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 political rights. Citizens can devote their time either to creating material benefits or to political activism (that improves political liberties). We demonstrate a non-monotonic relationship between income and democracy. In low income countries—where the elasticity of the marginal rate of substitution between material goods and political rights is low because of small incomes—exogenous increases in income (wages) lead to a reduction in the level of political liberties: as wages increase, citizens are increasingly willing to give up time otherwise devoted to activism to work more. In high income countries, the opposite is true: political 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. The predictions are equally validated for data spanning back to 1800.

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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 of situations observed in the real world: although many societies experienced a tandem rise of living conditions and an expansion of their political 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, 1999; Papaioannou and Siourounis, 2008; Murtin and Wacziarg, 2014). At the other end of the 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 political rights and provides corroborating empirical support for our theoretical predictions. We show that in less economically developed polities,

economic *contractions* induce higher levels of political rights, whereas in more economically developed countries political 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 political rights (in low income countries) as evidenced by some scholars. Moreover, our empirical results are shown to critically 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 political 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 most earlier works is that we allow citizens to enjoy their political rights above-and-beyond any material benefits such liberties may carry (e.g., benefits associated with tax rates and public goods). Although this idea has gained popularity in political science earlier than in economics (e.g. Inglehart and Welzel, 2005), some notable contributions from economists have embraced the assumption that citizens do intrinsically value political rights and liberties (Besley and Persson, 2019; Gratton and Lee, 2024). Indeed, political scientists have underlined that citizens have both *material* and *post-material* concerns, and that they value political 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). 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]

Our approach accounts for citizens' preferences (see Inglehart and Welzel, 2005, for a detailed analysis), and enables 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 political rights. While decreasing marginal utility over material goods is a commonly accepted assumption, it is also reasonable to think similarly of political 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). We also allow (but do not impose) the utility function to exhibit complementarities between these two components to the extent that wealth can

[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.

never perfectly substitute the lack of political rights and representation (see also Veenhoven, 2000).

From this modeling framework, it follows that in low income 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 phase. Our finding or argument 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*K 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 high income 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 domestic wealth, and produced by citizens, with the opportunity cost of production being the marginal improvement of political rights that would be obtained from more intense lobbying/protests; what we term political activism. We allow for a ruling elite that is a counterbalance to the citizens: the elite aim to minimize the degree of political rights of citizens so as to maximize their share of embezzled public wealth. As such, a contest exists between citizens and elites fighting for higher/lower political rights. 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 high marginal utility from material goods, modernization as captured by a positive productivity shock will *reduce* political activism and the ensuing political 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 of 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 political 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 (spline) regression, our results confirm the existence of a non-monotonic relationship 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, we show that our theoretical predictions are validated when measuring democracy with either the Polity IV or the V-Dem dataset, while making use of the Maddison Project (Maddison Project 2020) enables us to establish that the results are also valid when taking a longer view of history with data dating back to 1800. 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 domestic 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 domestic income per capita and election programs' inclination to see citizens democratically influencing politics. Our empirical findings therefore support the existence of a non-monotonic relationship between income and democracy; a hypothesis that reconciles apparent contradictory findings in the literature and that has thus far not been tested empirically.

The remainder of the article is organized as follows. In the next section we relate our analysis to the existing literature. In Section 3 the theoretical model is presented 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, 2022). In other words, citizens do not value political 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. The first strand of 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 initially pose a large enough threat, the regime will decide to educate the masses, thereby resulting in an endogenous democratization of the country.[2] 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 the second 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 performance 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.

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 revolution being successful 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

[2]Larsson Seim and Parente (2013) also 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.

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.

These three strands of literature on income and democracy disregard the intrinsic value of democracy to citizens. A partial attempt to integrate democratic values in citizens' behavior is proposed by Persson and Tabellini (2009) who consider the accumulation of democratic capital in an overlapping-generations model. In their setup, subsequent generations inherit a democratic stock of capital, which positively affects citizens' incentives to stand for their political rights. Unlike these authors, in our own approach citizens have actual *preferences* for political rights, and their valuation is subject to decreasing marginal utility implying that, all else equal, the incentives to stand for political rights in our theory are decreasing in the (possibly inherited) political stock of capital. Some scholars have studied 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. In our empirical analysis we control 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 low income polities where citizens' survival is not secured, the importance of these values is reduced, whereas in high income 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, under the reductive assumption that material and non-material goods are, at best, pure substitutes with linear valuations; i.e., citizens benefit from a lump-sum satisfaction from enjoying political rights. These assumptions may, however, appear arbitrary to the extent that the weight given to political 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., material goods and political rights, as well as complementarities between them, we show that the effect of modernization on democratization is non-monotonic. Recently, Gratton and Lee (2024) also assume citizens value intrinsic characteristics of democracies, in particular 'liberty'. Yet, the focus of their research is on the information manipulation of authoritarian regimes in such contexts rather than on the relationship between economic development and the degree of democracy.

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, and Ciccone et al. (2012) show that higher economic growth provoked by exogenous oil price shocks to oil-exporting countries results in higher levels of democracy. Barro (1999) additionally shows that education is a major lever of the process, and Castelló-Climent (2008) confirms the salient role played by education, by emphasizing 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, 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. With the former view, a polity's degree of democracy is intimately tied to the institutional (and cultural) legacies, which are rooted in a country's history (Alesina and Giuliano, 2015; Gorodnichenko and Roland, 2021; Bentzen and Gokmen, 2023) and often determined by events having taken place at 'critical junctures' (e.g., Acemoglu et al., 2008; Olsson, 2009; Acemoglu and Robinson, 2022). Given this 'long-run view' of societies, some scholars therefore explored the relationship between 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 main analysis—and as early as 1850 (Gundlach and Paldam, 2009). This evidence suggests that income does *eventually* give rise to more democratic regimes, yet, by disregarding the possibility that this relationship is non-monotonic, one may be missing part of the story. When expanding our analysis to data covering the period 1800-2010, we do confirm that the non-monotonicity is also present therefore uncovering that, although the positive relationship between income and democracy does eventually manifest itself, modernization can nevertheless push countries towards more authoritarianism for low levels of economic development.

3 The model

In this section we outline the setup of our model, explore the equilibrium and our core mechanism linking income and political rights in a simplified setting, then consider our core mechanism at work in the full model. While we take a static approach to the relationship between income and political rights in our formal model, we explore some dynamic aspects toward the end of this section.

3.1 The setup

Consider a society composed of citizens and elites where political rights $p \in [0, 1]$ define the weight of the citizens' influence in the decision-making process. We allow political 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., $p = 1$, or anywhere in between. We take the initial baseline political rights to be given by some value $p_0 \in (0, 1)$. Political rights determine how the society's resources, R (e.g., oil and land), 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 political rights above and beyond the material benefits derived from deciding public policies.

We consider that political rights can be influenced from the baseline by the actions of citizens and elites. Citizens have a time-endowment e that can be allocated to either labor or 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 $\sigma \equiv \frac{x}{x+y}$ and that awarded to the elite is $1 - \sigma$.[3]

If citizens do nothing while the elites are active, political rights reduce to $p_0 - p_0\gamma = p_0[1 - \gamma]$; if citizens are active in contesting political rights then the resulting political rights are determined by

$$p(x, y) \equiv p_0[1 - \gamma] + \sigma\gamma; \tag{1}$$

if the elites are inactive while citizens are active, then political rights increase to $p_0[1 - \gamma] + \gamma$. Note that if $\gamma = 1$ the full range of political rights are contested.[4] The contestable nature of political rights is illustrated in Figure 1.

The material goods that citizens enjoy come from two sources: their labor income (where the price of material goods is normalized to one); and the redistribution of society's resources to citizens. The former is given by $w[e - x]$ where w is the wage (equally, productivity). The latter is given by pR which depends on political rights.

We suppose that citizens derive utility over material goods, m, and over political rights, p, so their payoff is given by $U(m, p)$. We make the following assumptions: $U_m > 0$, $U_{mm} < 0$, $U_p > 0$, $U_{pp} < 0$, and $U_{mp} \geq 0$, with subscripts denoting partial derivatives. We are therefore viewing citizens as experiencing diminishing marginal utility over both material goods and political rights, reflecting the fact that increments in political rights in less democratic regimes (e.g., extending the suffrage) generates more utility than increments in highly demo-

[3]Of course, effort from citizens, x, and resources from the elite, y, are not necessarily measured on the same scale and so might not be comparable. As such, we should consider a rate of transformation of resources into effort for the elite, so their effort is αy, say. So long as this rate of transformation is constant nothing changes in the analysis and so to reduce notational burden we suppose $\alpha = 1$.

[4]We allow for $\gamma < 1$ as situations where political inactivity results in winning or losing all rights are rare. The introduction of γ allows us to consider political rights with varying degrees of contestability (and the impact on both citizens and elites).

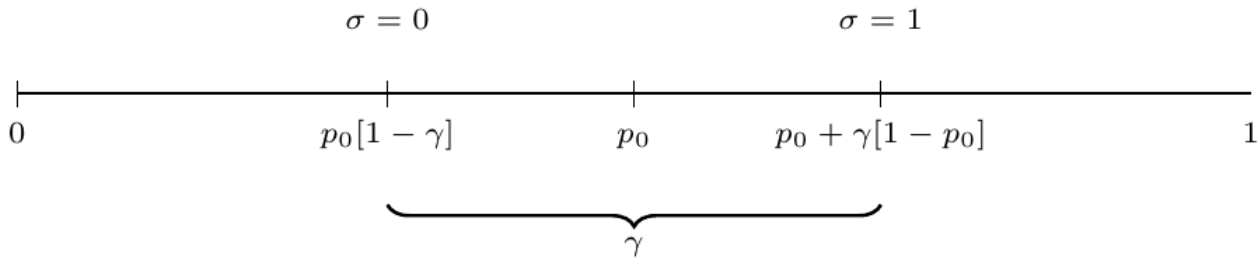

Figure 1: Contested political rights

cratic regimes (e.g., having a say—positive or negative—on animal rights). Moreover, we view material goods and political rights as being (weak) q-complements (Seidman, 1989). Defining $MRS \equiv \frac{U_m}{U_p}$, our assumptions imply the following.

Observation 1

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

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

3.2 The elites

The primary purpose of our model is to capture a mechanism through which citizens can influence political rights, and care about these in-and-of themselves alongside material goods. Our aim is to understand the incentives they face in fighting for political rights and how these relate to their material consumption. To do this we choose to model the fight for political freedom as a contest in which the opposing force is the ruling elite. We have in mind that citizens live alongside the elite but that the elite's political power is determined by the outcome of the struggle for rights between the citizens and the elite: if uncontested the elite maintain power and benefit from the country's resources, but if citizens contest this—by dedicating effort to fighting for political freedom—the elite's power diminishes resulting in less access to resources that are instead redistributed to citizens.[5] In other words, irrespective of the initial level of political rights and, consequently, of whether the polity can be categorized

[5]We are not considering in our setup the possibility of the elites increasing political rights prior to citizens taking action against them in order to deter opposition (e.g., Acemoglu and Robinson 2000), or to boost economic incentives (Barzel and Kiser 1987, Fleck and Hanssen 2006) although elites can concede political rights in our model by investing no repression effort. Instead, we are considering a setup where the commitment problem is

as a 'democracy' or an 'autocracy', we assume that elites do not benefit directly from living in freer societies, but instead have incentives to contain political rights to appropriate larger rents. This assumption captures well the fact that even in democracies, politics is influenced by economic elites who use their economic power to obtain political power, and eventually economic gains (e.g., Zingales, 2017; Callander et al., 2022). Indeed, when economic elites, for instance major corporations, lobby, influence the media, or intervene directly in grooming the judiciary (Grossman and Elhanan, 1996; Zingales, 2017; Schnakenberg and Turner, 2024), their objective is exclusively economic, and runs against political ideals of the citizens or of their ideological political representatives.

Formally, we suppose the elites are motivated by material benefits associated with the control of rents and, as such, their payoff is given by[6]

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

Substituting in (1), the elites can be seen as solving the problem

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

taking x as given. The first-order condition is

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

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

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

Throughout we assume that $R > \frac{e}{\gamma}$ to ensure the elites are always active in contesting democracy.

In equilibrium a particular choice of effort by the citizens x will, according to (1), translate into political rights given by $p = p_0[1 - \gamma] + \left[\frac{\gamma x}{R}\right]^{1/2}$. Effort dedicated to contesting political

indeed inverted: if politicians did manage to actually commit to a given degree of political rights, the citizens would still prove unable to commit from taking action to further increase their political rights subsequently. Rather than engaging with such more elaborate models, we present a simpler model that allows us to better comprehend the link between citizens' preferences and political activism, and to uncover new results compatible with the empirical reality.

[6]Note, however, that the elite's payoff could be represented by any monotonic transformation of this net material outcome, and so could exhibit diminishing marginal utility over such.

rights therefore increases those rights, at a decreasing rate.[7]

3.3 Equilibrium in a simplified setting

So that we can straightforwardly describe and explain our core mechanism linking income with democracy we begin by abstracting from the redistributive channel. Thus we consider that citizens pay no attention to any redistributive income they receive as a result of political rights. We stress that our intention is not to ignore redistribution—we re-introduce it in our subsequent analysis—but we first want to clearly illustrate how the core mechanism of our approach adds to an explanation of the link between income and democracy. As such, in this sub-section we assume $m \equiv w[e-x]$ (rather than $w[e-x]+pR$).

With this simplified view citizens, when choosing their effort in contesting political rights, can be seen as solving the problem

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

taking y as given. The associated first-order condition[8] is

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

This can be re-written as

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

Substituting for (5), equilibrium effort in this setting, x^*, can thus be (implicitly) defined by

[7] Knowing this, it would be feasible to create a more parsimonious model without the presence of a ruling elite where we specify, for example, that effort dedicated to politics is transformed into political rights via a black-box process given by $p = p_0[1-\gamma]+\gamma f(x)$ where $f' > 0$ and $f'' < 0$. It is not *a priori* obvious, however, that the elites' best response is indeed concave in the citizens' effort, if elites are instead strategic players as we assume. Nor indeed, is it obvious that an increase in citizens' efforts will lead to increased political rights as the elite's reaction to this may be to act in a way that reduces citizens' political rights. It is hard therefore to view a specific functional form $f(.)$ as being more intuitive than another, and we accordingly prefer our specification of a model with a contest between the citizens and the elite, which provides something of a foundation for this relationship.

[8] Again, the second-order condition is readily shown to be satisfied under our assumptions, as

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

the level of x such that

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

Equilibrium political rights are consequently given by $p^* = p_0[1-\gamma] + [\frac{\gamma x^*}{R}]^{1/2}$. It can be observed that the equilibrium is a result of the balance between the citizen's effort to obtain increased political rights and a counter force in which the elite attempts to retain political and economic power.

3.4 Core mechanism: the effect of modernization on political rights

We now explore the effect of economic development—as captured by increases in productivity, i.e., the wage, w—on citizens' equilibrium political activism x^* and associated level of equilibrium political rights p^*. We will then demonstrate that there is a monotonically increasing relationship between the wage (or productivity) and income, which will allow us to draw conclusions about the relationship between income and political rights as a result of economic development.

We begin by understanding the effect of w on x^*, defined in (7). By the implicit function theorem, we know that $dx^*/dw = -l_w/l_x$. Now, after some manipulation we find

$$l_x = -wMRS_m + \frac{1}{x}\left[\frac{1}{2}\left[\frac{\gamma x}{R}\right]^{1/2} MRS_p + \frac{1}{2w}\left[\frac{\gamma}{Rx}\right]^{1/2}\right] > 0$$

by Observation 1. It follows that the sign of dx^*/dw is given by the opposite of the sign of l_w. Exploring this, we find

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

where the second line follows from using $m \equiv w[e-x]$ and (7).

Define

$$\eta \equiv \left|\frac{mMRS_m}{MRS}\right|,$$

which is the material goods elasticity of the marginal rate of substitution, and recall that $MRS_m < 0$. It then follows that

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

Moreover, since $p^* = p_0[1-\gamma] + [\frac{\gamma x^*}{R}]^{1/2}$, $sgn\{\frac{\partial p^*}{\partial w}\} = sgn\{\frac{\partial x^*}{\partial w}\}$. This allows us to make the following statement.

Proposition 1 *In a setting where citizens disregard material redistribution, political activism, x^*, and political rights, p^*, are decreasing in the wage, w, for $\eta < 1$ and increasing in w for $\eta > 1$.*

We next establish that there is a monotonically increasing relationship between the wage and income.

Lemma 1 *The equilibrium income level of citizens $m^* = w[e - x^*]$ is a monotonically increasing function of the wage w.*

Proof. First, we have that

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

From our analysis above we know that $dx^*/dw = -l_w/l_x$. Substituting in the above expression, we obtain

$$\frac{dm^*}{dw} = \frac{1}{l_x}\left[[e - x^*]l_x + wl_w\right].$$

Utilizing the expressions for l_x and l_w from above allows us to deduce that

$$\frac{dm^*}{dw} = \frac{1}{l_x}\left[-w[e-x^*]MRS_m + \frac{e-x^*}{x^*}\left[\frac{1}{2}\left[\frac{\gamma x^*}{R}\right]^{1/2} MRS_p + \frac{1}{2w}\left[\frac{\gamma}{Rx^*}\right]^{1/2}\right] + mMRS_m + MRS\right]$$

which after some manipulation reduces to

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

■

This allows us to conclude that when there is an increase in the wage (or productivity) income will also increase but there is an ambiguous effect on political activism, and consequently political rights, that depends on the elasticity of the MRS: if this is above 1 then political rights will also increase, while if it is below 1 political rights will fall. As such, income and political rights will have a negative relationship if $\eta < 1$ and a positive relationship if $\eta > 1$.

The intuition of this result is as follows: if the MRS is elastic to m (i.e., $\eta > 1$), then increments in w will lead to a substantial 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. Consequently,

increases in the wage will be associated with both an increase in income and an increase in political activism. By contrast, in instances where the MRS is m-inelastic, higher wages will spur the incentives of citizens to increase their production effort and consequently decrease political activism. Thus, while an increase in the wage increases incomes, political activism declines.

Recalling the definition of the elasticity as being $\eta = \left|\frac{mMRS_m}{MRS}\right|$ and that $MRS_m < 0$ from Observation 1, the conditions favoring the MRS being m-inelastic are a) low income; b) high MRS; and c) low absolute value of MRS_m. Note that since the latter is given by $MRS_m = \frac{\left[U_{mm}U_p - U_m U_{mp}\right]}{\left[U_p\right]^2}$ its absolute value is lower the less complementary are material goods and political rights; indeed, the MRS can be m-inelastic if material goods and political rights are independent (i.e., $U_{mp} = 0$).

We now want to investigate the connection between the *level* of income and the relationship between productivity-induced changes in income and political rights. When m is small the numerator in the elasticity expression will be small via the effect of m, and the denominator will be relatively large as the MRS is decreasing in m. As such, the elasticity will be small and can be less than one when income is small enough. The effect of income increasing will be to increase the numerator and decrease the MRS in the denominator, thereby leading to a larger elasticity that will eventually be larger than one when income is large enough.

These arguments combined establish an anticipated U-shaped relationship between income and political rights. When income is low, but increases due to an increase in productivity, political rights decline as citizens instead pursue an increase in their material goods consumption. When income is high and it increases further, citizens care less about further increases in their material goods consumption and instead dedicate more time to increasing their political rights.

3.5 Re-introducing redistribution

We now revisit the analysis when citizens account for redistribution in their utility function. In this case, the quantity of material goods citizens consume is given by $w[e - x] + pR$ (recalling that $p(x, y) \equiv [1 - \gamma]p_0 + \frac{x}{x+y}\gamma$) and, as such, citizens can be seen as solving the problem

$$\max_{x \in [0,e]} U(w[e - x] + pR, p)$$

taking y as given. The first-order condition associated with an interior solution is given by

$$\frac{\partial U}{\partial x} = \left[-w + Rp_x\right] U_m + p_x U_p = 0 \tag{8}$$

where $p_x(x,y) \equiv \frac{y}{[x+y]^2}\gamma$.

The problem faced by the elites remains the same as in sub-section 3.2 so their repression will be given by $\hat{y}(x) = [\gamma Rx]^{1/2} - x$ as in (5). Let us define $\hat{p}(x) \equiv p(x, \hat{y}(x)) = [1-\gamma]p_0 + \left[\frac{\gamma x}{R}\right]^{1/2}$ and $\hat{\phi}(x) \equiv p_x(x, \hat{y}(x)) = \left[\frac{\gamma}{Rx}\right]^{1/2} - \frac{1}{R}$. Note that $\hat{p}' = \frac{1}{2}\left[\frac{\gamma}{Rx}\right]^{1/2} > 0$, and $\hat{\phi}' = -\frac{1}{2}\left[\frac{\gamma}{Rx^3}\right]^{1/2} < 0$.

Incorporating this into the first-order condition, the equilibrium effort of the citizens x^* will, so long as the solution is interior, satisfy

$$\hat{l} \equiv MRS(w[e-x] + R\hat{p}(x), \hat{p}(x)) - \frac{\hat{\phi}(x)}{w - R\hat{\phi}(x)} = 0. \tag{9}$$

When we account for redistribution, if the wage is particularly low citizens may choose not to work and instead dedicate all their effort to contesting political rights to secure material consumption through that channel. Considering (9) plotted as a function of x with $\hat{l}_x > 0$, define $\hat{l}(e) \equiv MRS(R\hat{p}(e), \hat{p}(e)) - \frac{\hat{\phi}(e)}{w - R\hat{\phi}(e)}$. If $\hat{l}(e) \leq 0$ the solution will be corner at $x^* = e$. Defining $\underline{w} \equiv \hat{\phi}(e)\left[R + \frac{1}{MRS(\hat{p}(e)R, \hat{p}(e))}\right]$ citizens will thus dedicate all their effort to contesting political rights when $w \leq \underline{w}$, while for $w > \underline{w}$ citizens will split their time between working and lobbying.[9]

Note that

$$\hat{l}_x = [-w + R\hat{p}']MRS_m + \hat{p}'MRS_p - \frac{w\hat{\phi}'}{[w - R\hat{\phi}]^2}.$$

To ensure $\hat{l}_x > 0$ (so the second-order condition holds at least in equilibrium), a sufficient—but by no means necessary—condition is $-w + R\hat{p}' < 0$. When $w > \underline{w}$ as just defined, we will have $w > R\hat{\phi}$ so this is satisfied if $\phi > \hat{p}'$. Comparing these objects, this requires $R > \frac{4x}{\gamma}$ and so is satisfied for all x if $R > \frac{4e}{\gamma}$, which we assume throughout the analysis.

When the wage is sufficiently high that citizens wish to split their time between working and lobbying (i.e., $w > \underline{w}$), we want to explore how citizens' effort in contesting political rights responds to changes in the wage. By the implicit function theorem applied to (9) we know that $dx^*/dw = -\hat{l}_w/\hat{l}_x$. Under our assumption that $\hat{l}_x > 0$ (as just discussed) the sign of dx^*/dw is

[9] When $w \leq R\hat{\phi}(e)$ inspection of the marginal payoff detailed in (8) reveals it is always positive so $x^* = e$. For $R\hat{\phi}(e) < w \leq \underline{w}$, $\hat{l}(e)$ is strictly increasing in w so the definition of $\underline{w}$ implies $\hat{l}(e) < 0$ and therefore $x^* = e$.

the opposite of the sign of $\hat{l}_w$, as in our benchmark case. Now,

$$\begin{aligned}\hat{l}_w &= [e-x]MRS_m + \frac{\hat{\phi}}{[w-R\hat{\phi}]^2} \\ &= [e-x]MRS_m + \frac{MRS}{w-R\hat{\phi}} \\ &= \frac{MRS}{w}\left[\frac{mMRS_m}{MRS} - \hat{p}R\frac{MRS_m}{MRS} + \frac{w}{w-R\hat{\phi}}\right]\end{aligned}$$

where the second line utilizes the fact that $MRS = \frac{\hat{\phi}}{w-R\hat{\phi}}$, and the third line utilizes the fact that $m \equiv w[e-x] + \hat{p}R \Rightarrow e - x = \frac{m-\hat{p}R}{w}$.

Recalling that $\eta \equiv \left|\frac{mMRS_m}{MRS}\right|$, we can deduce that $\hat{l}_w \gtrless 0$ if and only if $\eta \lessgtr \frac{w}{w-R\hat{\phi}} + \frac{\hat{p}R}{m}\eta$ which, using the definition of m, reduces to $\eta \lessgtr \frac{m}{w[e-x]}\frac{w}{w-R\hat{\phi}}$. This allows us to conclude that

$$\frac{dx^*}{dw} \lessgtr 0 \Leftrightarrow \eta \lessgtr \frac{m}{w[e-x]}\frac{w}{w-R\hat{\phi}}.$$

Notice that the threshold for η exceeds 1 since both fractions exceed 1.

As with the benchmark case, we can also deduce that the equilibrium level of citizens' income is monotonically increasing in the wage. To see this, note that $m^* = w[e-x^*] + \hat{p}R$ and therefore

$$\begin{aligned}\frac{dm^*}{dw} &= [e-x^*] - \left[[w-R\hat{p}']\frac{dx^*}{dw}\right] \\ &= \frac{1}{\hat{l}_x}[[e-x^*]\hat{l}_x + [w-R\hat{p}']\hat{l}_w]\end{aligned}$$

using the fact that $dx^*/dw = -\hat{l}_w/\hat{l}_x$. Using the expressions for $\hat{l}_x$ and $\hat{l}_w$ we can show that

$$\frac{dm^*}{dw} = \frac{1}{\hat{l}_x}\left[[e-x^*]\left[\hat{p}'MRS_p - \frac{w\hat{\phi}'}{[w-R\hat{\phi}]^2}\right] + [w-\beta R\hat{p}']\frac{\hat{\phi}}{[w-R\hat{\phi}]^2}\right] > 0$$

under our assumptions.

This allows us to draw the following conclusion.

Proposition 2 *Political activism, x^*, is at its highest level ($x^* = e$, and constant) when the wage is at or below the threshold $\underline{w} \equiv \hat{\phi}(e)\left[R + \frac{1}{MRS(\hat{p}(e)R,\hat{p}(e))}\right]$. If $w > \underline{w}$ then political activism, x^*, and political rights, p^*, are decreasing (increasing) in the wage, w, (and income) when $\eta < (>)\frac{m}{w[e-x]}\frac{w}{w-R\hat{\phi}}$.*

The intuition for this proposition parallels that in the benchmark case. When the elasticity

of the MRS is low and below a threshold (which is higher than the benchmark case where the threshold was 1) citizens see large increases in utility from working more when the wage increases. They consequently dedicate more time to work and less to political activism so there is a negative relationship between wages and political activism, and hence between income and political rights. This is more likely to be the case when income is low. By contrast, if the elasticity exceeds the threshold, which is more likely when income is high, further increases in the wage lead to less work being undertaken and consequently political activism increases, leading to a positive relationship between income and political rights.

This allows us to conclude that, while there might be a flat relationship between income and democracy at very low levels of income (because all effort is devoted to political activism given that this also generates material goods), above this low income threshold there is a U-shaped relationship between income and political rights.

3.6 A dynamic narrative

The basis of our model is a static framework where we take the initial political rights p_0 as given, and explore the impact of modernization (proxied by an increase in the wage) on political activism and consequently political rights. We find that income increases as the wage increases, but that political rights may fall when income is low (because citizens seize the opportunity to increase their material consumption from an increase in the wage when they currently have little material consumption, resulting in reduced political activism). Conversely, when income is higher an increase in the wage will be associated with an increase in political activism because material consumption is already so abundant their value of more consumption is low, so when the wage increases more time can be spent fighting for political rights.

In a dynamic setting of our baseline model (which we focus on to identify the key mechanisms; similar arguments would apply to the model with redistribution) we would consider modernization as an increase in the wage across successive periods. Under a presumption of myopic citizens who do not internalize the future consequences of current actions—that we pursue here for simplicity—there are therefore two additional components to think about: income increases from period to period; and the baseline political rights in a period will be inherited from the previous period.

The inheritance of baseline political rights from period-to-period, determined by how modernization influenced political fighting and the resulting political rights in the previous period, will have an effect on the incentives to fight in the current period. By the implicit function theorem applied to (7), $x^*_{p_0} = -l_{p_0}/l_x$. We have already established that $l_x > 0$ and it is easily established that

$$l_{p_0} = [1 - \gamma]MRS_p > 0.$$

As such, there is (unsurprisingly) a negative monotonic relationship between (inherited) baseline political rights and effort contesting political rights. Thus, if modernization gives rise to an increase (decrease) in fighting in one period we know this leads to an increase (decrease) in political rights in that period, and this will dampen (strengthen) the incentives to engage in more fighting in the following period.

If we start from a situation of a low income and consider an increase in the wage then our core mechanism implies that the strong desire for material goods means this increase in the wage will give rise to a reduction in effort contesting political rights. This consequently means political rights reduce. In the next period income is higher, baseline political rights are lower. Both of these factors will increase the incentive to fight for political rights when the wage increases again (income as we argued in our core mechanism, inherited political rights as we just established). After sufficient periods, therefore, effort in contesting political rights will stop reducing and start increasing, as will those political rights themselves. As modernization continues and incomes grow further effort in contesting political rights through the wage channel increases, but this will be suppressed by increased baseline political rights.

As such, with the additional factors of a dynamic setting taken into account our model is consistent with an initial negative relationship between income and political rights at low levels of income, and suggests that there will be a threshold level of income at which this relationship reverses so political rights increase with further increases in income (i.e., a U-shaped relationship), and that this positive relationship might flatten as incomes grow even more.

In summary, our theory sheds new light on the link between income and democracy and predicts a non-monotonic relationship between these variables. More specifically, the way increases in income are operationalized in our theory is through increases in the wage, that could result from improvements in productivity. Hence, although we do demonstrate that in the context of our model, increases in wages result in (i) higher equilibrium incomes, and (ii) a non-monotonic effect on political rights, it is true that the way modernization is modeled in our setup is specific and that one could possibly conceive other exogenous shocks pushing incomes upwards. That being said, however, the drivers of our mechanism that relies on the degree to which citizens are willing to substitute labor for political activism are to be found in the shape of the citizens' utility function and the trade-off of time allocation. As such, we are confident that our theoretical results predicting a non-monotonic relationship between income and democracy are quite general. In the next section, we empirically validate our theoretical findings.

4 Empirical evidence

4.1 Data

In order to test our theory empirically, we construct an (unbalanced)[10] 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 arguably not particularly suitable for the purpose of our exercise given that the earliest recorded entry for this index is 1972; a time-span constraint that would impair our ability to capture the predicted non-monotonic relationship empirically, as explained below.[11] Over the past years, the Varieties of Democracy (V-Dem) database has increasingly been used by scholars to measure the level of 'democracy' because of the richness of the dataset and because the set of indicators on which the measure relies is comprehensive (Coppedge et al. 2021). We therefore use the V-Dem database as an alternative measure of political rights, and re-run, in what follows, all our main estimations with this alternative dependent variable. All the results that rely on the V-Dem database can be found in Appendix B.

Income is captured by real GDP per capita, measured in thousand 2017 USD 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. 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). For consistency with our income data, 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 (thousand inhabitants) informed by PWT, and *age dependency ratio*, namely, the number of dependents per 100 working-age (15-64 years old) 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.

[10] Balancing the panel turns out to be extremely costly in terms of lost observations.

[11] Acemoglu et al. (2008) use both Polity data and the Freedom House index in their analysis. Given that Freedom House data is only available starting in 1972, when making use of this database in analyses starting in 1960, the authors merged the Freedom House database with Bollen's (2001) data. We deliberately abstained from making use of such merged databases for consistency reasons.

4.2 Empirical specification

Our analysis uncovers a non monotonic relationship between income and democracy, 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. Accordingly, our theory delivers a prediction that, keeping constant other characteristics of a country, its political rights should be higher for low and high income levels as compared to intermediate ones. 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 non-monotonic relationship predicted by our theory. The first equation is the following quadratic specification:

$$d_{it} = \alpha_0 + \alpha d_{it-1} + \beta_1 y_{it-1} + \beta_2 y_{it-1}^2 + u_i + \mu_t + v_{it}, \tag{10}$$

where d_{it} and y_{it} are our measures of democracy and income for 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 non-monotonic, a log-transformation would skew the distribution by flattening (steepening) the relationship for relatively low (high) values. This takes place as the log-transformation compresses (spreads) incomes higher (lower) than 2017 USD 1K per capita, a compression (spread) that is increasing (decreasing) in income. 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 income is already left-skewed, the above-described problem will be exacerbated. In what follows, whenever we discuss the results of the estimation of the quadratic specification (10), we refer to a U-shaped relationship.

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:

$$d_{it} = a_0 + a d_{it-1} + b_1 y_{it-1}^l + b_2 y_{it-1}^h + u_i + \mu_t + v_{it}, \tag{11}$$

where $y_{it-1}^l = \min(y_{it-1}, y_k)$, $y_{it-1}^h = \max(0, y_{it-1} - y_k)$, with y_k, the knot of the income spline, potentially at the income in the vertex of the estimated equation (10). Given, however, that the

data is highly skewed, the vertex of the estimated symmetric function is unlikely to capture the reversal of the relationship between our variables of interest. Accordingly, we show that the validation of our analysis is robust to alternative choices for the knot of the spline, and we shall focus in what follows on the knots that best capture the non-monotonicity. We expect the estimates of coefficients β_1 and b_1 to be negative and significant, while β_2 and b_2 to be positive and significant. An interesting feature of specification (11) is that it is flexible enough to detect non-monotonicities with (even highly) skewed data. In what follows, whenever we discuss the results of the estimation of the spline specification (11), we refer to a V-shaped relationship.

4.3 Estimators

We first run *OLS* on equation (10), including time-effects μ_t but naïvely ignoring country-specific fixed effects u_i that 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 (α) and, as a consequence, providing an upper bound for its estimate (Roodman 2009a).

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 de-meaning, 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 period (1960-2010) longer than much of the literature (e.g. Acemoglu et al. (2008) whose main 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 Nickel) panel bias (Nickel 1981, Bond 2002): in a data generating process where the idiosyncratic error v_{it} affects contemporaneous democracy d_{it}, the country de-meaning 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, de-meaned democracy is endogenous to unexplained changes in de-meaned democracy in other periods. In other words, the within-country transformation fails to produce 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 Nickel 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 $\Delta d_{it} = \alpha \Delta d_{it-1} + \beta_1 \Delta y_{it-1} + \beta_2 \Delta y_{it-1}^2 + \Delta \mu_t + \Delta v_{it}$. This cancels out the country-specific errors u_i and avoids our results being subject to the Nickel 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 2009a). 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 (2009a) 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's (2005) 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's (2005) small-sample correction. Also, to avoid instrument proliferation, following Roodman's (2009b) 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 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).

Given the limitations of OLS mentioned above and, to a lesser extent, those of FE and AH estimators, our analysis will essentially focus on AB estimates, even though we equally present additional results with alternative estimators.

4.4 Results

Tables 1 and 2 contain our benchmark results when estimating, respectively, a quadratic relationship between income and democracy, and a piecewise spline relationship between these same variables. In tables B1 and B2 in Appendix B we report the tables for the same estimations when using instead the V-Dem dataset to measure political rights. Our results are mostly unaffected by this change of dependent variable.

To contrast our results against 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 when estimating a linear-log relationship between the two variables of interest, excluding country-specific 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 vanishes. 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 income coefficients are statistically significant, a non-result that could (mistakenly) be interpreted as disproof of the modernization hypothesis. In Column (3) we introduce the quadratic measure of income to test our own theory under OLS, and yet the coefficients take the opposite signs to the ones predicted by our model (U-shape), with the β_1 coefficient on income being non-significant. This non-result comes as no surprise since—in case our theory is correct—the income coefficients are likely to be influenced by neglected country-specific characteristics. We thus re-estimate this relationship with fixed effects in Column (6) and find that the estimated coefficients of interest do have the expected sign and high or very high levels of significance. Indeed, the coefficient on lagged income is negative and significant at the 5% level while that on the square of lagged income is positive and significant at the 1% level. To overcome the potential biases explained above related to having a lagged explanatory variable alongside country-specific fixed effects with small T, in Columns (7) and (8) we provide, respectively, the estimates of the specification in equation (10) when instrumenting lagged income following Anderson and Hsiao's (1982) methodology (AH), and using the more precise Arellano and Bond (1991) GMM estimator

(AB). The results remain highly significant with the coefficients systematically confirming our theoretical predictions. In Table B1 in the Appendix, we show that the results are robust to replacing the Polity measure with the V-Dem one. We show the robustness of our results both with the AB estimator, and with the (less precise) AH estimator, none of which is subject to the Nickell bias that affects the FE estimator.

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***	0.5482***
	(0.0241)	(0.0181)	(0.0210)	(0.0396)	(0.0399)	(0.0412)	(0.1026)	(0.0735)
$ln(y_{-1})$	1.6007**			-1.1677				
	(0.6808)			(1.7466)				
y_{-1}		0.0064	0.1182		-0.1163	-0.3827**	-1.0067**	-0.6942**
		(0.0404)	(0.0759)		(0.1088)	(0.1504)	(0.4502)	(0.2752)
y_{-1}^2			-0.0008**			0.0014***	0.0032**	0.0023***
			(0.0004)			(0.0005)	(0.0014)	(0.0008)
N	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								0.29
p AR(2)								0.55

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. However, fitting a quadratic specification to the data is very stringent since it implies symmetry of the data around the vertex of the function. To allow for more flexibility, we present the estimation results of the spline specification (11) in Table 2. There is no consensus in the econometric literature on the ideal selection process for a knot in a non-balanced panel, and one could therefore be tempted to set the threshold y_v to the predicted vertex of equation (10). For the FE estimation, for instance, the knot would be fixed at $0.387/(2 \times 0.0014) \approx 138$, and for the AB estimation at $0.6942/(2 \times 0.0023) \approx 150$ thousand US dollars of 2017. However, these starting points are admittedly extremely high thresholds for defining the 'turning point'. They would imply that for countries with per capita income below these figures increases in income lead to lower democracy scores ceteris paribus. Instead, after observing the fit of the model for several alternative knots, we present the results for a knot of $\$40,000$ in Table 2, and we later also present the results for alternative knots.

Absent the inclusion of country-specific fixed effects, our estimations predict an inverted V-shaped relationship between income and democracy (Column 3). When controlling for country-specific fixed effects, however, the coefficients flip sign, are statistically significant, and thus suggest a systematic V-shape relationship between democracy and income (Column 6). The AH (Column 7) and AB (Column 8) estimations further confirm this finding at high or very high levels of significance. If we focus on our preferred estimator (AB), and bearing in mind our normalization of the Polity measure (0 to 100), an increase of $\$1,000/cap$ for an economy with a per capita income below $40,000 (in 2017 prices) is predicted to lead to a 0.83 drop in the polity score. For countries with a per capita income above $40,000, the same income increase is predicted to increase the Polity score by 0.10 points. Combined, these results confirm the existence of a non-monotonic relationship between income and democracy when exploring a possible trend reversal for incomes around $40,000. The estimations using V-Dem with the same cutoff point for the spline in Table B2 fail to deliver statistically significant results for the AH and AB models although, for the AB specification, one coefficient marginally fails to be significant at the $\$40K$ knot (p-value of 0.102). Nevertheless, as shown below, this non-result is entirely driven by the choice of the knot, since the results do hold with the V-Dem data for a $50K or a $70K knot.

Table 2: Benchmark spline specification for 40K

	(1) OLS lin-log	(2) OLS linear	(3) OLS spline	(4) FE lin-log	(5) FE linear	(6) FE spline	(7) AH spline	(8) AB spline
d_{-1}	0.8385***	0.8607***	0.8414***	0.5242***	0.5222***	0.5148***	0.5261***	0.6156***
	(0.0241)	(0.0181)	(0.0218)	(0.0396)	(0.0399)	(0.0416)	(0.1032)	(0.0971)
$ln(y_{-1})$	1.6007**			-1.1677				
	(0.6808)			(1.7466)				
y_{-1}		0.0064			-0.1163			
		(0.0404)			(0.1088)			
$y_{-1} \leq y_v$			0.1572**			-0.4283***	-1.1225***	-0.8344***
			(0.0620)			(0.1626)	(0.3399)	(0.2006)
$y_{-1} > y_v$			-0.1284***			0.0747*	0.1618***	0.0951**
			(0.0313)			(0.0416)	(0.0588)	(0.0371)
N	1299	1299	1299	1299	1299	1299	1145	1145
Fixed Effects				151	151	151		151
Instruments								100
R^2	0.79	0.79	0.79	0.51	0.51	0.52	.	
p Hansen								0.22
p AR(2)								0.53

Standard errors in parentheses

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

4.5 Robustness checks

Our quadratic specification in Table 1 confirms the existence of a non-monotonic relationship between income and democracy, although our AB estimates identify a very high value of $\$150,000$/cap as the turning point after which income is positively associated to democracy. As explained above, this is likely due to imposing a symmetric estimation on non-symmetrically distributed data, and when estimating instead the spline regression with a $\$40,000$ knot both the expected non-monotonicity and the absence of symmetry in the segments of the spline are indeed confirmed. To show that the selection of the knot is quite important, and that the quadratic specification is probably not the most accurate way of capturing the non-monotonicity between our variables of interest, in Table 3 we re-estimate Equation (11) for different knots with our most preferred specification, namely AB. In Column (1) we observe that a knot as low as $\$35,000$/capita fails to suggest a statistically significant positive relationship between our variables of interest. Yet, for intermediate knots ($\$40K$, $\$50K$, and $\$70K$), the coefficients confirm our theory mostly with high or very high statistical significance.

Although we view the AB specification as the most reliable one because of the remaining endogeneity issues the fixed effects estimation is subject to, to facilitate comparison with previous prominent empirical work, we report in Table A1 in the Appendix the equivalent results to the ones in Table 3 for the fixed effects estimation. Interestingly, our predictions are unaffected by this alternative choice of estimator.

To confirm that our results are not driven by our measure of democracy (Polity IV), in Table B3 in the Appendix we replicate Table 3 when using the V-Dem dataset instead. The coefficients of interest are statistically significant for intermediate knots ($\$50K$, and $\$70K$). Likewise, re-estimating the FE specification of Table A1 while using the V-Dem dataset in Table B4 further confirms our results. We can therefore reasonably conclude that income effectively maps into lower (resp. higher) political rights below (above) a per capita income threshold, with political rights being much more sensitive to income below the mentioned threshold.

Figure 2 helps us visualize our main results. On the x-axis, we have the GDP per-capita in USD of 2017. The plain lines taking the shape of a right-bended V depict the predicted democracy for the spline regression when using the AB estimator, with the coefficients for the low and high spline given, respectively, in column (8) of Table 2. The dashed line depicts the prediction based on the alternative lin-log AB estimation (not tabulated). For the purpose of visibility, all lines net out the country (u_i), and time (μ_t) fixed effects. The scatterplot includes the predicted value with the spline plus the idiosyncratic errors for observed incomes: $\hat{b}_1 y^l_{it-1} + \hat{b}_2 y^h_{it-1} + \hat{v}_{it}$. To avoid over-compressing the figure, we leave an income outlier (UAE) out of the figure, and we later show that our results are robust to the exclusion of income

Table 3: AB 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}	0.6032	0.6156***	0.6083***	0.6367***	0.6517***	0.6576***
	(0.3697)	(0.0971)	(0.0940)	(0.0913)	(0.0884)	(0.0888)
$y_{-1} \leq y_v$	-1.0671	-0.8344***	-0.7262***	-0.4726**	-0.3388*	-0.3268
	(1.4589)	(0.2006)	(0.1811)	(0.2041)	(0.1950)	(0.1991)
$y_{-1} > y_v$	0.0826	0.0951**	0.1175**	0.0753**	0.0351	0.1041
	(0.0998)	(0.0371)	(0.0470)	(0.0314)	(0.0538)	(0.1014)
N	1145	1145	1145	1145	1145	1145
Fixed Effects	151	151	151	151	151	151
Instruments	105	100	98	97	89	89
p Hansen	0.31	0.22	0.18	0.10	0.02	0.03
p AR(2)	0.68	0.53	0.53	0.51	0.50	0.49

Standard errors in parentheses

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

outliers, but also outliers that rely heavily on oil exports. Although, based on the lin-log estimation, one could mistakenly conclude that democracy is monotonically decreasing in income, the spline estimation reveals an underlying non-monotonic relationship that confirms our theoretical predictions with statistical significance.

We next consider in Table 4 the robustness of our results to the inclusion of a set of control variables taken from Acemoglu et al. (2008): log of population, population structure, human capital, and the exclusion of countries that were socialist until 1989. After replicating our AB estimates from Table 1 in Column (1), Column (2) shows the results are robust to ignoring the persistence of democracy by dropping its lagged value as an explanatory variable. We then sequentially introduce log of population and population structure (Col. (3)), human capital (Col. (4)), and all three control variables (Col. (5)), to finally exclude these controls and all former socialist countries (Col. (6)). Our findings of a quadratic relationship are robust to all these different specifications, although the β_1 coefficient is not statistically significant in estimations (3) and (5) where we have a reduced number of observations because of the inclusion of several control variables. Table A2 in the Appendix reports the analogous fixed effects estimations and the results very much confirm that our findings are robust to these specifications, since the coefficients of interest β_1 and β_2 are statistically significant in all specifications, including the ones featuring all control variables.

In Table 5 we include the same set of controls as in Table 4 but we estimate Equation (11) instead of Equation (10), for an income knot of \$40,000. The coefficients of interest are now

Table 4: AB results for the quadratic specification: Robustness checks

	(1) AB	(2) AB no-LDV	(3) AB Pop	(4) AB HK	(5) AB Both	(6) AB non-Soc
d_{-1}	0.5482***		0.5286***	0.5856***	0.5852***	0.6213***
	(0.0735)		(0.0767)	(0.0802)	(0.0818)	(0.0822)
y^2_{-1}	0.0023***	0.0029***	0.0014**	0.0020**	0.0015*	0.0019***
	(0.0008)	(0.0009)	(0.0006)	(0.0009)	(0.0008)	(0.0007)
y_{-1}	-0.6942**	-0.8328***	-0.2989	-0.6129**	-0.2912	-0.5809**
	(0.2752)	(0.3101)	(0.1887)	(0.2784)	(0.2090)	(0.2280)
$ln(pop_{-1})$			19.7716***		19.9890***	
			(4.5083)		(5.5266)	
$agedep_{-1}$			0.0521		0.1672	
			(0.1597)		(0.1987)	
hc_{-1}				3.2047	16.9981	
				(9.4998)	(12.6298)	
N	1145	1193	1076	1064	996	1070
Fixed Effects	151	151	149	135	133	127
Instruments	143	88	143	124	125	123
p Hansen	0.29	0.16	0.28	0.21	0.18	0.25
p AR(2)	0.55	0.16	0.52	0.47	0.43	0.50

Standard errors in parentheses

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

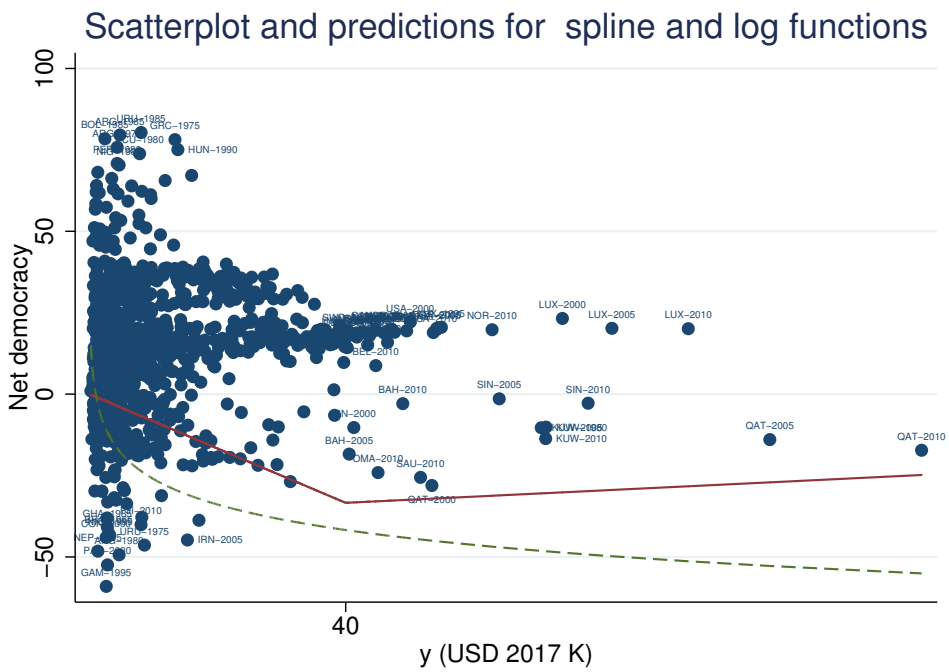

Figure 2: Income and Democracy. Plot of the correlation when exploiting within-country variation in the data: predicted V-shaped relationship for the lin-lin (—) and the lin-log (– –) specifications.

mostly highly significant, hence strengthening the results—as one would expect given the limitations of the quadratic estimation—and giving us further confidence that the relationship between the two variables of interest is indeed non-monotonic. Interestingly, the FE estimation results depicted in Table A3 in the Appendix provide further very robust evidence that the spline estimation with all controls confirms our non-monotonic theoretical prediction.

We next run a series of estimations that allows us to better comprehend why the existing literature has not identified this non-monotonic relationship so far, and we also consider in this same table longer time lags. To facilitate the contrast of our results to the ones of Acemoglu et al. (2008), we present both FE and AB estimations in Table 6. In Column (1) we re-estimate our FE benchmark specification (10) over the same period 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) significant. Hence, the addition of 10 years, tantamount to expanding the number of observations by more than 20%, is central. 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 (10) the two-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 after five years,

Table 5: AB results for the 40K spline specification: Robustness checks

	(1) AB	(2) AB no-LDV	(3) AB Pop	(4) AB HK	(5) AB Both	(6) AB non-Soc
d_{-1}	0.6156***		0.6211***	0.5868***	0.5998***	0.6180***
	(0.0971)		(0.0943)	(0.0951)	(0.1022)	(0.0920)
$y_{-1} \leq y_v$	-0.8344***	-1.0528***	-0.4773*	-0.9355***	-0.7503	-0.8145***
	(0.2006)	(0.2756)	(0.2850)	(0.2694)	(0.4609)	(0.1775)
$y_{-1} > y_v$	0.0951**	0.1493***	0.1167***	0.1348**	0.1836***	0.0872**
	(0.0371)	(0.0484)	(0.0316)	(0.0604)	(0.0644)	(0.0341)
$ln(pop_{-1})$			11.6462*		8.7254	
			(6.1717)		(8.5016)	
$agedep_{-1}$			0.0587		0.2711	
			(0.1434)		(0.1983)	
hc_{-1}				13.7620	23.7998	
				(11.3673)	(14.8108)	
N	1145	1193	1076	1064	996	1070
Fixed Effects	151	151	149	135	133	127
Instruments	100	101	101	101	102	100
p Hansen	0.22	0.19	0.23	0.22	0.23	0.33
p AR(2)	0.53	0.14	0.50	0.49	0.45	0.52

Standard errors in parentheses

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

if the process through which this happens is indeed a long one, the variables of interest could have an additional effect after 10 years. Our results indeed confirm this expectation, even though the one-lag linear term of income loses its statistical significance. Last, we re-estimate the benchmark specification with data observed every 10 years (column (3)) and every 20 years (column (4)). Although the 10 years lags estimation produces the expected results with high significance, the 20 years lags estimation does not. This is not entirely surprising since observing within-country data variation every 20 years over the selected time period implies having a maximum of 3 data points per country[12], and thus requires the non-monotonicity to take place (on average) over three observations; a demanding requirement. Columns (5) to (7) re-estimate columns (2) to (4) with the AB estimator. Although the 10 years lags estimation fails to produce statistically significant results, its p-value for the Hansen statistic suggests significant regressor endogeneity, and additional tests (not tabulated) suggest that its income lags are endogenous, invalidating their estimated coefficients.[13] The 20 years estimation is highly significant despite the rather low number of observations. The latter two results appear surprising, and given the skeweness of the distribution of our data, this calls in for a further, equivalent, test using the spline specification.

[12]These points are $t = [1970, 1990, 2010]$ for d_{it}, the dependent variable.

[13]This is the only regression where we find a low p-value for the Hansen statistic associated to endogenous incomes. The other statistic we compute, $AR2$ to detect autocorrelated residuals over time, proves satisfactory in all cases where the number of observations per country allows computing it.

Table 6: Fixed effects and GMM results for the quadratic specification: the temporal relationship

	(1) FE 1960-2000	(2) FE 2 5-yr lags	(3) FE 10-yr lag	(4) FE 20-yr lag	(5) AB 2 5-yr lags	(6) AB 10-yr lag	(7) AB 20-yr lag
d_{-1}	0.4399***	0.5212***	0.2305***	-0.1186	0.5411***	0.2445*	0.0123
	(0.0468)	(0.0550)	(0.0593)	(0.0790)	(0.0862)	(0.1394)	(0.2988)
d_{-2}		-0.0170			0.0213		
		(0.0458)			(0.0559)		
y^2_{-1}	0.0011*	0.0008*	0.0022***	-0.0252	0.0017***	-0.0031	0.1998**
	(0.0006)	(0.0004)	(0.0007)	(0.0242)	(0.0006)	(0.0127)	(0.0783)
y^2_{-2}		0.0009**			0.0012**		
		(0.0004)			(0.0005)		
y_{-1}	-0.2683	-0.2296	-0.7011***	-0.7125	-0.5225***	-0.9698	-15.1380***
	(0.2131)	(0.1394)	(0.2350)	(1.1369)	(0.1921)	(1.0549)	(4.9458)
y_{-2}		-0.2557*			-0.3421**		
		(0.1525)			(0.1657)		
N	1004	1145	642	285	993	490	155
Fixed Effects	151	151	130	151	151	130	114
R^2	0.41	0.51	0.36	0.35			
Instruments					141	40	7
p Hansen					0.34	0.01	.
p AR(2)					0.60	0.99	.

Standard errors in parentheses

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

In Table 7 we then follow the same strategy as in Table 6, while estimating instead the spline regression for the $\$40,000$ knot as elsewhere in our analysis, since this knot is expected to better capture the reversal point of the non-monotonicity than alternative knots. A very instructive finding of this table is that the non-monotonicity between income and democracy can indeed be identified in the data of Acemoglu et al. (2008) when running a spline estimation while tailoring the knot at income levels compatible with the actual reversal of trend in the relationship between the two variables (in this case, $\$40,000$). A second noteworthy result is that the while the 10 years estimation with the AB estimator now produces statistically significant results, the 20 years estimation does not. This reinforces our expectation 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. Overall, the results contained in Tables 6 and 7 inform us that the non-monotonic relationship between income and democracy we theoretically predict in this article is indeed present in the data, and that one needs to tailor the econometric model to adequately capture the reversal in trend. Failing to do so, as when estimating a fixed effects quadratic specification on the data of Acemoglu et al. (2008), i.e. 1960-2000, will produce the mistaken conclusion that no such non-monotonic relationship is at play.

Table 7: Fixed effects and GMM results for the spline 40K specification: the temporal relationship

	(1) FE 1960-2000	(2) FE 2 5-yr lags	(3) FE 10-yr lag	(4) FE 20-yr lag	(5) AB 2 5-yr lags	(6) AB 10-yr lag	(7) AB 20-yr lag
d_{-1}	0.4382***	0.5190***	0.2290***	-0.1004	0.5534***	0.2345	3.2708
	(0.0471)	(0.0554)	(0.0596)	(0.0819)	(0.0896)	(0.2098)	(2.8024)
d_{-2}		-0.0174			0.0255		
		(0.0458)			(0.0528)		
$y_{-1} \leq y_v$	-0.3953*	-0.0591	-0.7191***	-1.8146***	-0.5963**	-2.2512***	-1.4171
	(0.2200)	(0.1948)	(0.2302)	(0.4342)	(0.2555)	(0.4640)	(4.9155)
$y_{-2} \leq y_v$		-0.4946***			-0.3001		
		(0.1577)			(0.2065)		
$y_{-1} > y_v$	0.1343***	-0.0117	0.0753	0.1717	0.0598*	0.6521**	15.4838
	(0.0417)	(0.0645)	(0.0560)	(0.8632)	(0.0320)	(0.3291)	(125.8546)
$y_{-2} > y_v$		0.1036			0.0543		
		(0.0690)			(0.0609)		
N	1004	1145	642	285	993	490	155
Fixed Effects	151	151	130	151	151	130	114
R^2	0.41	0.52	0.36	0.35			
Instruments					116	28	4
p Hansen					0.34	0.13	.
p AR(2)					0.61	0.93	.

Standard errors in parentheses

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

Last, we address the concern that our results may be driven by outliers. Indeed, upon inspection of Figure 2, the reader could be concerned that a few extreme observations, as for instance Qatar in 2010 or the UAE that has been dropped from Figure 2 (but not from the estimations behind the figure), may be heavily leveraging upwards the curves' slopes for high incomes. Likewise, one could suspect that oil-producing countries could play a deterministic role in our results.To address these concerns, Table 8 provides evidence that our results are robust to a series of further controls. In Column (1) we report once more the baseline results of the AB estimation of equation (9) for simplifying the comparison of the various specifications. In Columns (2) and (3), respectively, we restrict the sample to observations for which the income per capita is below \$200K and \$100K. In Columns (4) to (6) we drop, sequentially, from the sample countries for which the oil dependence of GDP is higher than 17.70%, 12.30% and 7.36%.[14] Last, in Column (7) we exclude Middle East and North Africa (MENA) countries from the sample. Our results are robust to these further checks thereby providing evidence that our findings are not driven by either outliers with extremely high GDP/cap, or by major oil producers.

[14]These dependency thresholds are the ones used by the World Bank to classify countries in different groups as of December 2023, when we downloaded the data.

Table 8: AB estimations for the quadratic specification: Controlling for income levels and oil reliance

	(1) Base	(2) y<200	(3) y<100	(4) Non-oil l1	(5) Non-oil l2	(6) Non-oil l3	(7) No MENA
d_{-1}	0.5482***	0.5926***	0.5725***	0.6019***	0.6030***	0.6055***	0.6342***
	(0.0735)	(0.0848)	(0.0882)	(0.0911)	(0.0906)	(0.0931)	(0.0923)
y^2_{-1}	0.0023***	0.0021**	0.0093**	0.0137***	0.0130**	0.0132***	0.0161***
	(0.0008)	(0.0008)	(0.0038)	(0.0052)	(0.0052)	(0.0050)	(0.0057)
y_{-1}	-0.6942**	-0.6163**	-1.2696***	-1.7371***	-1.6714***	-1.6842***	-1.9521***
	(0.2752)	(0.2647)	(0.3841)	(0.4344)	(0.4294)	(0.4138)	(0.4759)
N	1145	1145	1139	1011	1030	1056	1023
Fixed Effects	151	151	151	134	136	139	134
Instruments	143	123	123	79	79	79	79
p Hansen	0.29	0.15	0.14	0.02	0.03	0.02	0.03
p AR(2)	0.55	0.53	0.55	0.60	0.60	0.55	0.54

Standard errors in parentheses

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

4.6 A Long Run Perspective

The nature of the data we use sets a lower bound on the starting date over which we can study the relationship between income and democracy. Admittedly, this 1960 lower bound, is very recent, and one could wonder whether the non-monotonic relationship we uncover is valid when considering a longer view of history. The data is limited, however, and to date the only reliable available estimate of incomes over earlier periods is to be found in the Maddison Project (Maddison 2020) which allows us, in combination with the Polity data which starts recording democracy scores in 1800, to expand our analysis back to the early 19^{th} century. This database does not come without biases, however, since most countries did not even exist two centuries ago. In fact, for 1800, we have data on 20 countries alone, and for many of the subsequent years the data is only available for a handful of countries. Despite these limitations, we inquire whether the relation between income and democracy is non-monotonic with this expanded database.

In Table 9 we present our results for the AB estimation of the spline specification when considering an array of knots. As explained earlier, this method allows us to identify non-monotonicities in a more reliable way than by estimating a quadratic specification. Given the long run perspective adopted here, one should expect the turning point in the relationship between income and democracy to take place at lower levels of income. Accordingly, we present the results for lower knots than in the previous estimations, with the chosen knots spanning from $\$30K$ (Column (1)) to $\$70K$ (Column (7)). The results are quite conclusive. In Columns (3) and (4) we see that democracy scores deteriorate with income for levels below, respectively, $\$40K$ and $\$45K$, and they rise with income above these thresholds, and our estimates are statistically significant at the 1% and 10% thresholds of statistical significance, respectively, for the b_1 and b_2 coefficients. For the remaining knots, the downward sloping part is robustly statistically significant, while the upward sloping part is not. Consequently, our empirical exercise does seem to confirm that income does eventually make countries more democratic, although low income countries will see their democracy score deteriorate as they develop economically, with the turning point taking place at a threshold roughly located around $40,000-$45,000.

Table 9: AB spline specification with different knots (1800-2010)

	(1) Knot 30	(2) Knot 35	(3) Knot 40	(4) Knot 45	(5) Knot 50	(6) Knot 60	(7) Knot 70
d_{-1}	0.5892***	0.6023***	0.5734***	0.5703***	0.5575***	0.5537***	0.5490***
	(0.0917)	(0.0837)	(0.0922)	(0.0923)	(0.0977)	(0.0976)	(0.0993)
$y_{-1} \leq y_v$	-1.2986***	-1.2689***	-1.2325***	-1.0286***	-0.9081***	-0.8537**	-0.7735***
	(0.2826)	(0.2988)	(0.3158)	(0.2765)	(0.2713)	(0.3275)	(0.2892)
$y_{-1} > y_v$	-0.1184	0.6607	1.2112*	1.4520*	1.2017	2.3742	16.2407
	(0.3611)	(0.4787)	(0.6252)	(0.7719)	(1.5477)	(4.3474)	(29.5697)
N	1935	1935	1935	1935	1935	1935	1935
Fixed Effects	145	145	145	145	145	145	145
Instruments	130	129	127	126	124	122	122
p Hansen	0.99	0.98	0.98	0.98	0.98	0.96	0.96
p AR(2)	0.86	0.86	0.83	0.81	0.81	0.81	0.81

Standard errors in parentheses

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

4.7 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—which provoke increases in income in the theory—should incentivize citizens to substitute their time away from political activism towards labour when wages are low because of the high relative marginal utility of material goods for low-income citizens. For high wages—and thus high incomes in our theory—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 of 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 to our theoretical predictions.

We first extract from the World Value Surveys (WVS) two variables that reflect citizens' preferences and political actions, namely one capturing *interest in politics*, and another measuring the extent to which citizens have *attended lawful/peaceful demonstrations*, for 7 waves of varying length (5 to 8 years) over the period 1981-2022.[15] Given the absence of an objective measure of income in WVS[16], our measure of income is taken from the Penn World Tables, as in previous regressions. Accordingly, we aggregate the variables capturing citizens' political preferences and actions at the country-wave level by constructing an average value of the sampled individuals for each country-wave, and normalizing the scores to $[0, 100]$ to aid the interpretation of our results. Because of data availability reasons, our sample is now reduced to 103 countries. We also aggregate the yearly real per capita income values at wave level by averaging them, for each country. We then test for a non-monotonic association of income with said variables by running spline estimations on the contemporaneous association of income with political actions and preferences.[17]

[15] These 7 waves are 1981-1988,1989-1993,1994-1998,1999-2004,2005-2009,2010-2016 and 2017-2022.

[16] 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.

[17] 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 10 looks at the association of income and political interest, considering several alternative knots ranging from \$20K to \$45K per capita. Although the number of observations is significantly lower than in previous regressions, our results unambiguously point to a non-monotonic relationship: political interest drops with income for low-income countries and rises with income for high-income countries, with statistically significant pairs of income coefficients observed for income knot values as low as \$20K/cap. Although the positive effect of income on preferences starts fading away when setting the knot at \$45K/cap—thus contrasting with our benchmark findings—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 10: Political interest on Spline with Varying Knots of Income for country-specific fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Knot 20	Knot 25	Knot 30	Knot 35	Knot 40	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.

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

While Table 10 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 11 the effect of income on political action for different knots. The non-monotonicity shows significance for knots up to \$20K/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. Our theoretical predictions are therefore indeed corroborated by this additional test since citizens are seen to reduce their participation in protests when income rises in low-income countries, and to increase their participation in high-income countries.

An important remark is nevertheless in order regarding the interpretation of these additional findings. Given the data limitations of the WVS, it is hard to claim a causal link between

income and political preferences and actions. We cannot exclude, for instance, that as countries become more democratic citizens might get more interested in politics and less fearful of repercussions for participating in peaceful protests. Although we do control for lagged values of democracy, thereby partly capturing such effects, our specification is not totally immune to similar potential endogeneity biases.

Table 11: Attending lawful demonstrations on Spline with Varying Knots of Income for country-specific fixed effects

	(1)	(2)	(3)	(4)	(5)
	Knot 10	Knot 15	Knot 20	Knot 25	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

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

Although the above results seem to convincingly support our theory, the data limitations of the WVS could potentially cast some doubts on this mechanism. We provide further evidence in support of the non-monotonic effect of income on citizens' political preferences by using data from the Manifesto Project Data Set (MPDS). This 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 other things, whether manifestos suggest that democracy should be "the only game in town" and citizens should participate in political decision-making. Although imperfect, this variable nevertheless reflects citizens' preferences, as reflected in political parties manifestos, weighted by vote shares.[18] We present the results of the spline estimation for this alternative dependent variable, for various knots between \$35K and \$80K, in Table 12. Our analysis reveals that although the positive association of income with the subjective value of democracy in wealthy countries is highly or very highly significant for knots at and above \$45K, the negative effect for low-income countries is only marginally insignificant, with p-values ranging from 0.108 at the \$50K knot, to 0.128 at the \$75K knot.[19] Bearing in mind that

[18]Observe that these results are equally subject to the same endogeneity concerns potentially at play in the WVS estimations above.

[19]While all these regressions have a very low R^2, those with $y_{knot} \geq$ \$45K report overall significance of the regression with p-value < 0.03.

the MPDS sample excludes many countries with low levels of GDP/capita, it is not surprising that we mostly capture the upward-sloping part of the story, and it is equally encouraging to see that a non-monotonic trend is nevertheless close to being statistically significant.

Table 12: Subjective Value of Democracy on Spline with Varying Knots of Income for country-specific fixed effects

	(1) Knot 35	(2) Knot 40	(3) Knot 45	(4) Knot 50	(5) 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) Knot 60	(7) Knot 65	(8) Knot 70	(9) Knot 75	(10) 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

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

5 Conclusion

In this article 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 political 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, where citizens experience a high marginal utility from material goods, modernization as captured by a positive productivity shock will *reduce* political activism and the ensuing political 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 material goods is high. For high levels of economic development when the marginal utility from material goods 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 deeply interwoven concepts of economics and politics.

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A Robustness checks

Table A1: FE 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)
$y_{-1} \leq y_v$	-0.4270**	-0.4283***	-0.4134***	-0.3385***	-0.2813**	-0.2674**
	(0.1785)	(0.1626)	(0.1439)	(0.1231)	(0.1242)	(0.1191)
$y_{-1} > y_v$	0.0367	0.0747*	0.1171***	0.1269***	0.1128***	0.1976***
	(0.0600)	(0.0416)	(0.0296)	(0.0307)	(0.0176)	(0.0417)
N	1299	1299	1299	1299	1299	1299
Fixed Effects	151	151	151	151	151	151
R^2	0.52	0.52	0.52	0.52	0.52	0.52

Standard errors in parentheses

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

Table A2: 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***	0.0020***	0.0017***	0.0013***	0.0016***	0.0015***
	(0.0005)	(0.0008)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
y_{-1}	-0.3827**	-0.5088**	-0.4470***	-0.3499**	-0.4158**	-0.4050***
	(0.1504)	(0.2440)	(0.1514)	(0.1522)	(0.1629)	(0.1537)
$ln(pop_{-1})$			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)	
N	1299	1348	1228	1201	1131	1200
Fixed Effects	151	151	149	135	133	127
R^2	0.52	0.30	0.51	0.51	0.51	0.50

Standard errors in parentheses

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

Table A3: Fixed effects results for the spline 40K specification: Robustness checks

	(1) FE	(2) FE no-LDV	(3) FE Pop	(4) FE HK	(5) FE Both	(6) FE non-Soc
d_{-1}	0.5148***		0.4946***	0.5236***	0.5044***	0.5037***
	(0.0416)		(0.0424)	(0.0427)	(0.0438)	(0.0447)
$y_{-1} \leq y_v$	-0.4283***	-0.5669**	-0.5855***	-0.4028**	-0.5648***	-0.4512***
	(0.1626)	(0.2693)	(0.1702)	(0.1653)	(0.1938)	(0.1680)
$y_{-1} > y_v$	0.0747*	0.1236	0.0820*	0.0710*	0.0901*	0.0686*
	(0.0416)	(0.0863)	(0.0441)	(0.0419)	(0.0465)	(0.0406)
$ln(pop_{-1})$			-0.9336		-0.1181	
			(5.0180)		(5.5213)	
$agedep_{-1}$			0.0583		0.1084	
			(0.0814)		(0.0869)	
hc_{-1}				0.0857	3.0494	
				(5.4146)	(5.8802)	
N	1299	1348	1228	1201	1131	1200
Fixed Effects	151	151	149	135	133	127
R^2	0.52	0.31	0.51	0.52	0.51	0.50

Standard errors in parentheses

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

B Estimations using the V-Dem dataset

Table B1: Benchmark quadratic specification (V-Dem)

	(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}	0.9032***	0.9232***	0.9124***	0.6284***	0.6286***	0.6272***		0.6722***
	(0.0176)	(0.0117)	(0.0147)	(0.0302)	(0.0307)	(0.0310)		(0.0881)
d_{-1}							0.5284***	
							(0.1821)	
$ln(y_{-1})$	0.9148**			0.2871				
	(0.4161)			(0.9600)				
y_{-1}		0.0040	0.0699		-0.0374	-0.1123		-0.2180**
		(0.0213)	(0.0435)		(0.0372)	(0.0680)		(0.0978)
y_{-1}							-0.7733*	
							(0.4570)	
y_{-1}^2			-0.0005**			0.0004*		0.0008**
			(0.0003)			(0.0002)		(0.0003)
y_{-1}^2							0.0025*	
							(0.0014)	
N	1480	1480	1480	1480	1480	1480	1340	1340
Fixed Effects				140	140	140		140
Instruments								111
R^2	0.87	0.87	0.87	0.64	0.64	0.64	.	
p Hansen								0.10
p AR(2)								0.19

Standard errors in parentheses

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

Table B2: Benchmark spline specification for sh vdem

	(1) OLS lin-log	(2) OLS linear	(3) OLS spline	(4) FE lin-log	(5) FE linear	(6) FE spline	(7) AH spline	(8) AB spline
d_{-1}	0.9032***	0.9232***	0.9043***	0.6284***	0.6286***	0.6280***	0.5108***	0.5409***
	(0.0176)	(0.0117)	(0.0159)	(0.0302)	(0.0307)	(0.0310)	(0.1675)	(0.0922)
$ln(y_{-1})$	0.9148**			0.2871				
	(0.4161)			(0.9600)				
y_{-1}		0.0040			-0.0374			
		(0.0213)			(0.0372)			
$y_{-1} \leq y_v$			0.0932**			-0.1327*	-0.8381**	-0.3232***
			(0.0402)			(0.0800)	(0.3650)	(0.1036)
$y_{-1} > y_v$			-0.0738***			0.0180	0.1468	0.0306
			(0.0185)			(0.0193)	(0.1153)	(0.0187)
N	1480	1480	1480	1480	1480	1480	1340	1340
Fixed Effects				140	140	140		140
Instruments								120
R^2	0.87	0.87	0.87	0.64	0.64	0.64	.	
p Hansen								0.61
p AR(2)								0.22

Standard errors in parentheses

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

Table B3: AB results for the spline specification with different knots (V-Dem)

	(1) Knot 35	(2) Knot 40	(3) Knot 50	(4) Knot 70	(5) Knot 100	(6) Knot 135
d_{-1}	0.5460***	0.5409***	0.5408***	0.5614***	0.5946***	0.6025***
	(0.0915)	(0.0922)	(0.0898)	(0.0906)	(0.0927)	(0.0901)
$y_{-1} \leq y_v$	-0.4058***	-0.3232***	-0.2595**	-0.1613*	-0.1171*	-0.1075
	(0.1434)	(0.1036)	(0.1017)	(0.0822)	(0.0672)	(0.0650)
$y_{-1} > y_v$	0.0196	0.0306	0.0454**	0.0268*	0.0253	0.0490
	(0.0216)	(0.0187)	(0.0200)	(0.0147)	(0.0274)	(0.0480)
N	1340	1340	1340	1340	1340	1340
Fixed Effects	140	140	140	140	140	140
Instruments	123	120	117	115	102	102
p Hansen	0.46	0.61	0.48	0.39	0.21	0.19
p AR(2)	0.22	0.22	0.22	0.21	0.19	0.19

Standard errors in parentheses

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

Table B4: FE results for the spline specification with different knots (V-Dem)

	(1) Knot 35	(2) Knot 40	(3) Knot 50	(4) Knot 70	(5) Knot 100	(6) Knot 135
d_{-1}	0.6292***	0.6280***	0.6264***	0.6261***	0.6264***	0.6264***
	(0.0308)	(0.0310)	(0.0313)	(0.0312)	(0.0311)	(0.0311)
$y_{-1} \leq y_v$	-0.1229	-0.1327*	-0.1290*	-0.1011*	-0.0814	-0.0766
	(0.0894)	(0.0800)	(0.0679)	(0.0561)	(0.0505)	(0.0472)
$y_{-1} > y_v$	0.0012	0.0180	0.0356**	0.0383***	0.0425***	0.0782***
	(0.0251)	(0.0193)	(0.0153)	(0.0117)	(0.0116)	(0.0217)
N	1480	1480	1480	1480	1480	1480
Fixed Effects	140	140	140	140	140	140
R^2	0.64	0.64	0.64	0.64	0.64	0.64

Standard errors in parentheses

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