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Income and the (eventual) rise of democracy*

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Abstract

We investigate the relationship between income and democracy. A theoretical framework is developed where citizens derive utility from both material goods and democratic rights. Citizens can devote their time either to creating material benefits or to political activism (that improves democratic liberties). We demonstrate a non-monotonic relationship between income and democracy. In poor countries—where the elasticity of the marginal rate of substitution between material good and democratic rights is low—exogenous increases in income (wages) lead to a reduction in the level of democratic liberties: as wages increase, citizens are increasingly willing to give up time otherwise devoted to activism to work more. In wealthy countries, the opposite is true: democratic liberties increase with income. Our country fixed-effects and GMM estimations on cross-country data over 1960-2010 empirically validate this non-monotonic prediction, thereby corroborating our theory above-and-beyond the effect of institutions and culture.

JEL classification codes: C72, D72, P16, P26

Keywords: Income, Democratic Values, Preferences.

1 Introduction

The relationship between income and democracy has preoccupied thinkers dating back at least as far as Aristotle. Despite the plethora of writings by influential scholars (Marx, 1904; Lipset, 1959; Huntington, 1991), the debate on whether modernization is conducive to freer and more representative political regimes remains unsettled. Such lack of consensus tracks the diversity

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of situations observed in the real world: although many societies experienced a tandem rise of living conditions and an expansion of their democratic rights (e.g., OECD countries after WWII), we have equally witnessed a consolidation of authoritarian rule in several countries with growing economies, including China; Russia and Turkey. Conversely, deep economic crises, including the Great Depression, can result in authoritarian regimes (e.g., Hitler and Mussolini), and in other instances can result in dictators being deposed following citizens' demands for a more democratic regime (e.g., Arab spring).

Recent research on the topic has helped us better understand mechanisms tying modernization to political evolution, yet apparent deep contradictions persist. The scholarship can be approximately divided into three perspectives: (i) the proponents of Lipset's *modernization hypothesis* arguing that economic development results in more liberal rights, (ii) authors defending the exact opposite view that negative income shocks lead to democratization, and (iii) scholars pointing at the critical role of institutions or culture and negating possible links between income and democracy.

The general argument put forth by Lipset (1959) is that with the advent of industrialization, urbanization, and increases in wealth and education, polities democratize but also become more resilient to autocratic reversals. Subsequent empirical investigations provided support for this thesis by establishing a causal link flowing through time variant variables like income (Boix and Stokes, 2003; Boix, 2011; Madsen et al., 2015; Treisman, 2020), education (Bobba and Coviello, 2007), or both (Barro, 1999a; Papaioannou and Siourounis, 2008; Murtin and Wacziarg, 2014). At the other spectrum, several scholars have provided evidence in support of an opportunity cost argument whereby negative income shocks reduce the cost of political activism, rebellion, or revolutionary effort, in turn increasing the likelihood of witnessing democratization (e.g., Burke and Leigh, 2010; Bruckner and Ciccone, 2011; Aidt and Leon, 2016). A third strand of the literature spearheaded by the work of Acemoglu et al. (2008) demonstrates that factors such as institutions or culture constitute the main determinants of political equilibria, possibly annihilating the effects of time-varying variables like income and education (e.g., Ang et al., 2021; Gorodnichenko and Roland, 2021).

This article reconciles the existing theories and evidence by developing a theory yielding a non-monotonic effect of income on democratic rights and provide corroborating empirical support for our theoretical predictions. We show that in less economically developed polities, economic *contractions* induce higher levels of democratic rights, whereas in more economically developed countries democratic rights will improve following economic *expansions*. Consequently, our approach supports the modernization hypothesis for sufficiently developed countries, and it equally confirms that economic crises may expand democratic rights (in poor countries) as evidenced by some scholars. Moreover, our empirical results are shown to criti-

cally hinge on the inclusion of fixed effects, thereby confirming earlier findings demonstrating the important role of time-invariant variables like institutions, culture, or geography when studying the relationship between economic development and democratic rights. Importantly, however, we show that estimating a monotonic relationship between income and democracy indicates the absence of any effect, hence implying that it is the failure to account for the non-monotonic relationship that leads to the conclusion of a non-effect.

Our main point of departure from earlier works is that we allow citizens to enjoy their democratic rights above-and-beyond any material benefits such liberties may carry (e.g., benefits associated with tax rates and public goods). This assumption contrasts with most of the literature on regime transitions, which has thus far assumed that the objective of citizens is to maximize their *material* welfare, with education, income levels, or technology modifying the relative costs and benefits of pushing for a democratic transition (e.g., Bourguignon and Verdier, 2000; Acemoglu and Robinson, 2006).[1] On the other hand, some political scientists have underlined that citizens have both *material* and *post-material* concerns, and that they value democratic rights, implying that concepts like self-expression, participation, or tolerance are an integral part of citizens' utility functions (Inglehart and Welzel, 2005; Welzel, 2007; Inglehart and Welzel, 2010). To date, few theoretical advances on the topic have accounted for this important nuance, with the reductive assumption in these works being that material and non-material goods are at best pure substitutes with linear valuations; i.e., citizens benefit from a lump-sum satisfaction from (not) enjoying democratic rights (e.g., Besley and Persson, 2019).

Our approach closely track citizens' preferences (see Inglehart and Welzel, 2005, for a detailed analysis), and enable us to uncover highly intuitive mechanisms that have, up until now, remained unexplored. We adopt the most natural approach to conceptualize citizens' preferences by assuming decreasing marginal utility over both material goods and democratic rights. While decreasing marginal utility over material goods is a commonly accepted assumption, it is also reasonable to think similarly of democratic rights to the extent that the first concessions granted (voting rights) certainly bear more utility than more 'marginal' improvements in free societies (e.g., abortion rights, gay rights). Importantly, we allow (but do not impose) the utility function to exhibit complementarities between these two components to the extent that wealth can never perfectly substitute the lack of democratic rights and representation (see also Veenhoven, 2000).

From this modeling framework, it follows that in poor countries experiencing economic development, citizens will increasingly be willing to trade away time that could have been dedicated to political activism, to work more intensely and benefit from the modernization

[1] Campante and Chor (2012, 2014) show that beyond education being a critical determinant of political activism, it is the combination of rising education and unemployment/failed economic opportunities that may produce political activism.

phase. Our finding therefore partly echoes Inglehart and Welzel's perspective: *"Survival is such a basic human goal that when it is uncertain, one's entire life strategy is shaped by the struggle to survive. Whether people grow up in a society with an annual per capita income of* \$300 *or* \$30,000 *has more direct impact on their daily lives than whether they grow up in a country that has free elections or not." (Inglehart and Welzel, 2005, p. 23)*

Conversely, in wealthy countries where citizens' basic needs are mostly satisfied, modernization will push citizens to increase political activism despite its higher opportunity cost (i.e., remuneration of labor) because of the high relative utility gains from obtaining further political concessions. Again, echoing Inglehart and Welzel: *"Socioeconomic modernization reduces the external constraints on human choice by increasing people's material, cognitive, and social resources. This brings growing mass emphasis on self-expression values, which in turn lead to growing public demands for civil and political liberties, gender equality, and responsive government, helping to establish and sustain the institutions best suited to maximize human choice - in a word, democracy." (Inglehart and Welzel, 2005, p. 2)*

We allow material goods to be both available in the form of national wealth, and produced by citizens, with the opportunity cost of production being the marginal improvement of democratic rights that would be obtained from more intense lobbying/protests; what we term political activism. The ruling elites aim at minimizing the degree of democratic rights so as to maximize the share of embezzled public wealth. We are able to demonstrate that the effect of increases in economic development on the degree of democracy is conditional on the level of economic development of the society under study. For low initial levels of economic development, when citizens experience a high marginal utility from material goods, modernization as captured by a positive productivity shock will *reduce* political activism and the ensuing democratic rights. This result is driven by the fact that increased marginal benefits from productive activities will outmatch the marginal gains from political activism when the marginal utility of income is high. For high levels of economic development when the marginal utility from income is low, the reasoning is reversed. Following a modernization shock, the marginal utility from the material good will be low while the complementarity between material goods and non-material goods will increase the marginal return from political activism, eventually incentivizing citizens to trade-away part of their already high income for increased democratic rights.

We provide corroborating empirical evidence for our theoretical mechanism and findings. We reproduce the methodology of Acemoglu et al. (2008) whose data spans 1960-2000 and consider a longer time period (1960-2010). Importantly, although estimations that impose a monotonic relationship between income and democracy reveal an independence between the two variables, accounting for possible non-monotonicities in the relationship between income

and democracy yield radically different predictions. Indeed, whether we estimate a U-shaped relationship between the two variables of interest or a piece-wise linear regression (spline estimation), our results confirm the existence of a non-monotonic relationship as predicted by our theory. Importantly, these results are shown to be robust to GMM estimations and to the inclusion of controls used in Acemoglu et al. (2008), namely human capital, population, and age structure. Moreover, to provide evidence of the specific mechanism identified in our theory—that democratization, or its reversal, is driven by changes in living conditions influencing political activism—we supplement our analysis with two further estimations. First, we use World Value Surveys data and confirm a non-monotonic relationship between national income per capita and citizens' interest in politics and propensity to attend peaceful/lawful demonstrations. Second, using data from the Manifesto project we equally uncover a non-monotonic relationship between national income per capita and election programs' inclination to see citizens democratically influencing politics.

Our contribution is to provide new insights into the relationship between income and democracy. By incorporating a dimension that has been recognized to be salient by political scientists—non-material valuation of democratic rights—we are able to reconcile multiple theories and evidence into an intuitive approach towards understanding the relationship between income and democracy. We view our framework—that material goods and democratic rights feature some degree of complementarity—as the most natural way of thinking about preferences over these "goods". This perspective gives rise to a very interesting and yet intuitive mechanism: in wealthy societies, citizens become increasingly willing to sacrifice material wealth for increased political rights since these will, in turn, enhance the satisfaction derived from material goods too. Our predictions point to an expected non-monotonic relationship between economic development and democratization. Our empirical findings support the existence of a U-shaped relationship between income and democracy; a hypothesis that has thus far not been tested empirically and one that reconciles apparent contradictory findings in the literature.

The remainder of the article is organized as follows. In the following section we relate our analysis to the existing literature. In Section 3 the theoretical model is presented with our main findings and Section 4 details the empirical evidence. Section 5 concludes.

2 Related literature

Recognizing the important connections tying economics to politics (Acemoglu and Robinson, 2013), a large body of theoretical literature has developed to better understand the factors and mechanisms conducive to democratization. The common denominator to most of these

writings is the implicit assumption that democracy carries value to citizens only to the extent that it enables them to reallocate material resources in a beneficial way (e.g., Acemoglu et al., 2005; Edmond, 2013; Gehlbach et al., 2016; Mayoral and Ray, 2021). In other words, citizens do not value democratic rights *per se*—as is the case in our own setup—but have instead an instrumental view of politics.

The current state of the theoretical literature can be decomposed into three strands. In the first strand, scholars propose models where democratization results from negative economic shocks. Acemoglu and Robinson (2001) developed a framework in this context, where the disenfranchised parts of society can be granted voting rights in times of negative economic performances because of the elites' inability to commit to a future redistribution of resources. The main prediction stemming from Acemoglu and Robinson (2001) is the democratizing effect of negative income shocks. In a similar vein, Kotschy and Sunde (2021) show that negative income shocks push countries to democratize, with the important nuance that the effect is conditioned by the presence of inequality.

A second strand of the literature brings theoretical support for Lipset's modernization hypothesis. Huang (2012) proposes a theoretical model where the political power of society's different groups is a function of their economic power. With modernization, the economic power gradually switches to the capital owners, before transitioning to workers once they accumulate sufficient human capital. Boucekkine et al. (2019) and Parente et al. (2022) propose models emphasizing the education channel mechanism through which modernization may lead to democratization. In Boucekkine et al. (2019), education raises citizens' democratic/political awareness and in Parente et al. (2022) it facilitates citizens' push for democratization, thus implying that in both frameworks education leads to democratization. Parente et al. (2022) demonstrate that if the masses pose initially a large enough threat, the regime will decide to educate the masses, thereby resulting in an endogenous democratization of the country. Boucekkine et al. (2019) predict that along the democratization equilibrium, a society may also end up in an authoritarian equilibrium featuring high inequality and little education.

In a third strand, Robinson (2006) proposes a model where better institutions enable citizens to experience both better economic outcomes and to overcome collective action problems that are key for pushing changes in regime types. Accordingly, economic and political outcomes are highly dependent on the quality of institutions. Gorodnichenko and Roland (2021) compare individualistic and collectivist cultures, and demonstrate that the former is more likely to produce democratic transitions because although collectivist societies experience a higher probability of successful revolution—conditional on a successful revolution—they also face a higher probability of re-establishing another autocrat. In more recent work, Acemoglu and Robinson (2022) develop a theory whereby the distribution of power molds a society's

cultural attributes, eventually resulting in very different economic and political development paths. These works therefore point at the central role played by country-specific characteristics (institutions and culture), and confirm both the importance of these notions, and the necessity to account for them in empirical studies.

Our own model predicts a non-monotonic relationship, partially tracking the results of Larsson Seim and Parente (2013). These authors show that autocracies with elites will starkly oppose any democratization attempt, but in sufficiently industrialized polities elites will increasingly favor democracy to avoid their capital being taxed by the regime.

The three strands of literature on income and democracy disregard the intrinsic value of democracy to citizens. Some scholars have partially overcome this limitation by studying the effect of education on political activism. The argument developed is that education enables citizens to better comprehend the world they live in but also to resolve collective action problems and be more efficient in political activism, in turn pushing them to be politically more involved and active (e.g., Brady et al., 1995; Glaeser et al., 2007; Parente et al., 2022). Although these theories, which have also received empirical support (Milligan et al., 2004; Parente et al., 2022), do recognize that the relative valuation of democracy may be a function of education, these articles do not provide an explicit formulation of the utility of democracy to citizens, as we outline in this article. Observe that in our empirical analysis we account for the potential effects of education on democratization, thereby identifying a non-monotonic effect of income on democracy that is not explained by citizens' educational attainment.

Inglehart and Welzel (2005, 2010) and Welzel (2007) emphasize the importance of self-expression values when studying the prevalent degree of political rights in a society. These authors argue that citizens derive intrinsic utility from political rights such as freedom of speech, or the ability to influence decisions over non-material issues like e.g., abortion, gay marriage, or religious public education. Accordingly, in poor polities where citizens' survival is not secured, the importance of these values is reduced, whereas in wealthy societies citizens put more emphasis on these values. Besley and Persson (2019) incorporate non-material considerations but in a restrictive manner. In Besley and Persson (2019), citizens derive utility from democratic values alongside material goods, with the reductive assumption in this work being that material and non-material goods are, at best, pure substitutes with linear valuations; i.e., citizens benefit from a lump-sum satisfaction from (not) enjoying democratic rights. These assumptions may, however, appear arbitrary to the extent that the weight given to democratic values is not independent from one's own material wealth, or, in the words of Inglehart and Welzel (2010) "*rising levels of economic security bring growing emphasis on self-expression values [...] When survival is insecure, it tends to dominate people's life strategies*". By adopting a more general formulation of citizens' preferences that accommodates decreasing marginal utility for

both components of the utility function, i.e., the material good and democratic rights, as well as complementarities between material goods and democratic rights, we show that the effect of modernization on democratization is non-monotonic.

In the empirical literature linking economic performance and regime type, there is no consensus either. Boix and Stokes (2003), Boix (2011), and Treisman (2020), for instance, showed that economic development enables countries to democratize, while Ciccone et al. (2012) show that higher economic growth provoked by exogenous oil price shocks to oil-exporting countries, result in higher levels of democracy. Barro (1999b) additionally shows that education is a major lever of the process, and Castelló-Climent (2008) confirms the salient role played by education, by emphasizing however the importance that the education be uniformly distributed over the population for it to play a role. Przeworski and Limongi (1997) posit that economic development can, at best, help democracies avoid a relapse in authoritarianism, but not initiate the democratization process. Acemoglu et al. (2008) brought evidence that the correlations in support of Lipset's hypothesis were entirely driven by country-specific characteristics, thus resulting in the theory being disproved when adding country fixed effects to the econometric exercise. Subsequent work resurrected the modernization hypothesis, whether by adding further control (institutional) variables (Cervellati et al., 2014) while using the same methodology as Acemoglu et al. (2008), by using system GMM rather than difference GMM (Heid et al., 2012; Che et al., 2013), or by distinguishing short run from long run effects of modernization (Treisman, 2015). Pittaluga et al. (2020) nuance the relationship between income and democracy by establishing a positive causal link conditional on income being generated by a multi-sector industry that gives rise to numerous different and separate interest groups. Last, in partial support of the modernization hypothesis thesis, Rod et al. (2020) run a very large number of theory-free regressions finding that income is not a very robust predictor of democracy, although the relationship is nevertheless confirmed for some measures of democracy.

Other literature produces findings in stark contrast with the above results by showing that negative income shocks may help polities democratize. Burke and Leigh (2010), Bruckner and Ciccone (2011), and Franck (2016) establish empirical evidence corroborating the theory of Acemoglu and Robinson (2001): that economic contractions lead to democratization, hence presenting evidence in stark opposition to Lipset's hypothesis. Further, Aidt and Leon (2016) confirm that negative economic shocks in Sub-Saharan Africa sparked riots that resulted in the elites making democratic concessions for fear of the riots evolving in a full-fledged revolution (e.g., Aidt and Jensen, 2014; Aidt and Franck, 2015).

Prima Facie, it appears that the empirical debate has to a large extent opposed scholars working on institutions and culture to proponents of (various forms of) the modernization hypothesis. The former view, where a polity's degree of democracy intimately tied to the institu-

tional (and cultural) legacies, are rooted in a country's history and often determined by events having taken place at "critical junctures" (e.g., Acemoglu et al., 2008; Olsson, 2009; Alesina and Giuliano, 2015; Gorodnichenko and Roland, 2021; Acemoglu and Robinson, 2022). Given this "long-run view" of societies, some scholars therefore explored the relationship of income and democracy with longer time series than the ones typically used in the empirical literature. These scholars re-establish the (positive) connection between the two variables by adopting a "long-run analysis" that extends the period under consideration before 1960 (Murtin and Wacziarg, 2014; Barro, 2015)—the starting date of Acemoglu et al. (2008)'s analysis—and as early as 1820 (Gundlach and Paldam, 2009). Both approaches contribute importantly to our understanding of the relationship between income and democracy, but their approach to the question has disregarded the possibility that this relationship is non-monotonic—as we show to be the case both theoretically and empirically in this article. We thus view our contribution as complementary to earlier writings, and opening the way for further explorations of the topic.

Our framework provides a theoretical underpinning to seemingly contrasting empirical results. On the one hand, we show that for low levels of economic development, negative economic shocks will incentivize citizens to increasingly contest democratic rights, especially if the elites have a privileged access to material resources. Our explanation derives from a different mechanism than Acemoglu and Robinson (2001) because we show that for low levels of economic development a negative productivity shock will reduce the marginal utility from economic activities, thus incentivizing citizens to substitute economic activity by political activism since the marginal utility of the latter will have been left mostly unaffected by the economic shock. Quite interestingly, the empirical works in support of Acemoglu and Robinson (2001)'s theory have made use of identification strategies affecting poor populations alone (e.g., Climate or resource-related shocks, or the study of historical cases like 18^{th} century France and 19^{th} Century England), giving thus additional explanatory power to our theory whose predictions are conditional on countries' economic development. On the other hand, for high levels of economic development our predictions are reversed and thus bring support (but also a theoretical basis) to the empirical findings confirming the modernization hypothesis. Indeed, and echoing the intuition of Inglehart and Welzel (2005), at high levels of economic development when basic needs are satisfied and the marginal utility from material goods has reached low levels. In such contexts, an increase in one's productivity will provoke a strong enough income effect to incentivize the citizens to invest in political activism in view of expanding the amount of (complementary) democratic rights enjoyed.

3 The model

3.1 The setup and equilibrium

Consider a society composed of citizens and elites where democratic rights, $p \in [0,1]$, define the weight of the citizens' influence in the decision-making process. We allow democratic rights to reflect any possible polity ranging from a pure autocracy where elites are in total control of policies, i.e., $p = 0$, to a perfect democracy where citizens decide policies on their own, i.e., $p = 1$. We take the initial democratic rights to be given by some value $p_0 \in (0,1)$ and we term this the initial degree of democracy. Democratic rights determine how the society's resources, R (e.g., oil, land, etc...), are shared between the two societal groups, while citizens also derive direct utility from living in a more democratic polity: citizens enjoy civil liberties and democratic rights above and beyond the material benefits derived from deciding public policies.

We consider that democratic rights can be influenced from the initial degree of democracy by the actions of citizens and elites. Citizens have a time-endowment e that can be allocated to either labor at a unit wage of w, or to political activism. They can therefore dedicate effort, $x \in [0,e]$, to contest the current degree of democracy by protesting, rioting, or engaging in other forms of political activism. We suppose the elites can allocate $y \geq 0$ resources in countering these demands. We assume that the scope of rights that are contested is given by $\gamma \in [0,1]$. The outcome of this political tension is given by a simple Tullock contest so that the share of γ awarded to the citizens is $\sigma\gamma$, where $\sigma = \frac{x}{x+y}$, and that awarded to the elite is $[1-\sigma]\gamma$. If citizens do nothing while the elites are active, democratic rights reduce to $p_0 - p_0\gamma = [1-p_0]\gamma$; if citizens are active in contesting democratic rights then the resulting degree of democracy is determined by

$$p \equiv p_0[1-\gamma] + \sigma\gamma;$$

if the elites are inactive while citizens are, then democratic rights increase to $p_0[1-\gamma]+\gamma$.

Citizens derive utility over material goods, m, and over democratic rights, p, and their payoff is given by

$$U = U(m,p). \tag{1}$$

Material goods are determined by $m = w[e-x] + \beta pR$, which captures that citizens enjoy the output of their labor and benefit from society's resources being redistributed to citizens, the extent of which is determined by the degree of democracy. The parameter $\beta \in [0,1]$ allows us to control the importance of this latter aspect and indeed turn it off by setting $\beta = 0$; this is reasonable in large societies where the per-capita amount of resources would

be insignificant, and is what we impose for the remainder of the analysis. We make the following assumptions on $U(m,p)$: $U_m > 0$, $U_{mm} < 0$, $U_p > 0$, $U_{pp} < 0$, and $U_{mp} \geq 0$, with subscripts denoting partial derivatives. We are therefore adopting a very standard approach in viewing citizens experiencing diminishing marginal utility over both material goods and democratic rights, with the latter assumption reflecting the fact that increments in democratic rights in less democratic regimes (e.g., extending the suffrage) generates more utility than increments in highly democratic regimes (e.g., having a say—positive or negative—on animal rights). Moreover, we view material goods and democratic rights as featuring some degree of complementarity, or at least we rule out the possibility of the goods being substitutes. Defining $MRS \equiv \frac{U_m}{U_p}$, we observe that since our assumptions imply U is strictly concave (and therefore quasi-concave), the following observation holds:

Observation 1

$$MRS_m = \frac{U_{mm}Up - U_m U_{mp}}{[U_p]^2} < 0, and \tag{2}$$

$$MRS_p = \frac{U_{mp}Up - U_m U_{pp}}{[U_p]^2} > 0. \tag{3}$$

We assume that the elites merely enjoy material benefits, and as such their payoff is given by

$$V = [1-p]R - y. \tag{4}$$

Note, however, that the elite's payoff could be represented by any monotonic transformation of this net material outcome.

In choosing their expenditure in contesting citizens' fight for democratic rights, the elites seek to

$$\max_{y \geq 0} \left[1 - p_0[1-\gamma] - \frac{x}{x+y}\gamma\right] R - y.$$

The first-order condition is given by

$$\frac{x}{[x+y]^2}\gamma R - 1 = 0;$$

the second-order condition is readily shown to be satisfied. Accordingly, the elite's repression reaction function is given by

$$\hat{y}(x) = [\gamma R x]^{1/2} - x. \tag{5}$$

Citizens, on the other hand, when choosing their effort in contesting democratic rights will seek to

$$\max_{x \in [0,e]} U\left(w[e-x], p_0[1-\gamma] + \frac{x}{x+y}\gamma\right).$$

The associated first-order condition is

$$\frac{\partial U}{\partial x} = -wU_m + \frac{y}{[x+y]^2}\gamma U_p = 0,$$

while the second-order condition is satisfied since

$$\frac{\partial^2 U}{\partial x \partial x} = w^2 U_{mm} - 2w\frac{y}{[x+y]^2}\gamma U_{mp} - \frac{2y}{[x+y]^3}\gamma U_p + \left[\frac{y}{[x+y]^2}\gamma\right]^2 U_{pp} < 0.$$

The first-order condition can then be written as follows:

$$MRS\left(w[e-x], p_0[1-\gamma] + \frac{x}{x+y}\gamma\right) = \frac{y}{[x+y]^2}\frac{\gamma}{w}, \tag{6}$$

and substituting for (5), the equilibrium effort of political activism x^* is thus defined by

$$x : l \equiv MRS\left(w[e-x], p_0[1-\gamma] + \left[\frac{\gamma x}{R}\right]^{1/2}\right) - \frac{[\gamma R x]^{1/2} - x}{wRx} = 0. \tag{7}$$

The equilibrium democratic rights are therefore given by $p^* = p_0[1-\gamma] + \gamma\sigma^*$, where $\sigma^* = \frac{x^*}{x^*+y^*} = [\frac{x^*}{\gamma R}]^{1/2}$.

3.2 The effect of modernization on democratic rights

We now explore the effect of economic development—as captured by increases in wages w—on citizens' equilibrium political activism x^* and associated level of equilibrium democratic rights p^*. As a starter, we establish the following lemma:

Lemma 1 *The equilibrium income level of citizens m^* is a monotonically increasing function of wages w^*.*

Proof. Recall first the definition of m^*: $m^* = w[e - x^*]$. Accordingly, we have:

$$\frac{dm^*}{dw} = [e - x^*] - w\frac{dx^*}{dw}.$$

By the implicit function theorem, we know that $dx^*/dw = -\frac{\partial l}{\partial w}/\frac{\partial l}{\partial x}$. Substituting in the above expression, we obtain:

$$\frac{dm^*}{dw} = \frac{1}{\frac{\partial l}{\partial x}}\left[[e - x^*]\frac{\partial l}{\partial x} - w\frac{\partial l}{\partial w}\right].$$

We next compute $\frac{\partial l}{\partial x}$ and $\frac{\partial l}{\partial w}$:

$$\begin{aligned}\frac{\partial l}{\partial x} &= -wMRS_m + \frac{1}{2}\frac{\gamma}{R}\left[\frac{\gamma x}{R}\right]^{-1/2} MRS_p + \frac{1/2[\gamma Rx]^{1/2}}{wR[x]^2} \\ &= -wMRS_m + \frac{1}{x}\left[\frac{1}{2}\left[\frac{\gamma x}{R}\right]^{1/2} MRS_p + \frac{1}{2w}\left[\frac{\gamma}{Rx}\right]^{1/2}\right] > 0.\end{aligned}$$

Focusing next on $\partial l/\partial w$, we obtain:

$$\begin{aligned}\frac{\partial l}{\partial w} &= [e-x]MRS_m + \frac{[\gamma Rx]^{1/2} - x}{w^2 Rx} \\ &= \frac{1}{w}\left[w[e-x]MRS_m + MRS\right] \\ &= \frac{1}{w}\left[mMRS_m + MRS\right],\end{aligned}$$

where the second line follows from using (7).

Substituting these expressions in $\frac{dm^*}{dw}$ yields:

$$\frac{dm^*}{dw} = \frac{1}{\frac{\partial l}{\partial x^*}}\left[-\underbrace{w[e-x^*]}_{=m^*} MRS_m + \frac{e-x^*}{x^*}\left[\frac{1}{2}\left[\frac{\gamma x^*}{R}\right]^{1/2} MRS_p + \frac{1}{2w}\left[\frac{\gamma}{Rx^*}\right]^{1/2}\right] + m^* MRS_m + MRS\right],$$

and this then reduces to:

$$\frac{dm^*}{dw} = \frac{1}{\frac{\partial l}{\partial x^*}}\left[\frac{e-x^*}{x^*}\left[\frac{1}{2}\left[\frac{\gamma x^*}{R}\right]^{1/2} MRS_p + \frac{1}{2w}\left[\frac{\gamma}{Rx^*}\right]^{1/2}\right] + MRS\right] > 0.$$

■

Given Lemma 1, we now explore the effect of w on citizens' political activism (and associated democratic rights), since we will then be able to deduce a relationship between income (m) and democratic rights by the above lemma. We begin by understanding the effect of w on x^*. By the implicit function theorem, we know that $dx^*/dw = -\frac{\partial l}{\partial w}/\frac{\partial l}{\partial x}$. Since we have shown that $\frac{\partial l}{\partial x} > 0$, it follows that the sign of dx^*/dw is given by the (inverse of the) sign of $\frac{\partial l}{\partial w}$. Define $\eta_m \equiv \left|\frac{mMRS_m}{MRS}\right|$ and recall that $MRS_m < 0$. Then it follows that

$$\frac{\partial l}{\partial w} \gtreqless 0 \iff \eta_m \lesseqgtr 1.$$

We can then deduce that:

$$\frac{\partial x^*}{\partial w} \lesseqgtr 0 \iff \eta_m \lesseqgtr 1.$$

Moreover, since $\sigma^* = [\frac{x^*}{\gamma R}]^{1/2}$ it follows that $sgn\{\frac{\partial \sigma^*}{\partial w}\} = sgn\{\frac{\partial x^*}{\partial w}\}$. This allows us to state the following proposition:

Proposition 1 *Political activism and the degree of democracy are increasing in income for $\eta_m > 1$, and decreasing otherwise.*

The intuition of this proposition is that the effect of citizens' wages on political activism, and by extension the equilibrium degree of democracy, critically hinges on the elasticity of the marginal rate of substitution (between material goods and democratic rights) to the amount of material goods consumed by the citizen: if the MRS is highly elastic to m (i.e. $\eta_m > 1$), then increments in w will lead to a drastic reduction of the MRS, which—accounting for the strategic reaction of the elites—in turn incentivizes citizens to substitute production effort by political activism, i.e., $\partial x^*/\partial w > 0$, despite its higher opportunity cost. Since the equilibrium degree of democracy is monotonically increasing in political activism, this in turn implies that higher incomes map into more democratic polities. Contrariwise, in instances where the m-elasticity of the MRS is low, higher wages will spur the incentives of citizens to increase their production effort and consequently decrease political activism.

We can further decompose the key expression determining the sign of $\partial x^*/\partial w$ since, replacing by the appropriate terms, we obtain that:

$$\frac{\partial x^*}{\partial w} \lessgtr 0 \iff \frac{m\left[U_{mm}U_p - U_m U_{mp}\right]}{\left[U_p\right]^2} + \frac{U_m}{U_p} \gtrless 0.$$

Accordingly, the counter-modernization result identified in Proposition 1 for $\eta_m < 1$ is more likely to be observed if (i) the MRS is high, (ii) the MRS is not very sensitive to changes in m, and (iii) the complementarities between m and p are limited.

It is interesting at this stage to reflect on the relationship between a country's income and the degree of democracy. From the above three conditions determining whether η_m is larger or smaller than unity, we deduce that the degree of democracy is likely to *decrease* with a country's income level (as proxied by wages) if the country is relatively poor. Indeed, for such countries the wage is low and the MRS is high (because of decreasing marginal utility), while it is also reasonable to expect that for such low incomes the *complementarities* between material goods and democratic rights will be low. Last, this will be all the more true if the utility derived from material benefits and democratic rights is rather insensitive to changes in quantities, i.e., if the citizens' needs, in terms of material goods, are far from being satisfied so that their marginal utility of consuming goods does not drop with marginal increases in income. Conversely, we expect the degree of democracy to *increase* with income for wealthier polities, thereby establishing an anticipated U-shaped relationship between income and democracy.

4 Empirical evidence

4.1 Data

Our theory sheds new light on the link between income and democracy and predicts a U-shaped relationship between these variables. In order to empirically test our theory we construct an (unbalanced) country-level panel dataset spanning from 1960 to 2010 that includes variables from earlier literature that has investigated the modernization hypothesis.

We measure democracy with the Polity IV score of democracy that spans from -10 (full autocracy) to $+10$ (full democracy). To facilitate the interpretation of the estimated coefficients, we normalize the Polity index to lie between 0 and 100. Although the Polity IV index has been widely used in the literature, some scholars have equally relied on the Freedom House index, yet the latter variable is not suitable for the purpose of our exercise given that the earlier recorded entry for this index is 1972; a time-span constraint that would impair our ability to empirically capture the predicted non-monotonic relationship, as explained later.

Income is captured by real GDP per capita, measured in thousand 2017 USD per capita obtained by dividing real GDP, expenditure side in millions of 2017 USD by Population (millions) from version 10 of the Penn World Tables (PWT), times 10^{-3}. Yet, since many scholars who studied the modernization hypothesis—including Lipset (1967)—have identified different channels than the one we uncover in this article, most notably the one flowing through education and human capital accumulation, we introduce a set of controls used in Acemoglu et al. (2008). Our measure of *education* is the human capital index provided by PWT. We make use of *population*, measured as the log of the total population (PWT) in thousand inhabitants, and *age dependency ratio*, namely, the number of dependents (15-64 years old) per 100 working-age individuals, taken from the World Development Indicators (WDI) of the World Bank, in turn informed by the United Nations Population Division's World Population Prospects: 2019 Revision. Savings rate data is computed from PWT, as $1 - csh_c - csh_g$, where csh_c and csh_g are, respectively, the share of household and government consumption at current PPPs. When instrumenting income with the saving rate, we control for the share of labour income, consistently informed by PWT.

4.2 Empirical specification

Our theory sheds new light on the relationship between income and democracy by uncovering a mechanism that has so far been totally disregarded by scholars: the (marginal) valuation of extended democratic rights is a function of both current rights and expected consumption of material goods. Proposition 1 uncovers a U-shaped relationship between income and democ-

racy, while the literature has exclusively explored monotonic relationships that either support (e.g. Benhabib et al. 2013) or disprove (e.g. Acemoglu et al. 2008) Lipset's argument. Yet, our non-monotonic prediction—if empirically true—is likely to deeply impair the predictive capacity of empirical models focusing exclusively on monotonic relationships. To inquire whether there is indeed such a non-monotonic relationship between income and democracy we estimate two equations that amend the specification of Acemoglu et al. (2008) so as to capture the expected U-shape predicted by our theory. The first equation is the following quadratic specification:

$$d_{it} = \alpha_0 + \alpha d_{it-1} + \beta_1 y_{it-1} + \beta_2 y_{it-1}^2 + u_i + \mu_t + v_{it}, \tag{8}$$

where d_{it} is our measure of democracy for country i in year t, y_{it} is income in country i in year t, and u_i and μ_t are country and time fixed effects. The lagged variable of democracy is introduced to capture the well established persistence of regime type (e.g. Acemoglu et al. 2008, 2009, Heid et al. 2012, Che et al. 2013), while country- and time- fixed effects have been shown to be essential in testing the validity of the modernization hypothesis (Acemoglu et al. 2008, Cervelatti et al. 2014). Unlike previous literature, we do not log-transform our main variable of interest, income, to better fit the empirical specification to our theoretical predictions of the previous section. Indeed, if the data is U-shaped, and thus roughly symmetrically distributed around some mean value (the vertex of the U), then a log-transformation would skew the distribution by flattening the relationship for values below the vertex and steepening the relationship for values above the vertex. Fitting a quadratic specification to such skewed data would likely fail to capture the non-monotonic nature present in the data. Moreover, given that in the panel of countries per capita incomes is already left-skewed, the above-described problem will be further exacerbated.

To provide further evidence of the expected non-monotonic relationship and to overcome some estimation issues that may arise with the quadratic specification for the reasons evoked above, we also estimate the following spline-regression:

$$d_{it} = a_0 + a d_{it-1} + b_1 y_{it-1}^l + b_2 y_{it-1}^h + u_i + \mu_t + v_{it}, \tag{9}$$

where $y_{it-1}^l = min(y_{it-1}, y_k)$, $y_{it-1}^h = max(0, y_{it-1} - y_k)$, and in the benchmark estimations y_k, the knot of the income spline, is the income in the vertex of the estimated equation (8). Also, we show that our results are robust to alternative choices for the knot of the spline. Accordingly, our expectations are that the estimates of coefficients b_1 and β_1 should be negative and significant, while b_2 and β_2 should be positive and significant. An interesting feature of specification (9) is that it is flexible enough to detect non-monotonicities with (even highly)

skewed data, hence allowing us to equally estimate the relationship with log-transformed GDP/capita data as shown below.

4.3 Estimators

We first run pooled OLS on equation (8), naively ignoring country-specific fixed effects u_i that instead become part of a composite unobserved error, $\epsilon_{it} = u_i + v_{it}$. This means that when a country faces an early negative (positive) unexplained shock on democracy that leads to democracy being low (high) in that country for consecutive observations, the estimator does not take this shock as a country-specific negative (positive) fixed effect, but fully as evidence of democracy's persistence, inflating the persistence estimate (β_1) and providing as a consequence an upper bound for its estimate (Roodman 2009).

We then include country-specific dummy indicators that were omitted in OLS to run the fixed-effects (FE) estimator. This leads to country-specific estimated intercepts $\hat{u}_i = \frac{1}{T}(d_{i1} + .. + d_{iT})$ or, equivalently, to running OLS after country demeaning, where the transformed explanatory lagged dependent variable becomes $d^*_{i,t-1} = d_{i,t-1} - \frac{1}{T}(d_{i1} + .. + d_{iT})$ and the error term becomes $v^*_{it} = v_{it} - \frac{1}{T}(v_{i1} + .. + v_{iT})$. Although we consider a longer period (1960-2010) than much of the literature (e.g. Acemoglu et al. (2008) whose period is 1960-2000), by observing data every 5 years as is standard in the literature we are still left with a small number of observations per country (T). This makes the FE estimator of persistence inconsistent due to dynamic (alias Nickell) panel bias (Nickell 1981, Bond 2002): in a data generating process where the idiosyncratic error v_{it} affects contemporaneous democracy d_{it}, the country demeaning for d_{it-1} subtracts $\frac{1}{T}(d_{i1} + .. + d_{iT})$ from each observation, with terms affected by the contemporaneous idiosyncratic errors of several periods $v_{it}, t = 1, .., T$. As a result, demeaned democracy is endogenous to unexplained changes in demeaned democracy in other periods. In other words, the within-country transformation fails to provide explanatory variables that are orthogonal to the errors, leading to an inconsistency in the estimator of α that is increasing in $\frac{1}{T}$ and hence decreasing in the number of observations per country, T. The Nickell bias leads to a downward bias in persistence thus biasing results in the opposite direction to the OLS bias. More importantly, if income is also correlated with the idiosyncratic residuals, the dynamic panel bias could also affect the FE estimator of the coefficients on lagged incomes, which are key to our main empirical question.

To overcome this concern, we run the Anderson-Hsiao (AH) estimator, which starts by first-differencing the original equation, resulting in $\Delta d_{it} = \alpha \Delta d_{it-1} + \beta_1 \Delta y_{it-1} + \beta_2 \Delta y^2_{it-1} + \Delta \mu_t + \Delta v_{it}$. This cancels out the country-specific errors u_i and avoids our results being subject to the Nickell bias. However, at this stage, the explanatory lagged dependent variable Δd_{it-1} is still potentially endogenous to the error term Δv_{it} via the contemporaneous effect

of v_{it-1} on d_{it-1}, as $v_{it-1}(d_{it-1})$ is the subtrahend (minuend) in $\Delta v_{it}(\Delta d_{it-1})$ (Roodman 2009). By extension, if income is not strictly exogenous, the transformed variables Δy_{it-1} and Δy_{it-1}^2 could be endogenous to Δv_{it}, thereby leading to inconsistent estimates for the effect of income on democracy. Still, unlike the mean-deviations transform, longer lags of the regressors remain orthogonal to the error and available as internal instruments. AH uses the lags of order 2 to instrument for the explanatory changes and, following Wooldridge (2010), we include for our base equation all instrumental variables for each of the instrumented ones: $\{\Delta d_{it-1}, \Delta y_{it-1}, \Delta y_{it-1}^2\}^{IV} = \{d_{it-2}, y_{it-2}, y_{it-2}^2\}$. Unlike OLS and FE, the AH estimator is consistent in the context of a lagged dependent variable with few observations per individual country, and should provide estimates that lie between the FE and the OLS ones.

Finally, we run the Arellano-Bond (AB) General Methods of Moments (GMM) estimator. AB also starts by first-differencing the original equation, but uses not only the second order lags but also additional ones for the instrumentation. As Roodman (2009) argues, GMM estimators are designed for situations with small T and large N panel, explanatory variables that are not strictly exogenous (with correlation of regressors with contemporaneous or lagged residuals), individual-specific fixed effects, and possible heteroscedasticity and autocorrelation within individual disturbances, where a linear functional relationship on parameters is assumed, and the dependent variable is allowed to depend on its past. Because of its sophisticated re-weighting based on second moments, AB is in general more efficient than AH. We rely on the two-step GMM estimator which, following Windmeijer (2005)'s simulations, performs better than the 1-step GMM in estimating coefficients, since it produces lower biases and standard errors. To correct for potential spurious precision caused by the downward bias in the computed standard errors of a small sample, we use Windmeijer (2005) small-sample correction. Also, to avoid instrument proliferation, following Roodman's rule of thumb , we keep the number of instruments below the number of individual countries in each regression, by reducing the number of periods used for the instrumentation until honouring this rule. The resulting estimator is efficient and robust to within-individual heteroscedasticity and/or autocorrelation. In each of these regressions, we test for the exogeneity of the instruments using the Hansen test of overidentifying restrictions. We also test against autocorrelation in the model's residuals, using the test due to Arellano and Bond (1991), which has arguably greater power than the Hansen test to detect lagged instruments that are invalid because of autocorrelation (Arellano and Bond, 1991).

4.4 Results

Tables 1 and 2 contain our benchmark results when estimating, respectively, a quadratic relationship between income and democracy (Table 1), and a piecewise linear relationship between

these same variables (Table 2).

In order to contrast our results to the earlier literature, and to underline the importance of considering non-monotonicities when exploring the relationship between income and democracy, we first show in Column (1) of Table 1 the results that obtain from estimating a linear-log relationship between the two variables of interest, absent the inclusion of fixed effects. The resulting coefficient of (lagged) income on democracy is significant at the 5% threshold of significance. Interestingly, the inclusion of fixed effects in Column (4) confirms Acemoglu et al.'s (2008) findings with our extended dataset since the statistical relationship between the two variables disappears. Columns (2) and (5) replicate, respectively, Columns (1) and (4) when abstaining to log-transform the main variable of interest, since in our specification we do not log-transform income for reasons explained earlier. None of the coefficients of interest are statistically significant, a non-result that could (mistakenly) be interpreted as a disproof of the modernization hypothesis. In Column (3) we introduce the quadratic measure of income to put to test our own theory, and yet the coefficients take the opposite signs to the ones predicted by our model (U-shape) and the statistical significance is either low (y^2_{-1}) or absent (y_{-1}). This non-result comes as no surprise since—in case our theory is correct—the country-specific turning point in a non-monotonic relationship, as well as the intercept and slopes of the equation's coefficients are likely to be influenced by a series of country-specific characteristics. Estimating then a quadratic relationship with pooled data is totally uninformative. We thus re-estimate this relationship with fixed effects in Column (6) and the coefficients of interest obtain the expected sign at high levels of significance. Indeed, lagged income is negative and significant at the 5% level while the square of lagged income is positive and significant at the 1% level. To overcome the potential biases related to having a lagged explanatory variable alongside fixed effects, in Columns (7) and (8) we provide, respectively, the estimates of specification (8) when instrumenting lagged income following Anderson and Hsiao's (1982) methodology (AH), and using the Arellano and Bond (1991) GMM estimator (AB). The results remain highly significant with the coefficients systematically confirming our theoretical predictions.

Table 1: Benchmark quadratic specification

	(1) OLS lin-log	(2) OLS linear	(3) OLS quadratic	(4) FE lin-log	(5) FE linear	(6) FE quadratic	(7) AH quadratic	(8) AB quadratic
d_{-1}	0.8385***	0.8607***	0.8498***	0.5242***	0.5222***	0.5156***	0.5571***	0.5620***
	(0.0241)	(0.0181)	(0.0210)	(0.0396)	(0.0399)	(0.0412)	(0.1026)	(0.0692)
$ln(y_{-1})$	1.6007**			-1.1677				
	(0.6808)			(1.7466)				
y_{-1}		0.0064	0.1182		-0.1163	-0.3827**	-1.0067**	-0.6959***
		(0.0404)	(0.0759)		(0.1088)	(0.1504)	(0.4502)	(0.2298)
y_{-1}^2			-0.0008**			0.0014***	0.0032**	0.0023***
			(0.0004)			(0.0005)	(0.0014)	(0.0007)
Observations	1299	1299	1299	1299	1299	1299	1145	1145
Fixed Effects				151	151	151		151
Instruments								143
R^2	0.79	0.79	0.79	0.51	0.51	0.52	.	
p Hansen								0.38
p AR(2)								0.54

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1 validates the presence of a U-shaped relationship between income and democracy. As mentioned earlier, however, fitting a quadratic specification to the data is very stringent since it implies a perfect symmetry of the data around the vertex of the function. To allow for more flexibility, at the expense of losing the convexity captured by the square function, we present the estimation results of the spline specification in Table 2 (9). As a starting point, and given the lack of consensus in the literature on the ideal selection of the knot we set the threshold y_v to the predicted vertex of equation (8), namely at $0.38/(2 \times 0.0014) \approx 135$. This is an admittedly very high threshold for the 'turning point' to occur since it implies that for countries whose mean income is lower to 135 thousand dollars per year, increases in income map in lower democracy scores, and we relax this assumption later. Column (1) of Table 2 evaluates the spline regression with pooled data. The results mirror the ones of Table 1 since the coefficients' signs are opposite to our expectations, and the lower spline is not significant. When introducing fixed effects in Column (2), the coefficients flip sign and they are statistically significant at the 5% threshold for the lower spline and at the 1% threshold for the higher spline. The AH and AB estimations depicted in Columns (3) and (4), respectively, report coefficients with the expected signs, although the significance levels are lower than in Column (2).

Table 2: Benchmark spline specification

	(1) OLS	(2) FE	(3) AH	(4) AB
d_{-1}	0.8511***	0.5158***	0.7074***	0.5444***
	(0.0203)	(0.0410)	(0.1133)	(0.0762)
$y_{-1} \leq y_{knot}$	0.0833	-0.2678**		-0.3468**
	(0.0549)	(0.1193)		(0.1598)
$y_{-1} > y_{knot}$	-0.1326***	0.1950***	0.5365	0.1762*
	(0.0391)	(0.0409)	(0.7363)	(0.0931)
Observations	1299	1299	1145	1145
Fixed Effects		151		151
Instruments				109
R^2	0.79	0.52	.	
p Hansen				0.20
p AR(2)				0.54

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.5 Robustness checks

The analysis this far has confirmed the non-monotonic relationship between income and democracy, although our quadratic estimation identifies $\$135,000$/capita as the turning point after which income correlates positively with democracy. As explained above, this is likely due to the estimation of non-symmetrically distributed data with a symmetric estimation. To overcome this limitation, in Table 3 we re-estimate Equation (9) for different knots. In Column (1) we observe that a knot as low as $\$35,000$/capita fails to capture the rising part of the non-monotonic relationship. Yet, for all the remaining knots above that value, the signs of the coefficients confirm our theory and are statistically significant at high levels of statistical significance. Interestingly, if one was to evaluate the most appropriate knot on the basis of the highest R^2, then the threshold income of $\$50,000$/capita would be retained. Accordingly, our econometric exercise reveals that the turning point above which income correlates positively with democracy is quite high.

Table 3: Fixed effects results for the spline specification with different knots

	(1) Knot 35	(2) Knot 40	(3) Knot 50	(4) Knot 70	(5) Knot 100	(6) Knot 135
d_{-1}	0.5176***	0.5148***	0.5127***	0.5135***	0.5151***	0.5159***
	(0.0412)	(0.0416)	(0.0418)	(0.0415)	(0.0411)	(0.0409)
$y_{-1} \leq y_{knot}$	-0.4270**	-0.4283***	-0.4134***	-0.3385***	-0.2813**	-0.2674**
	(0.1785)	(0.1626)	(0.1439)	(0.1231)	(0.1242)	(0.1191)
$y_{-1} > y_{knot}$	0.0367	0.0747*	0.1171***	0.1269***	0.1128***	0.1976***
	(0.0600)	(0.0416)	(0.0296)	(0.0307)	(0.0176)	(0.0417)
Observations	1299	1299	1299	1299	1299	1299
Fixed Effects	151	151	151	151	151	151
R^2	0.5175	0.5185	0.5191	0.5183	0.5173	0.5172

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To help the reader visualize our results, we plot on Figure 1 democracy scores against income levels while controlling for country and time fixed effects. We then plot our predicted relationship from the spline estimation (plain lines) as well as the one from the linear estimation (dotted line). One observes that although—based on the linear estimation—one could mistakenly conclude that the two variables are independent, the spline estimation reveals an underlying non-monotonic relationship that confirms our theoretical predictions.

A second potential concern is the fact that unlike most scholars having studied the relationship between income and democracy, we abstain from log-transforming our main explanatory

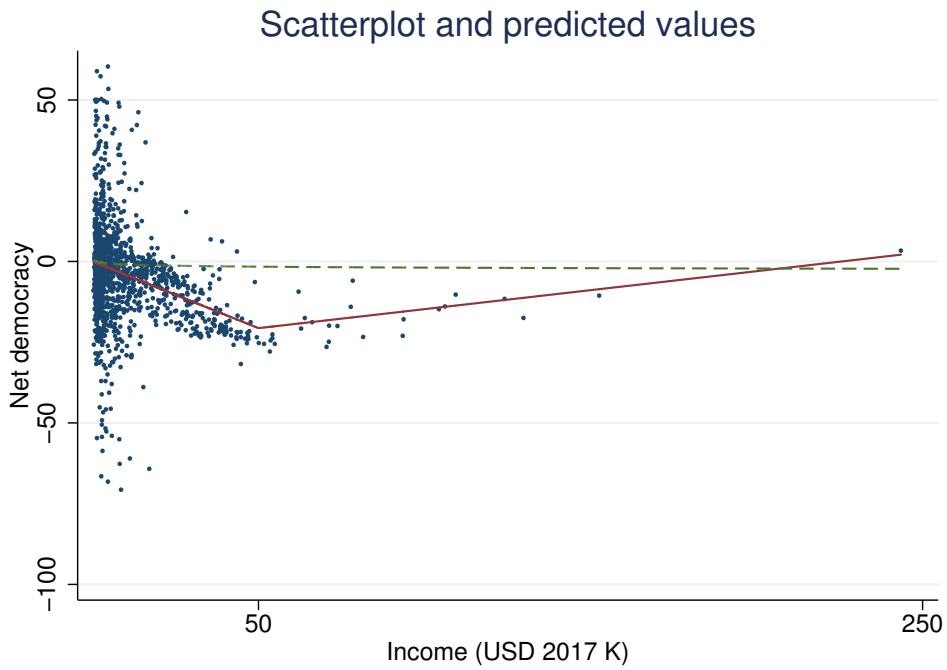

Figure 1: Income and Democracy.

variable, income, because of the skew such log transformation creates by increasingly squeezing together higher values of income. Our earlier analysis has revealed that the data is not symmetrically distributed around the "turning point" which we identified to be roughly at $\$50,000$/capita, rather than at the $\$135,000$/capita value estimated with the quadratic specification. Log-transforming income per capita would then exacerbate the issues related to the estimation of a quadratic specification. Estimating the spline specification with log-transformed income will most likely fail to reveal a negative relationship between the two variables of interest since by squeezing together increasingly more higher values of the explanatory variable, even the influence of "good leverage points" (Dehon et al. 2009) will fade away. We re-estimate equation (9) when log-transforming income, with the results reported in Table 4. Our estimations confirm our expectations since the p-values of the low spline coefficients are systematically above 0.1. Moreover, our estimation reveals that the high spline, although not always significant (for the same reason), is nevertheless highly significant for the $\$100,000$/capita and $\$135,000$/capita knots. To visualize these results, we replicate Figure 1 after log-transforming the income variable on Figure 2. Quite interestingly, the linear-log estimate, that has been widely used in the literature, may mistakenly suggest that the two variables are independent, although, once more, accounting for non-monotonicities in the identification strategy confirms that our theory is indeed validated by the data.

We next consider in Table 5 the set of the following control variables taken from Acemoglu

Table 4: Fixed effects results for the spline specification with log income

	(1)	(2)	(3)	(4)
	Knot 35	Knot 50	Knot 100	Knot 135
d_{-1}	0.5225***	0.5241***	0.5231***	0.5232***
	(0.0397)	(0.0397)	(0.0398)	(0.0398)
$ln(y_{-1}) \leq ln(y_{knot})$	-0.8634	-1.3142	-1.3152	-1.3106
	(1.7832)	(1.7876)	(1.7648)	(1.7610)
$ln(y_{-1}) > ln(y_{knot})$	-8.0785	5.2783	15.8161***	23.7869***
	(7.0531)	(6.8121)	(2.6279)	(3.9124)
Observations	1299	1299	1299	1299
Fixed Effects	151	151	151	151
R^2	0.5137	0.5134	0.5137	0.5137

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

et al. (2008): log of population, population structure, human capital, and whether a country was socialist prior to 1989. In Column (1) we replicate our fixed effects estimates from Table 1 and in Column (2) we show that the results are robust to dropping the lagged value of democracy. We then sequentially introduce log of population and population structure (Col. (3)), human capital (Col. (4)), all three control variables (Col (5)), and the exclusion of former socialist countries (Col (6)). Our findings are robust to all these different specifications, thus giving us high confidence that the relationship between income and democracy is indeed non-monotonic. In the Appendix we report the equivalent table when considering the AH and AB estimators. As can be seen, although the AH estimates are not robust to the inclusion of controls, the AB estimates vey much confirm that our findings are robust to the inclusion of all these additional covariates, with the linear coefficient failing to be statistically significant only in the estimation featuring all control variables together. In Table 6 we include the same set of controls as in Table 5 when estimating equation (9) instead of equation (8). All coefficients retain the same sign as in our benchmark estimation as well as high degrees of statistical significance. Proceeding as with the quadratic estimation, in the Appendix we reproduce the table when considering the AH and AB estimators and here too find our results to be robust to the AB estimation.

We next run a series of estimations that allow us to better comprehend why the existing literature has not identified this non-monotonic relationship this far. In Column (1) of Table 7 we re-estimate our benchmark specification (8) over the same period (and with the same data therefore) covered by Acemoglu et al. (2008), namely over 1960-2000. Although the coefficients take the expected signs, only the squared term of the quadratic expression is (marginally)

Table 5: Fixed effects results for the quadratic specification: Robustness checks

	(1) FE	(2) FE no-LDV	(3) FE Pop	(4) FE HK	(5) FE Both	(6) FE non-Soc
d_{-1}	0.5156***		0.4990***	0.5243***	0.5088***	0.5047***
	(0.0412)		(0.0421)	(0.0423)	(0.0436)	(0.0442)
y^2_{-1}	0.0014***	0.0024***	0.0017***	0.0013***	0.0016***	0.0015***
	(0.0005)	(0.0008)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
y_{-1}	-0.3827**	-0.6448**	-0.4470***	-0.3499**	-0.4158**	-0.4050***
	(0.1504)	(0.2486)	(0.1514)	(0.1522)	(0.1629)	(0.1538)
$ln(pop_{-1})$			1.9093		2.9918	
			(4.7525)		(5.0563)	
$agedep_{-1}$			0.0710		0.1155	
			(0.0807)		(0.0869)	
hc_{-1}				-0.5347	2.3658	
				(5.4333)	(5.8140)	
Observations	1299	1304	1228	1201	1131	1196
Fixed Effects	151	151	149	135	133	126
R^2	0.52	0.33	0.51	0.51	0.51	0.50

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Fixed effects results for the spline specification: Robustness checks

	(1) FE	(2) FE Pop	(3) FE HK	(4) FE Both	(5) FE non-Soc
d_{-1}	0.5158***	0.5005***	0.5245***	0.5100***	0.5054***
	(0.0410)	(0.0421)	(0.0421)	(0.0436)	(0.0438)
$y_{-1} \leq y_v$	-0.2678**	-0.2884**	-0.2396**	-0.2595*	-0.2803**
	(0.1193)	(0.1289)	(0.1176)	(0.1321)	(0.1202)
$y_{-1} > y_v$	0.1950***	0.2269***	0.1735***	0.2126***	0.1970***
	(0.0409)	(0.0487)	(0.0490)	(0.0518)	(0.0445)
$ln(pop_{-1})$		2.9956		4.1411	
		(4.7607)		(4.9926)	
$agedep_{-1}$		0.0807		0.1184	
		(0.0802)		(0.0871)	
hc_{-1}			-1.3028	1.5561	
			(5.3878)	(5.7340)	
Observations	1299	1228	1201	1131	1196
Fixed Effects	151	149	135	133	126
R^2	0.52	0.51	0.51	0.51	0.50

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

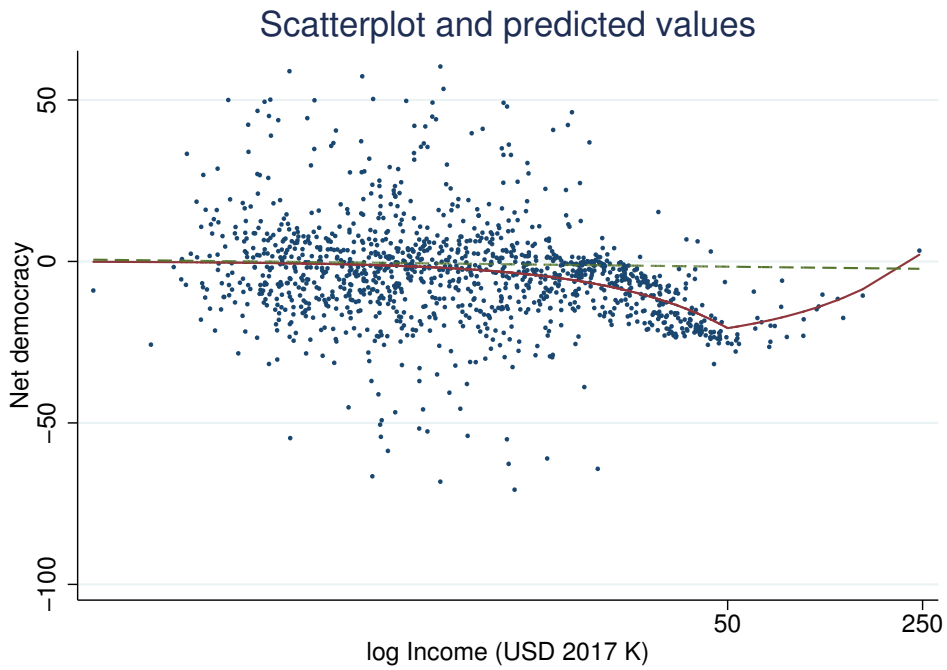

Figure 2: Log of income and Democracy.

significant. Observe that adding 10 years of data is tantamount to expanding the number of observations by more than 20%, which given the inclusion of country fixed effects prove crucial for identifying a non-monotonic relationship. Indeed, the process by which incomes influence the degree of democracy in a country may be slow, and over a 40 year time it is much more unlikely to observe such non-monotonic relationships inside countries than over a 50 year time. To provide further evidence that the process through which income influences the degree of democracy requires some time, in Column (2) we consider the full time span (1960-2010) and add to specification (8) the 2-lag values of income and of its square. The purpose of this exercise is to show that although one expects income to impact the degree of democracy five years down the line, if the process through which this happens is indeed a slow one, the variables of interest should then perhaps have an effect 10 years ahead as well. Our results indeed confirm this expectation even though the 1-lag linear term of income is not statistically significant. Last we re-estimate the benchmark specification with data observed every 10 years (Column (2)) and every 20 years (Column (3)). Although the 10 years lags estimation still produces the expected results, the 20 years lags estimation does not. This is not quite surprising since observing data every 20 years over the selected time period implies having 3 data points per country, and thus the non-monotonicity to take place (on average) roughly at the time of the second observation; a quite demanding requirement. Columns (5) to (7) re-estimate Columns (1) to (3) with the AB estimators, and the results obtained are even

more conclusive than with fixed effects. Overall, the results contained in Table 7 inform us that the non-monotonic relationship we uncover in this article can only be observed with data spanning over sufficiently long time periods, and by carefully choosing the lags over which observations are selected so as to be able to capture middle range trends without, however, omitting to capture trend reversals as is the case with too long time lags.

Table 7: Fixed effects and GMM results for the quadratic specification: the temporal relationship

	(1) FE 2 5-yr lags	(2) FE 10-yr lag	(3) FE 20-yr lag	(4) FE 1960-2000	(5) AB 2 5-yr lags	(6) AB 10-yr lag	(7) AB 20-yr lag
d_{-1}	0.5212***	0.2305***	-0.1186	0.4399***	0.5682***	0.2415*	-0.0915
	(0.0550)	(0.0593)	(0.0790)	(0.0468)	(0.0839)	(0.1296)	(0.3085)
d_{-2}	-0.0170				0.0362		
	(0.0458)				(0.0536)		
y^2_{-1}	0.0008*	0.0022***	-0.0252	0.0011*	0.0015***	-0.0069	0.2139***
	(0.0004)	(0.0007)	(0.0242)	(0.0006)	(0.0005)	(0.0135)	(0.0803)
y^2_{-2}	0.0009**				0.0010**		
	(0.0004)				(0.0004)		
y_{-1}	-0.2296	-0.7011***	-0.7125	-0.2683	-0.4554**	-0.7958	-16.2585***
	(0.1394)	(0.2350)	(1.1369)	(0.2131)	(0.1812)	(0.9844)	(5.0734)
y_{-2}	-0.2557*				-0.2930**		
	(0.1525)				(0.1351)		
Observations	1145	642	285	1004	993	490	155
Fixed Effects	151	151	130	151	151	130	114
Instruments					141	40	7
R^2	0.51	0.36	0.35	0.41			
p Hansen					0.39	0.00	.
p AR(2)					0.67	0.95	.

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.6 Testing the Transmission Channel

In this article we have developed a theory nuancing the predictions of the Modernization hypothesis since our expectations are that the relationship between income and democracy should be non-monotonic. The mechanism uncovered by our model is such that increases in wages when these are low should incentivize citizens to substitute away their time from political activism towards labour because of the high relative marginal gain of material goods for low-income citizens. For high wages, economic development is expected to map into higher political activism given the relative satiation of consuming material goods. We now provide additional evidence in support for the mechanism identified in our theory by regressing a proxy of citizens' perceptions of and interest in democracy on their country's GDP/capita. We are thus interested in studying whether increases in income in low-income countries may reduce citizens' interest and involvement in politics, while also testing whether similar increases in high-income countries have the potential to increase their interest and involvement in politics. We sequentially present the results of two separate tests, both providing supporting evidence of our theoretical predictions.

We first extract from the World Value Surveys for the period 1981-2010 two variables that reflect citizens' political actions and preferences, namely one capturing whether citizens have *attended lawful/peaceful demonstrations*, and another measuring their *interest in politics*. Since our main regressor is at the country level, and given the inappropriate measure of income in the WVS[2], our measure of income is taken from the Penn World tables. Accordingly, we aggregate the variables capturing citizens' political actions and preferences at the country-round level by constructing an average value of the sampled individuals for each country-round, and we normalize the scores to $[0, 100]$ to uniformize the interpretation of our results. We then test for a non-monotonic effect of income on the said variables by running spline estimations on the contemporaneous effect of income on political actions and preferences.[3]

Table 8 looks at the effect of income on political interest, and considers several alternative knots ranging from \$20,000 to \$45,000 per capita. Although the number of observations per country is quite limited, our results unambiguously point at a non-monotonic relationship: political interest drop with income for low-income countries, and it rises with income for high-income countries, with the positive relationship being observed for values as low as

[2]In order to avoid non-responses, the WVS master questionnaire uses a 10-point subjective income scale where the respondents are asked to allocate themselves on the imaginary 10-step ladder based on their subjective assessment of their own income and income of other people in the society. To avoid having subjective assessments on both sides of the equation, and given the importance of appropriately measuring income for our study, we instead rely on countries' GDP per capita.

[3]Introducing lags would prove conceptually problematic since the WVS waves are not conducted at regular intervals. Moreover, unlike changes in the actual level of democracy which admittedly take time, preferences and actions are expected to react much faster to income.

Table 8: Political interest on Spline with Varying Knots of Income for country-specific fixed effects

	(1) Knot 20	(2) Knot 25	(3) Knot 30	(4) Knot 35	(5) Knot 40	(6) Knot 45
$y \leq y_{knot}$	-0.4733***	-0.3453***	-0.2774***	-0.2291***	-0.1853**	-0.1427*
	(0.1220)	(0.1002)	(0.0855)	(0.0838)	(0.0814)	(0.0792)
$y > y_{knot}$	0.1370*	0.1516**	0.1667**	0.1921**	0.2216*	0.2230
	(0.0744)	(0.0752)	(0.0756)	(0.0869)	(0.1179)	(0.1511)
Observations	289	289	289	289	289	289
Fixed Effects	103	103	103	103	103	103
R^2	0.05	0.04	0.04	0.03	0.03	0.02

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$20,000/cap. Although the positive effect of income on preferences starts fading away when setting the know at $45,000/cap—thus slightly contrasting with our benchmark findings that point at a turning point around $50,000/cap—it is important to underline that the present estimation features fewer countries (and years) than the benchmark estimation, with several high income countries being absent from the WVS that we make use of. These results support our theoretical predictions that citizens' attention is decreasingly (increasingly) directed at politics in low-income (high-income) countries experiencing economic development.

Table 9: Attending lawful demonstrations on Spline with Varying Knots of Income for country-specific fixed effects

	(1) Knot 10	(2) Knot 15	(3) Knot 20	(4) Knot 25	(5) Knot 30
$y \leq y_{knot}$	-0.7331*	-0.4935*	-0.3649*	-0.2381	-0.1294
	(0.4108)	(0.2663)	(0.2197)	(0.1926)	(0.1676)
$y > y_{knot}$	0.1838*	0.2393**	0.2872***	0.3130***	0.3176***
	(0.0934)	(0.0934)	(0.0912)	(0.1011)	(0.1171)
Observations	279	279	279	279	279
Fixed Effects	99	99	99	99	99
R^2	0.04	0.06	0.07	0.06	0.05

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

While Table 8 focuses on citizens' preferences, the mechanism in our theory flows through citizens' actions eventually producing changes in the degree of democracy. To therefore test that precise channel, we estimate in Table 9 the effect of income on political actions for knots.

The non-monotonicity shows up significantly for knots up to $20,000/cap, while for larger knots the negative effect (i.e. low-income countries) of income on political actions is marginally insignificant, and the positive effect (i.e. high-income countries) is highly significant. Notwithstanding the above remark on the sample size and scope, our theoretical predictions are indeed verified since citizens are seen to reduce their participation to protests when income rises in low-income countries, and to increase their participation in high-income countries.

Although the above results seem to convincingly support our theory, the data limitations of the WVS could potentially cast some doubts on our findings. We thence provide further evidence in support of the non-monotonic effect of income on citizens' political preferences by using data from the *Manifesto project*. That database codes election programmes over the entire period of interest for 56 nations, mostly OECD countries. Our proxy measure of citizens' perceptions of and interest in democracy is captured by the variable "Democracy" measuring, amongst others, whether democracy should be "the only game in town", and whether citizens should participate in political decision-making. Although imperfect, this variable nevertheless reflects citizens' preferences, as reflected in political parties manifestos. In Table 10 we present the results of the spline estimation for this alternative dependent variable, for various knots between $35,000 and $80,000. Our analysis reveals that although the positive effect of income on the subjective value of democracy in wealthy countries is highly significant for knots at and above $45,000, the negative effect for low-income countries is only "marginally insignificant", with p-values ranging from 0.108 at the $50,000 knot, to 0.128 at the $75,000 knot. Bearing in mind that our sample does not feature countries with low levels of GDP/capita, it is not surprising that we mostly capture the upward-slopping part of the story, and it is equally encouraging to see that a non-monotonic trend is nevertheless close to be statistically significant.

5 Conclusion

In this paper we proposed a novel view of the relationship between income and democracy. In our theory we assume decreasing marginal utility over both material goods and democratic rights, while also allowing for complementarities between the two components of the citizens' utility function. Our core contribution is to demonstrate that the effect of increases in economic development on the degree of democracy is conditional on the level of economic development of the society under study. For low initial levels of economic development, when citizens experience a high marginal utility from material goods, modernization as captured by a positive productivity shock will *reduce* political activism and the ensuing democratic rights. This result is driven by the fact that increased marginal benefits from productive activities will outmatch the marginal gains from political activism when the marginal utility of income

Table 10: Subjective Value of Democracy on Spline with Varying Knots of Income for country-specific fixed effects

	(1)	(2)	(3)	(4)	(5)
	Knot 35	Knot 40	Knot 45	Knot 50	Knot 55
$y_{-1} \leq y_{knot}$	-0.1444	-0.1276	-0.1180	-0.1108	-0.1056
	(0.0977)	(0.0812)	(0.0725)	(0.0676)	(0.0661)
$y_{-1} > y_{knot}$	0.0480	0.0761	0.1114**	0.1364***	0.1503***
	(0.0570)	(0.0482)	(0.0462)	(0.0476)	(0.0552)
Observations	553	553	553	553	553
Fixed Effects	49	49	49	49	49
R^2	0.01	0.01	0.01	0.01	0.01
	(6)	(7)	(8)	(9)	(10)
	Knot 60	Knot 65	Knot 70	Knot 75	Knot 80
$y_{-1} \leq y_{knot}$	-0.1020	-0.0981	-0.0960	-0.0952	-0.0953
	(0.0647)	(0.0630)	(0.0619)	(0.0615)	(0.0614)
$y_{-1} > y_{knot}$	0.1718**	0.1954***	0.2358***	0.3005***	0.4131***
	(0.0662)	(0.0724)	(0.0837)	(0.1074)	(0.1530)
Observations	553	553	553	553	553
Fixed Effects	49	49	49	49	49
R^2	0.01	0.01	0.01	0.01	0.01

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

is high. For high levels of economic development when the marginal utility from income is low, the reasoning is reversed. Combined, these observations suggest a U-shaped relationship between income and democracy; a relationship that we show to hold empirically.Interestingly, our empirical findings are shown to hold for setups where scholars have otherwise found either no relationship between the variables of interest, or an increasing monotonic one. We view our results as opening up a new avenue of research on the literature surrounding the modernization hypothesis.

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6 Appendix

Table 11: Democracy on Income for Anderson-Hsiao and Arellano-Bond estimators with set of controls and samples

	(1) AH	(2) AH Pop	(3) AH HK	(4) AH Both	(5) AH no-Soc	(6) AB	(7) AB Pop	(8) AB HK	(9) AB Both	(10) AB no-Soc
d_{-1}	0.5571***	0.5092**	0.5545***	0.5219***	0.5586***	0.5620***	0.5387***	0.6057***	0.6007***	0.6346***
	(0.1026)	(0.2138)	(0.1315)	(0.1908)	(0.1095)	(0.0692)	(0.0718)	(0.0689)	(0.0687)	(0.0728)
y^2_{-1}	0.0032**	0.0045	0.0039	0.0071	0.0031**	0.0023***	0.0014**	0.0020***	0.0013**	0.0019***
	(0.0014)	(0.0033)	(0.0092)	(0.0121)	(0.0014)	(0.0007)	(0.0006)	(0.0007)	(0.0006)	(0.0006)
y_{-1}	-1.0067**	-1.3904	-1.2214	-2.2127	-1.0058**	-0.6959***	-0.3039*	-0.6144***	-0.2576	-0.5968***
	(0.4502)	(0.9244)	(2.8300)	(3.4654)	(0.4734)	(0.2298)	(0.1633)	(0.2291)	(0.1680)	(0.2110)
$ln(pop_{-1})$		-5.8830		-6.4392			19.4962***		18.2176***	
		(13.6301)		(29.1833)			(5.0107)		(5.4444)	
$agedep_{-1}$		1.3285		0.7037			-0.0489		0.0041	
		(2.8762)		(1.3264)			(0.1355)		(0.1641)	
hc_{-1}			25.0804	81.3419				11.3468	16.3524	
			(178.0011)	(276.3408)				(10.1899)	(12.3107)	
Observations	1145	1076	1064	996	1067	1145	1076	1064	996	1067
Fixed Effects						151	149	135	133	126
Instruments						143	143	128	129	123
R^2	.	.	.	.	.					
p Hansen						0.38	0.32	0.33	0.36	0.25
p AR(2)						0.54	0.51	0.46	0.42	0.50

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Democracy on spline of Income for Anderson-Hsiao and Arellano-Bond estimators with set of controls and samples

	(1) AH	(2) AH Pop	(3) AH HK	(4) AH Both	(5) AH no-Soc	(6) AB	(7) AB Pop	(8) AB HK	(9) AB Both	(10) AB no-Soc
d_{-1}	0.7074***	0.6248***	0.5888***	0.6734***	0.7094***	0.5444***	0.5193***	0.5550***	0.5213***	0.5488***
	(0.1133)	(0.1417)	(0.0868)	(0.1533)	(0.1128)	(0.0762)	(0.0776)	(0.0731)	(0.0776)	(0.0762)
$y_{-1} > y_v$	0.5365	0.6024	0.0511	-0.7449	0.4867	0.1762*	0.1951***	0.1269	0.2282***	0.1951**
	(0.7363)	(0.6956)	(0.1529)	(1.2888)	(0.6649)	(0.0931)	(0.0690)	(0.0907)	(0.0716)	(0.0947)
$y_{-1} \leq y_v$						-0.3468**	-0.1604*	-0.3185**	-0.1946*	-0.3694**
						(0.1598)	(0.0961)	(0.1448)	(0.1149)	(0.1560)
$ln(pop_{-1})$		28.4701		-38.6393			17.5673***		18.0873***	
		(25.0173)		(63.8066)			(4.3836)		(5.0371)	
$agedep_{-1}$		-1.2675		-0.0955			-0.0308		0.0936	
		(1.6561)		(0.6529)			(0.1379)		(0.1674)	
hc_{-1}			-55.3916***	-1.1e+02				-0.6801	14.2203	
			(19.7250)	(85.4409)				(8.5625)	(9.5728)	
Observations	1145	1076	1064	996	1067	1145	1076	1064	996	1067
Fixed Effects						151	149	135	133	126
Instruments						109	109	110	110	109
R^2	.	.	.	.	.					
p Hansen						0.20	0.21	0.36	0.41	0.25
p AR(2)						0.54	0.53	0.48	0.46	0.53

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$