{\partial \phi} &= \frac{\partial p_B}{\partial \phi} [(t_A - t_P)Y_{Bi} + V_{Bi}(g)] + p_B \left[\frac{k}{\sigma_B} (t_A - t_P) \right] \\ \frac{\partial R_i}{\partial k} &= \frac{\partial p_B}{\partial k} [(t_A - t_P)Y_{Bi} + V_{Bi}(g)] + p_B \left[\frac{Y_{Bi}}{Y} t_P + \frac{\phi}{\sigma_B} (t_A - t_P) \right] \end{aligned}$$

The effect of land inequality on the expected utility of rebelling is negative provided $t_A \geq t_P$, that is if taxation under autocracy is higher than the Bourgeoisie's optimal rate. Even if this does not hold, if the value of public goods is high increased land inequality may still have a negative effect on the expected utility of rebelling as it reduces the probability of success. Industrial inequality provides precisely the reverse conditions, increasing the expected utility of rebelling if $t_A \geq t_P$, or if the value of public goods is very high. Finally, increased intersectoral inequality increases the expected utility of rebellion. Here along with the tax difference and the probability effect there is a positive effect related to higher public goods provision due to higher aggregate output, which further intensifies the incentive to rebel.

If the Bourgeoisie do not rebel then the choice for the landed Elite is simple, they will retain Autocracy. However, if they will rebel, then the Elite must decide between granting partial democracy or not. As before, they do so if expected utility of granting partial democracy

$G_i = (1 - p_B) \left[(1 - t_P) Y_{Ei} + V_{Ei}(tY) - t_A (Y_B + Y_M) / \sigma_E \right] + c_{Ei}$ is greater than zero. We take derivatives with respect to γ , ϕ , and k and simplify by setting $V_{Bi}(g) = V_{Ei}(g)$.⁴⁵

$$\begin{aligned} \frac{\partial G_i}{\partial \gamma} &= -\frac{\partial p_B}{\partial \gamma} \left[-t_P Y_{Ei} + V_{Ei}(g) - \frac{t_A Y_B + Y_M}{\sigma_E} \right] + (1 - p_B) \left[\frac{\partial t_P}{\partial \gamma} (Y_{Bi} - Y_{Ei}) + \frac{t_A - t_P}{\sigma_E} \right] \\ \frac{\partial G_i}{\partial \phi} &= -\frac{\partial p_B}{\partial \phi} \left[-t_P Y_{Ei} + V_{Ei}(g) - \frac{t_A Y_B + Y_M}{\sigma_E} \right] + (1 - p_B) \left[\frac{\partial t_P}{\partial \phi} (Y_{Bi} - Y_{Ei}) \right] \\ \frac{\partial G_i}{\partial k} &= -\frac{\partial p_B}{\partial k} \left[-t_P Y_{Ei} + V_{Ei}(g) - \frac{t_A Y_B + Y_M}{\sigma_E} \right] + (1 - p_B) \left[\frac{\partial t_P}{\partial k} (Y_{Bi} - Y_{Ei}) - \frac{t_A}{\sigma_E} + t_P \frac{Y_{Bi}}{Y} \right] \end{aligned}$$

Let us assume that $Y_{Bi} < Y_{Ei}$ - that is, that the bourgeoisie are poorer than the aristocracy individually. How can we interpret the derivatives? In reverse order, we begin with intersectoral inequality $\partial G_i / \partial k$. The first element is positive since keeping autocracy is harder to do when the probability of the aristocracy winning is lower. The second element involves trading off the *tax rate effect*, positive as long as $Y_{Bi} < Y_{Ei}$, the *lost expropriation effect* where the aristocracy is unable to tax the increased earnings of the bourgeoisie, which is negative $-t_A / \sigma_E$, and the *public goods effect*, which is positive. Provided $-t_A / \sigma_E$ is not too large, the benefits of granting partial democracy rise in the level of industrial output. The effect of industrial inequality is also positive. The first element is positive as it means a stronger bourgeoisie who are more likely to prevail in a rebellion. The second element is also positive provided that $Y_{Bi} < Y_{Ei}$. So in this case, the result is unequivocally that increased industrial inequality raises the benefits of granting partial democracy. Finally, the effect of land inequality is the reverse. The first element is negative since increased land inequality increases the probability of the aristocracy prevailing in a rebellion. The *tax rate effect* is negative also if $Y_{Bi} < Y_{Ei}$ and finally there is a positive effect of

$(t_A - t_P)/\sigma_E$ This positive effect occurs because increased land inequality reduces the amount of income that can be expropriated from the Bourgeoisie and Masses. Provided this is not too large, we would expect increased land inequality to reduce the chances of granting partial democracy.

Above we assumed that the costs of organising the masses were too high for them to credibly threaten the Elite. We now briefly consider the case, when the Bourgeoisie and Masses ally to overthrow the Elite. The benefit for the Bourgeoisie of rebelling jointly with the Masses, producing a ‘full democracy’, where the Masses control tax-setting, as compared to continued autocracy can be written as: $R_i^J = p_J [(t_A - t_D)Y_{Bi} + V_{Bi}(t_D Y)] - c_{Ji}$, where we assume that $p_J > p_B$, $c_{Ji} < c_{Bi}$ and $t_D > t_P$. Thus, the advantages to the Bourgeoisie of joint rebellion are a higher probability of victory and lower costs of fighting. However, the tax rate will be higher than their preferred optimum. Consequently, joint rebellion and full democracy may be preferred to sole rebellion and partial democracy where the former exceed the latter. The effects of the three inequality measures on R_i^J are broadly similar to those in the case of sole rebellion. Provided that $t_A > t_D$ (i.e., assuming autocracies are more expropriative than democracies), then land inequality always reduces the likelihood of the bourgeoisie choosing to rebel jointly rather than accept continued autocracy. For industrial inequality, the probability effect vanishes, and the bourgeoisie must trade off reduced expropriation by the autocracy against a higher tax rate under democracy: industrial inequality promotes joint rebellion if $(t_A - t_D)k/\sigma_B > \partial t_D / \partial \phi(Y_{Bi} - Y_{Mi})$. Intersectoral inequality increases the probability of successful rebellion and if, combined with reduced expropriation by the autocracy and increased public good supply, this outweighs the higher taxes under democracy, sectoral inequality will also promote joint rebellion and full democracy. These effects are all somewhat weaker than the case of partial democracy, since the masses set their preferred tax rate, however the increased probability of victory and reduced

costs may outweigh this cost. Consequently our expectations that democratisation should be negatively associated with land inequality and positively associated with industrial and sectoral inequality, are met for both partial *and* full democracy.

¹ Przeworski, Adam, *et al.*, *Democracy and Development: Political Institutions and Well-being in the World 1950-1990*. (New York: Cambridge University Press, 2000).

² Daron Acemoglu and James Robinson, 'A Theory of Political Transitions', *American Economic Review*, 91 (2001). Daron Acemoglu and James Robinson, *Economic Origins of Dictatorship and Democracy* (New York: Cambridge University Press, 2006); Carles Boix, *Democracy and Redistribution*. (New York: Cambridge University Press, 2003).

³ Douglass North and Barry Weingast. "Constitutions and Commitment: The Evolutions of Institutions Governing Public Choice in Seventeenth-Century England." *Journal of Economic History* 49 (1989): 803-832; Mancur Olson, "Dictatorship, Democracy, and Development." *American Political Science Review* 87 (1996): 567-576.

⁴ Acemoglu and Robinson, 'A Theory of Political Transitions'; Allan Meltzer and Scott Richard 'A Rational Theory of the Size of Government.' *Journal of Political Economy* 89 (1981): 914-927.

⁵ Acemoglu and Robinson, *Economic Origins of Dictatorship and Democracy*. We agree that asset-specificity may matter in the way Boix and Acemoglu and Robinson suggest, but unlike these authors we focus on the effects of inequality within economic sectors with different degrees of asset-specificity. (Since no convincing measure of country asset-specificity exists, neither Boix nor Acemoglu and Robinson test this proposition, in any case.)

⁶ See also Robert Bates, and Donald Lien. 'A note on taxation, development, and representative government.' *Politics and Society* 14 (1985): 53-70; Margaret Levi, *Of Rule and Revenue*. (Berkeley: University of California Press, 1988); and Michael Ross, 'Does Taxation Lead to Representation?' *British Journal of Political Science* 34 (2004): 229-249.

⁷ Olson, 'Dictatorship, Democracy, and Development' 572.

⁸ Douglass North, *Institutions, Institutional Change and Economic Performance*. (New York: Cambridge University Press, 1990) 51.

⁹ Douglass North, *Institutions, Institutional Change and Economic Performance*. 47.

¹⁰ Jack Knight, *Institutions and Social Conflict*. (New York: Cambridge University Press, 1992).

¹¹ Olson, 'Dictatorship, Democracy, and Development' 574.

¹² A recent paper confirming this hypothesis is Daniel Ziblatt, "Does Landholding Inequality Block Democratization? A Test of the 'Bread and Democracy' Thesis and the Case of Prussia." *World Politics* 60(4) (2008).

¹³ Simon Kuznets, "Economic Growth and Income Inequality." *American Economic Review* 45(1) (1955): 1-28. We accept that the left-hand side of the Kuznets curve (inequality increases with initial growth) holds historically, although the right-hand side (inequality subsequently declines) may not.

¹⁴ Branko Milanovic, Peter Lindert and Jeffrey Williamson. 2007. "Measuring Ancient Inequality." Unpublished manuscript, World Bank.

¹⁵ Kenneth Pomeranz, *The Great Divergence: China, Europe, and the Making of the Modern World Economy*. (Princeton: Princeton University Press, 2000).

¹⁶ Johan Söderberg, 'Wage differentials in Sweden: 1725-1950', in Y.S. Brenner et al (eds.) *Income Distribution in Historical Perspective*, Cambridge University Press, 1991.

¹⁷ Real-world Gini coefficients never exceed approximately .7, or go below .2. See Milanovic *et al.* (note 14) for why Gini coefficients in real-world economies above .7 are virtually impossible. If we observed Gini coefficients above this level our argument would require modification.

¹⁸ Boix does not examine sectoral differences directly, though he does address the political role of a middle class distinguished solely by income. A&R do examine sectors but assume that landed and industrial elites are members of the same political group and hence do not compete with one another.

¹⁹ Ruth Berins Collier, *Paths Towards Democracy: The Working Class and Elites in Western Europe and South America*. (New York: Cambridge University Press, 1999).

²⁰ Alessandro Lizzeri and Nicola Persico, 'Why Did the Elites Extend the Suffrage?' *Quarterly Journal of Economics* 119, (2004).

²¹ Both results are partly dependent on t_A being larger than t_P : that is, on taxation or expected expropriation of the Bourgeoisie being higher under autocracy than under partial democracy. However, even if this were not so, the probability effects may still outweigh the tax effects and produce a positive effect of industrial inequality on regime change (see Appendix).

²² A small positive effect comes from the reduced land income of the Bourgeoisie and Masses under autocracy, reducing the benefits of expropriation for the Elite, but under most parameter values this is outweighed.

²³ A small negative effect comes from a *lost expropriation* effect since the Elite are no longer able to tax increased industrial earnings. However, under most parameter values, the overall effect of industrial growth on the expected utility of granting partial democracy is positive.

²⁴ Boix, *Democracy and Redistribution*; David Epstein *et al.* 'Democratic Transitions' *American Journal of Political Science* 50 (2006): 551-569; Daron Acemoglu *et al.*, 'Income and Democracy', *American Economic Review* (2007).

²⁵ Francois Bourguignon and Christian Morrisson. 'Data Sources for Inequality among World Citizens, 1820-1992', available at <http://www.delta.ens.fr/XIX/>, used in Bourguignon and Morrisson, 'Inequality among World Citizens 1820-1992.' *American Economic Review* 92 (2002); and Salvatore J. Babones and Maria Jose Álvarez-Rivadulla, 'Standardized Income Inequality Data for Use in Cross-National Research.' *Sociological Inquiry* 77: 3-22 (2007), which builds off Klaus Deininger and Lyn Squire, 'A New Data Set Measuring Income Inequality.' *World Bank Economic Review* 10(3): 565-91, (1996) and the United Nations' World Income Inequality Database, available at http://www.wider.unu.edu/research/Database/en_GB/database/. Babones and Álvarez-Rivadulla's data, which are available at <http://salvatorebabones.com/>, come in the form of Gini coefficients. For Bourguignon and Morrisson's (BM) data, we calculated the Gini coefficient from their estimates of the income distribution in 55 countries from 1820 to 1992. Bourguignon and Morrisson's estimates are the sole cross-national measures of actual income inequality for the pre-1945 period currently available. These data have been cited several hundred times, yet like all inequality data they have a number of shortcomings. For example, many of the data-points are estimates based on evidence from another country with a similar economic structure. Consequently, though fifteen states have individual data, the remaining states share their measure of inequality with at least one other state. Given this, there is likely to be measurement error for at least some countries. However, the effect of this should be to inflate the size of standard errors rather than to actually bias coefficients, on the assumption that if countries sharing income distribution data experience different regime transitions this ought to reduce the precision of regression estimates. In any case, our Gini coefficients from the BM data correlate highly (.843) with Deininger and Squire's (1996) "high quality" Gini measures, and our results hold if we use the BM data only for the post-war period.

²⁶ Tatu Vanhanen, 'Democratisation and Power Resources 1850-2000' [computer file] (2003). Available at the Finnish Social Science Data Archive, <http://www.fsd.uta.fi/english/data/catalogue/FSD1216/meF1216e.html>.

²⁷ Boix, *Democracy and Redistribution* 89.

²⁸ These come from the BM dataset. See Angus Maddison, *The World Economy, Volume 1: A Millennial Perspective*. (Paris: OECD, 2006).

²⁹ Adam Przeworski et al, *Democracy and Development*; Carles Boix and Sebastian Rosato ‘A Complete Dataset of Political Regimes, 1800-1999’ Unpublished, University of Chicago (2001). Acquired from the authors.

³⁰ Dynamic probit models simultaneously produce estimates of the effects of the independent variables on both the probability of an autocracy democratising *and* a democracy autocratizing. The model lags each independent variable one period and includes the interaction of the lagged independent variables with the lagged dependent variable. Thus if a state was a democracy in the previous period, the lagged dependent variable equals one and all the interaction terms remain in the regression. If a state was an autocracy in the previous period the lagged dependent variables equal zero and all the interaction terms drop out. By reading off only the coefficients of the non-interacted terms we obtain the effect of each variable on the probability of an autocracy democratising. See Takeshi Amemiya, *Advanced Econometrics*. (Cambridge, MA: Harvard University Press 1985).

³¹ We also ran these models using random-effects dynamic probit; and using clustered standard errors. The results do not differ substantially.

³² Boix’s results suggest the opposite: that equality and democratisation go hand in hand. However, selection bias may explain his results, because his sample includes a maximum of only 1042 cases (Table 2.1), and excludes a number of transitions that occurred under relatively high inequality. Our postwar sample using Babones and Álvarez-Rivadulla’s data has 3860 cases.

³³ Epstein *et al*, ‘Democratic Transitions’; the Polity score comes from Montgomery Marshall and Keith Jagers. Polity IV Project: Dataset Users Manual. College Park: University of Maryland (2002).

³⁴ The statistical derivation of this model is similar to that used with the dynamic probit model since we include the independent variables of interest *and* their interaction with the regime type in the previous period. However, we now interact with *two* regime variables: a dummy for whether a state was a ‘full autocracy’ in the previous period, and a dummy for whether a state was full autocracy or a partial democracy in the previous period.

³⁵ Full results are available on request from the authors.

³⁶ Acemoglu et al, ‘Income and Democracy.’

³⁷ Table Four uses a time trend specification. Using year dummies produces similar effects except in the case of the Polity score with country fixed effects where the coefficients on income and rural inequality lose significance.

However, even with year dummies and fixed effects, the coefficients remain robust when MaxPolity is used.

³⁸ We do not replicate here the trichotomous analysis both for reasons of space and because they were relatively few transitions to partial democracy in the post-war era, potentially causing selection bias. Results (available from the authors) are signed in the expected direction, though less robust than Table Three.

³⁹ We conducted similar analyses using the Prais-Winston approach and the MaxPolity and MinPolity variables as well as different time specifications. Results do not change substantively.

⁴⁰ Using the CLARIFY program: Gary King, Michael Tomz, and Jason Wittenberg. ‘Making the Most of Statistical Analyses: Improving Interpretation and Presentation.’ *American Journal of Political Science* 44(2000): 341-355.

⁴¹ Roberto Perotti, ‘Growth, Income Distribution and Democracy: What do the Data Say?’, *Journal of Economics Growth*, 1, 1996, 149-187. Francisco Rodriguez, ‘Does Distributional Skewness Lead to Redistribution? Evidence from the United States’, *Economics and Politics* 16: 1999. 171-199.

⁴² For example, Barrington Moore, *Social Origins of Dictatorship and Democracy*. (Boston: Beacon Press, 1966); Dietrich Rueschmeyer, Evelyn Stephens and John Stephens, *Capitalist Development and Democracy* (Chicago: University of Chicago Press, 1992).

⁴³ Similar results obtain if we use group incomes relative to the mean as our baseline measure of inequality.

⁴⁴ Kuznets, “Economic Growth and Income Inequality.”

⁴⁵ Altering this assumption to reflect $V_{Bi}(g) > V_{Ei}(g)$ strengthens all the qualitative results but at the expense of a much more complicated setup.

Figure 1: Extensive Form of the Partial Democracy Game

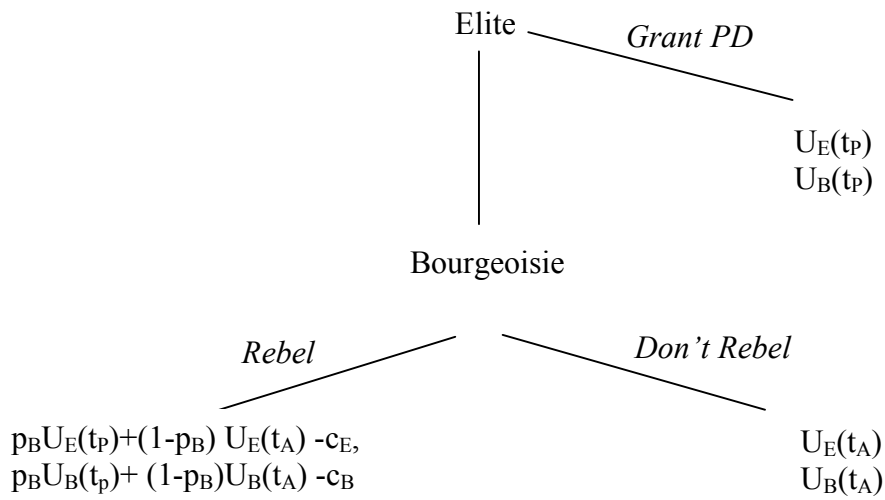


Figure Two (a): Linear estimations (BM and Babones)

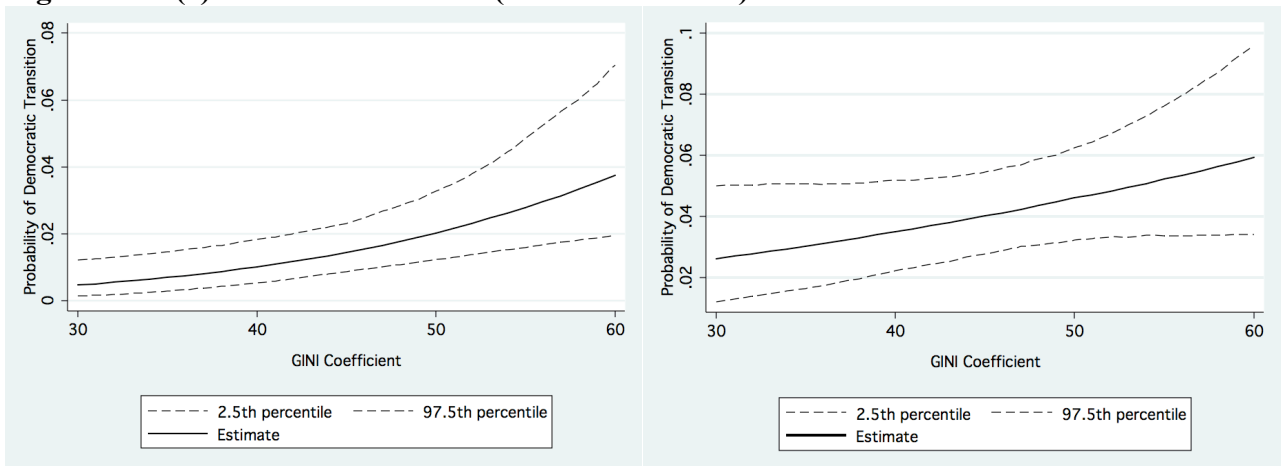


Figure Two (b): Quadratic Estimations (BM and Babones)

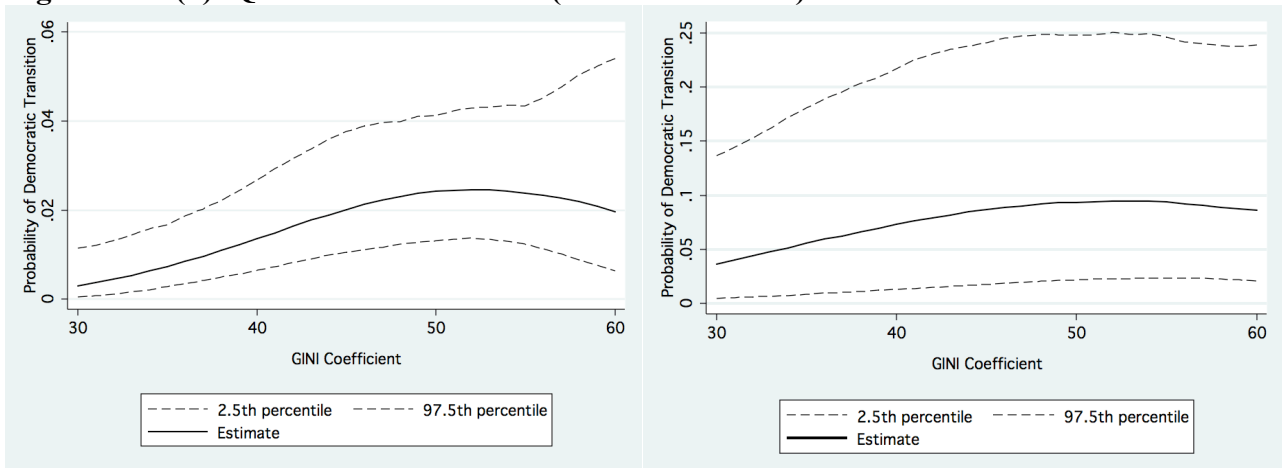


Table One: Binary Measure of Democracy

	MODELA	MODEL B	MODEL C	MODEL D	MODEL E	MODEL F
Estimation	PROBIT	PROBIT	GOMPIT	GOMPIT	GOMPIT	GOMPIT
Time Trend	TREND	YRS	TREND	YRS	TREND	YRS
Lag Democracy	5.736 (1.093)***	6.807 (1.111)***	8.138 (1.406)***	10.028 (1.615)***	7.386 (1.902)***	9.870 (2.548)***
GINI	2.730 (0.891)***	2.866 (0.931)***	5.417 (1.945)***	5.692 (2.158)***	6.497 (3.272)**	4.344 (4.628)
GDP per cap	0.178 (0.055)***	0.207 (0.063)***	0.385 (0.119)***	0.403 (0.174)**	0.339 (0.140)**	0.433 (0.211)**
Dem X GINI	-2.998 (1.878)	-3.620 (2.163)*	-5.536 (2.067)***	-6.212 (2.306)***	-8.120 (2.934)***	-12.437 (4.568)***
Dem X GDP	-0.035 (0.072)	-0.031 (0.086)	-0.258 (0.122)**	-0.176 (0.179)**	-0.196 (0.127)	0.024 (0.174)
Rural Inequality	-1.406 (0.346)***	-1.265 (0.389)***	-3.055 (0.861)***	-2.718 (0.952)***	-2.555 (1.086)**	-1.476 (1.462)
Dem X RI	0.005 (0.783)	0.230 (0.899)	1.754 (0.983)*	1.041 (1.128)	4.179 (1.469)***	5.663 (2.127)***
VH Knowledge	.001 (.001)	.002 (.006)	.003 (.014)	.007 (.018)	-.025 (.014)*	-.019 (.022)
Dem X Know	-.009 (.012)	-.017 (.012)	-.014 (.015)	-.025 (.019)	-.009 (.019)	-.024 (.022)
Constant	-15.046 (136.292)	-3.727 (0.630)***	158.466 (133.957)	-7.146 (1.529)***	624.584 (280.051)**	-17.761 (3.372)***
Fixed FX	NO	NO	NO	NO	YES	YES
Observations	4769	4769	4769	4769	3449	3351
Countries	53	53	53	53	35	35

Table Two: Simulated Effects of Income Inequality and Rural Inequality on Probability of Democratisation (Using Table One Model A)

Rural Inequality (percentile)	Income Inequality (percentile)						X
	.3 (3 rd)	.35 (8 th)	.4 (14 th)	.45 (41 st)	.5 (66 th)	.55 (97 th)	
.21 (3 rd)	3.36	4.44	5.82	7.57	9.74	12.37	3.68
.33 (8 th)	2.26	3.03	4.06	5.39	7.08	9.20	4.07
.58 (41 st)	0.93	1.29	1.80	2.49	3.42	4.65	5.00
.71 (66 th)	0.57	0.81	1.15	1.62	2.28	3.16	5.54
.92 (97 th)	0.26	0.37	0.54	0.79	1.15	1.65	6.35
X	12.92	12.00	10.77	9.58	8.47	7.50	

Table Three (a): Transition Probabilities for Change in GINI from 0.3 to 0.55

Transition “From”	Transition “to”		
	Autocracy	Partial Democracy	Democracy
Autocracy	-.129 (.057)**	.127 (.056)**	.001 (.001)**
Partial Democracy	.007 (.017)	.022 (.049)	-.028 (.063)
Democracy	-.000 (.000)	-.041 (.037)	.041 (.037)

Table Three (b): Transition Probabilities for Change in Rural Inequality from 0 to 0.95

Transition “from”	Transition “to”		
	Autocracy	Partial Democracy	Democracy
Autocracy	.196 (.080)***	-.194 (.078)***	-.002 (.002)***
Partial Democracy	.002 (.013)	-.016 (.086)	-.018 (.097)
Democracy	.000 (.000)	.055 (.057)	-.051 (.057)

Table Four: Continuous Measures of Democracy

	MODEL A	MODEL B	MODEL C	MODEL D	MODEL E	MODEL F
DV	POLITY	POLITY	MAX	MAX	MIN	MIN
Time Controls	FIXED FX	PRAIS -W	FIXED FX	PRAIS -W	FIXED FX	PRAIS -W
Lag Polity	0.927 (0.006)***	0.950 (0.009)***	0.959 (0.004)***	0.968 (0.006)***	0.968 (0.004)***	0.979 (0.005)***
GINI	1.395 (0.798)*	1.467 (0.415)***	2.011 (0.576)***	1.270 (0.489)**	-0.618 (0.532)	0.257 (0.484)
GDP per cap	-0.013 (0.015)	0.030 (0.015)*	-0.035 (0.011)***	-0.012 (0.010)	0.022 (0.010)**	0.045 (0.011)***
Rural Inequality	-0.526 (0.256)**	-0.608 (0.130)***	-0.324 (0.184)*	-0.395 (0.151)**	-0.203 (0.171)	-0.244 (0.134)*
VH Knowledge	-0.009 (0.004)**	0.004 (0.002)**	-0.004 (0.003)	0.003 (0.002)	-0.006 (0.003)***	0.001 (0.002)
Constant	233.561 (86.685)***	63.260 (113.179)	-0.192 (0.313)	51.224 (64.395)	90.181 (57.971)	0.271 (67.507)
Observations	4838	4838	4838	4838	4856	4856
Countries	53	0.94	53	0.97	53	0.98
R-squared	0.89		0.94		0.95	

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.
All regressions use country fixed effects and a time trend. Year dummies produce similar results.

Table Five: Examining the Babones/Álvarez-Rivadulla Data 1955-2004

	MODEL A	MODEL B	MODEL C	MODEL D	MODEL E	MODEL F	MODEL G	MODEL H
DV	BINARY	BINARY	POLITY	POLITY	POLITY	POLITY	POLITY	POLITY
Model	PROBIT	PROBIT	FIXED FX	FIXED FX	PRAIS	PRAIS	PRAIS	PRAIS
Time controls	TREND	YEARS	TREND	YEARS	TREND	YEARS	TREND	YEARS
Lagged DV	4.011 (.778)***	4.351 (.768)***	.867 (.015)***	.862 (.016)***	.929 (.008)***	.928 (.008)***	.917 (.009)***	.916 (.009)***
Babones GINI	1.271 (.751)*	1.241 (.723)*	1.442 (.852)*	1.197 (.895)	1.205 (.424)***	1.172 (.420)***	.983 (.507)*	.876 (.502)*
Maddison GDPCAP	.040 (.029)	.056 (.028)**	-.075 (.026)***	-.072 (.026)***	.016 (.008)*	.020 (.009)**	.003 (.010)	.006 (.010)
Rural Inequality	-.372 (.349)	-.0941 (.385)	-1.004 (.393)**	-.392 (.410)	-.859 (.232)***	-.671 (.236)***	-.853 (.258)***	-.582 (.267)**
VH Knowledge	-.003 (.005)	-.000 (.004)	-.026 (.010)**	-.019 (.010)**	.006 (.003)**	.007 (.003)**	.003 (.003)	.005 (.004)
DEM*GINI	-.082 (1.169)	.0373 (1.177)						
DEM*GDPCAP	.050 (.042)	.036 (.044)						
DEM*Rural Ineq.	-1.488 (.749)**	-1.576 (.791)**						
DEM*Knowledge	.002 (.008)	-.001 (.008)						
Oil Exporter							.005 (.170)	.012 (.168)
Islam over 50%							-.129 (.129)	-.101 (.128)
Communism							-.488 (.222)**	-.563 (.220)**
Constant	-17.92 (8.700)**	-2.348 (.484)***	-86.710 (18.39)***	.279 (.607)	-12.860 (4.776)***	-.299 (.342)	-23.350 (5.495)***	.311 (.410)
Observations	3828	3738	3860	3860	3860	3860	3860	3860
Countries	123	123	126	126	126	126	126	126
R-squared			0.808	0.812	0.931	0.933	0.931	0.933

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Models A, B, G, and H include region dummies.

Table Six: Comparing Functional Forms

Estimation	MODEL A PROBIT	MODEL B PROBIT	MODEL C POLITY FIXED	MODEL D POLITY FIXED	MODEL E PROBIT	MODEL F PROBIT	MODEL G POLITY FIXED	MODEL H POLITY FIXED
Dataset	BM	BM	BM	BM	BAR	BAR	BAR	BAR
Lag Democracy	5.736 (1.093)***	7.030 (3.535)**	.927 (.006)***	.927 (.006)***	4.011 (.778)***	7.427 (2.442)***	.867 (.0149)***	.867 (.0150)***
GINI	2.730 (.891)***	16.607 (8.654)*	1.395 (.798)*	-6.415 (.7026)	1.271 (.751)*	9.808 (5.112)*	1.442 (.852*)	-5.821 (6.335)
GINI Sq.		-15.848 (9.559)*		9.394 (8.468)		-9.333 (6.017)		8.184 (6.915)
GDP per capita	.178 (.055)***	.192 (.055)***	-.013 (.015)	-.012 (.017)	.040 (.029)	.051 (.032)	-.075 (.026)***	-.074 (.028)***
Rural Inequality	-1.406 (.346)***	.032 (1.320)	-.526 (.256)**	-.577 (.662)	-.372 (.349)	1.320 (1.671)	-1.004 (.393)**	-.852 (1.363)
Rural Ineq Sq		-1.254 (1.254)		.025 (.632)		-1.788 (1.787)		-.200 (1.282)
Education	.001 (.001)	.000 (.005)	-.009 (.004)**	-.010 (.004)**	-.003 (.005)	-.002 (.005)	-.026 (.010)**	-.026 (.010)**
Dem*GINI	-2.998 (1.878)	-7.013 (14.647)			-.0816 (1.169)	-13.996 (10.914)		
Dem*GDPCAP	-.035 (.072)	-.060 (.080)			.050 (.042)	.032 (.045)		
Dem*Rural Ineq	.005 (.783)	-2.150 (2.675)			-1.488 (.749)**	-3.044 (3.001)		
Dem*Education	-.009 (.012)	-.007 (.013)			.002 (.008)	.001 (.008)		
Dem*GINI Sq.		4.496 (16.638)				-15.312 (12.086)		
Dem*R.Ineq. Sq.		2.235 (2.971)				1.605 (3.404)		
Constant	-15.046 (136.292)	30.690 (146.904)	233.561 (86.685)***	217.279 (88.864)***	-17.92 (8.700)**	-11.412 (4.575)***	-86.710 (18.390)***	-85.313 (18.612)***
LR Test		0.441		0.526		0.439		0.482
AIC	742.526	746.778	18222.24	18224.96	765.96	770.20	15589.12	15591.66
BIC	820.164	850.296	18274.11	18289.8	890.97	920.20	15626.67	15641.73
Observations	4769	4769	4838	4838	3828	3828	3860	3860
Countries	53	53	53	53	123	123	126	126

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. All regressions include time trend.