Voting Up?
The Effects of Democracy and Franchise Extension on Human Stature†

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ABSTRACT

We study the effect of the spread of democracy on population health in 15 European countries since the middle of the nineteenth century, and more specifically the average height of adult males by 5-year birth cohort and we estimate the effect of transitions to democracy using within-country variation. We find that the advent of democracy increased average height by about 0.7cm. When we also account for the extension of the franchise to women, this increases to 1cm or about 9 per cent of the total increase in height of birth cohorts from the 1870s to the 1970s. Intervening mechanisms include reduced inequality and increased expenditure on social and health services. Our results are robust to a wide range of econometric tests.

Keywords: height, democracy, transition, voting rights, franchise, inequality, political contestation, health services.
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1. Introduction

The relationship between transitions from autocratic rule to democracy and the health status of populations is widely debated. Worldwide evidence for recent decades suggests that the advent of democracy is associated with reductions in infectious and chronic diseases with concomitant increases in life expectancy, which mostly reflect progress in developing countries (Besley and Kudamatsu, 2006; Bollyky et al., 2019). In this paper we examine the countries of western Europe over more than a century from the 1860s as their political structures evolved towards democracy and as they emerged from an epidemiological environment very different from today. We focus on average male height as an indicator of health conditions faced by the general population during the critical childhood years. Over eleven decades, adult heights increased by about 11cm while, at different times, European countries transitioned from non-democracy to democracy. Our purpose is to examine the link between these two variables.

Moving to democracy involves furthering the political accountability of governments to wider social groups, as well as increasing the representation of a broader range of social and economic interests. In some settings, democratic transitions provide a pathway for ordinary citizens to challenge privileged elites, and to bring about reforms (Acemoglu and Robinson, 2000 Deaton, 2013; Weil, 2015), such as public health and welfare programs (Besley and Kudamatsu, 2006; Norris, 2012) and, more generally, pro-poor fiscal policies (Aidt et al., 2006). Democratic institutions may also improve the living conditions for the average household through a variety of other channels, including income rises, wider education attainment, and health information. But democratic institutions do not always address the needs of the poorest individuals in society (Krueger et al., 2015). In some cases, they may even fail to expand government's political accountability (Chapman, 2018), when governments are captured by a dominant elite, with clientelistic support from the middle class (Powell-Jackson et al., 2011), and hence

they fail to incorporate the preferences of those lower down the social scale (Keefer and Khemani, 2005). Finally, public health initiatives to fight the spread of infectious disease can conflict with political and economic liberties under democracies (Troesken, 2015). Thus, the health-enhancing effects of transitions to democracy are ultimately an empirical question.

In this paper we study the effect of democratic transitions in fifteen western European countries on the average height of males around the age of 21 by five-year birth cohorts from 1860 to 1980. Our research design has several strengths in relation to the existing literature. First, our outcome variable, adult stature, although varying widely across individuals, when averaged across populations is widely regarded as a reliable indicator of what has become known as the 'biological standard of living' (Silventoinen et al., 2003; Steckel, 1995; 2009; 2013). Unlike measures of infant or child mortality, it reflects the general health status of those who survive and not just conditions that result in fatalities. The standard of measurement of heights is constant across countries and over time, unlike the incidence of specific diseases or causes of death. But perhaps most importantly, growth in stature is concentrated in childhood and especially in early childhood. This means that the timing of democratic reforms can be linked more tightly to a critical period when health is most influenced, unlike other measures such as average life expectancy at birth, which reflects health insults distributed over the whole lifespan.

Second, we develop several measures of democracy, combining and augmenting existing indices. Most importantly, we incorporate the extension of the franchise to women, which was a key feature of the European democratic transition. Female suffrage is especially significant because, even though we focus on the heights of males, women play a crucial role in nurturing them as children. Women's priorities differ from those of men, and recent studies have emphasised that the political empowerment of women has important implications for a range of health outcomes, especially among children

(Bhalotra and Clots-Figueras, 2014; Chattopadhyay and Duflo, 2004). Consistent with this, Aidt and Dallal (2008) find that female suffrage is associated with increased social expenditure. The extension of the franchise to women may be important also because it has been associated with a range of civil rights improvements (Wang et al., 2017).

Third, much of the existing research has focused on recent decades when most of the countries transitioning to democracy have been poor and middle-income countries. These transitions have occurred mainly in what, in Huntington's (1991; 1993) typology, is the third wave of democratisation. By focusing on Europe from the middle of the nineteenth century, we embrace the first and second waves of democratisation, which have been understudied in previous research. These could have disparate implications for health and height for at least two reasons. One is that epidemiological conditions were very different, especially in the years before 1950 than they have been since. As Europe was close to the frontier of medical understanding and technology, political change could not simply open the door to radical improvements from abroad. Equally important, political systems evolved across the century together with political ideas. By using recently developed historical indices of different dimensions of democratic change we can explore their influences in a constant set of countries.

In a regression framework that accounts for country and period fixed effects, our baseline regression results indicate that transitions from autocracy to democracy are associated with a gain in average height of about 0.7cm, or 6.4% of the total increase of 11cm between 1871-5 to 1976-80. When we include in our index of democracy the extension of voting rights to women, we find evidence of a gain in height of around 1cm, or about 9% of the total increase. These results are robust to the inclusion of lags, to falsification and placebo tests and are confirmed in a quasi-event study. They are also robust to treating democracy as endogenous in an instrumental variables framework. In addition, we explore possible intervening mechanisms through which democratic

innovations lead to improved health outcomes and we find that the principal channels are the expansion of social and health services and the reduction of inequality. Finally, we investigate possible heterogeneity in the link between democracy and height. Surprisingly, we find little variation across country groups and over time although different dimensions of democracy have different impacts.

The rest of the paper proceeds as follows. In the next section we provide some background to our study that includes an outline of related literature and an overview of relevant historical developments in Europe. Then we set out our estimating framework and describe our dataset. Next, we present our baseline results, and this is followed by a range of robustness tests. We then examine the connections between democracy and intervening variables and the links between these variables and height. Finally, we turn to examining heterogeneity across countries and over time and we follow this by exploring indicators of different dimensions of democracy. We draw implications from our study in a brief conclusion.

2. Background

2.1 Related Literature

A range of studies have examined the link between democracy and various health-related outcomes. In a review of the literature Muntaner et al. (2011) found that 21 out of 26 studies reported a positive association between democracy and health, mostly using life expectancy or infant/child mortality as the outcome. As one example, Besley and Kudamatsu (2006) find a positive association between democracy and life expectancy across countries from the 1960s to the 2000s. Exploring dynamic effects in a panel of countries over a similar period, Lin et al. (2012) found the effect of democracy on life expectancy to be small, although it increases in size over the life cycle. Other studies focus on early-life outcomes, where the changes in the social environment are likely to have the

greatest impact. While Zweifel and Navia (2000) document a strong negative association between democracy and infant mortality, Burroway (2016) finds that infant health is influenced by specific interventions rather than directly by democracy, perhaps because such interventions are partly contingent on democracy.

Some other strands in the literature focus specifically on transitions to democracy. Ross (2006) finds that, in a country panel, the effects of democracy on infant and child mortality are sensitive to the selection of countries and the inclusion of country fixed effects. Comparing siblings in Sub-Saharan Africa, Kudamatsu (2012) finds deaths among those born after a transition to democracy were reduced in comparison with their siblings born earlier. Komlos and Kriwy (2003) found that the heights of males in East and West Germany converged following reunification while Costa-Font and Gil (2008) show that the height gap in Spain narrowed after the transition to democracy. In contrast, Pak (2004) reports a substantial divergence between the heights of North and South Koreans born before and after the division of the country.[2]

To understand the effect of such diverse literature, it is important to identify the intervening mechanisms that underlie the association between health and democracy. Much attention has been paid to the links between democracy and per capita income, or income distribution, where the effects could flow in both directions. Following Lipset (1959), some studies find evidence that income influences transitions to democracy (Barro, 1999; Przeworski et al., 2000). On the other hand, Acemoglu et. al (2008) do not find a causal connection from income to democracy, while Acemoglu et al. (2019) find instead that transitions to democracy increase per capita income by 22 % in the long run. As the franchise widens, voting rights typically percolate down the hierarchy of social class and income, potentially leading to income redistribution (Acemoglu and Robinson,

[2] The effects of transition to democracy could be negative in the short-term if it involves massive dislocation. Adserà et al. (2021) find shorter heights among those born during the dissolution of the Soviet Union, followed by recovery.

2000; Lindert, 2004; Gradstein and Milanovic, 2004). Redistribution alone could lead to improved aggregate health outcomes if the health gains to the poor outweigh the effects on other socio-economic groups.

As Deaton observes (2013, p. 98), "Whenever health depends on collective action—whether through public works, the provision of health care or education—politics must play a role" (see also Preston 1975; Easterlin 1999). A key link from democracy to health is through increased government expenditure on health-related social services. In fact, some studies focus on the welfare effects of changes in the political empowerment of women. For the US, Lott and Kenny (1999) found that the introduction of female suffrage significantly increased state and federal government expenditure and led to more liberal congressional voting. This in turn had implications for health. Examining a panel of US states from 1900 to 1936, Miller (2008) found that female enfranchisement led to immediate increases in state and local expenditure on health and social services and it substantially reduced the mortality rates of young children. Other studies also find that female political empowerment has significant positive effects on child health in a variety of different settings (Bhalotra and Clots-Figueras, 2014; Chattopadhyay and Duflo, 2004; Swiss et al., 2012; Varkey et al., 2010).

Tighter government accountability may also improve the quality and the targeting of health-related infrastructures (Lake and Baum, 2001). Democracy may also improve health by altering behaviours beyond the access to information by shaping incentives (Frey and Stutzer, 2000; Inglehart et al., 2008, Sen, 1999; Wigley and Akkoyunlu-Wigley, 2011). This was especially important in the nineteenth century, as rudimentary knowledge of nutrition and hygiene was disseminated around that time. On a broader scale there is evidence that democracies may protect health by reducing uncertainty from corruption and political extraction, by averting famines and by avoiding major wars (Kolstad and Wiig, 2016; Siegle et al., 2004; Akresh et al., 2012).

2.2 The European Setting

Evidence from the fifteen European countries examined in this study suggests that the average height of males, measured at the age of around 21, increased by 11cm between the birth cohorts of 1871-5 and 1976-80. Figure 1 divides all countries into three country groups, each of which shows a strong upward trend but with some country-specific differences. More specifically, Figure 1 displays a slight acceleration in the northern group in the late nineteenth century and in the central group in the interwar years. The southern group exhibits slower growth in the period embracing the two world wars followed by steeper increase after 1950. Similarly, Table 1 shows democratic transitions across the fifteen countries at five-year benchmarks, based on the democracy index of Boix, Miller and Rosato (2013), (discussed further below). Evidence from democratic transitions illustrates that democracy spread widely in the later nineteenth century, with a setback in the interwar years followed by recovery after the Second World War.

[Insert Figure 1 and Table 1 about here]

At first sight the links between democracy and health indicators are not obvious although some instances can be readily identified. In Spain, following slow progress in health services during a forty-year dictatorship, a new Ministry of Health and Social Services was established in 1977 and the 1978 constitution recognised the right of all citizens to health protection (Costa-Font and Gil, 2008; Perdiguero and Comelles, 2019). In Greece the restoration of democracy in 1974 was followed with a lag by improved access to health services and the establishment of a national health service (Tragakes and Polyzos, 1998). In Austria the short-lived years of democracy in the 1920s gave rise in

Vienna to welfare and housing programmes that favoured the newly enfranchised working class (Lewis, 1983). Among earlier democratic events, the introduction of electoral reforms that included universal suffrage in Sweden in 1911 and Norway in 1913 led to a range of social insurance and welfare reforms supporting women and families (Sainsbury, 2001).

However, three points are worth noting. First, advances in health-related social welfare systems and the dissemination of medical knowledge and technology were often not directly contingent on political reform.[3] One example is the rapid diffusion of sulfa drugs in the late 1930s followed by penicillin in the 1940s, which dramatically improved health outcomes in subsequent decades (Acemoglu and Johnson, 2007; Achilladelis, 1993). Second, the advance of democracy was incremental and not always associated with radical reforms focusing on the health and welfare of the bulk of the population. Although there is overwhelming historical evidence that higher incomes and better health infrastructure, such as sanitation, clean water and access to improved medical services, had substantial effects on health (Chapman, 2019; Cutler and Miller, 2008; Kesztenbaum and Rosenthal, 2017), the influence of political reform is less clear. However, for Europe there is historical evidence that the advent of democracy increased the size of government and that the introduction of female suffrage increased welfare-related expenditure and transfers (Abrams and Settle, 1999; Aidt et al., 2006; Aidt and Dallal, 2008). Third, and as noted above, democratic reforms could filter through to improved health indirectly via channels such as the development of public infrastructure, increases income and living standards or information flows and public attitudes. So, while

[3] Examples from the US where mortality-reducing public health initiatives preceded women's suffrage include clean water in Massachusetts before 1920 (Alsan and Goldin, 2019) and measures to control TB infection in 1900-17 (Anderson et al., 2019). In contrast, in Denmark, the initiation of TB dispensaries post-dated female enfranchisement (Egedesø et al., 2020).

we might expect some association between democracy and height over the sweep of European history, its size, strength and stability is an empirical question.

3. Model and Data

3.1 The Basic Model

Our baseline specification can be expressed as follows:

$$H_{it} = \beta_1 + \beta_2 D_{it} + \boldsymbol{\beta_3'} \boldsymbol{X_{it}} + \pi_i + \tau_t + \varepsilon_{it} \quad (1)$$

Where H_{it} is average adult height in country i for individuals born between time $t-4$ and t, where t is the last year of each five-year period. The explanatory variables are aligned with the cohort birth period. D_{it} refers to different measures of democracy for country i at time t and its coefficient, β_2, measures the treatment effect. $\boldsymbol{X_{it}}$ is a vector of controls. π_i is a country fixed effect and τ_t is a time fixed effect.

The inclusion of country fixed effects allows us to control for time invariant omitted variables such as the distinct historical legacies of each country. Period-specific fixed effects on the other hand can account for non-linear trends in heights resulting from improvement in medical technologies. Our controls are variables that may influence height directly but could also be determinants of democracy as a range of studies have suggested (Bobba and Coviello, 2007; Gundlach and Paldam, 2009; Lipset, 1959; Lizzeri and Persico (2004); Moral-Benito and Bartolucci, 2012). As the presence of controls may be expected to attenuate the influence of democracy, we therefore estimate with and without these controls.

3.2 Data on Height and Controls

Our dependent variable is a five-year average of heights, measured in cm, of cohorts of men aged around 21, where heights are aligned with the years of birth. These data are from Hatton and Bray (2010) [HB10] and provide an unbalanced panel of 15

European countries for birth cohorts from 1856-60 to 1976-80. The average height is 171.5cm with a range of 20cm (Table 2). We use three main controls, which are widely used as determinants of height. These are: (i) the log of real per capita GDP (Income (log)) as a measure of living standards, (ii) the infant mortality rate (Infant Mortality) as an indicator of the disease environment, and (iii) average years of education of the parents' generation (Parental Education) as a proxy for the quality of child nurturing. As Table 2 illustrates, infant mortality averaged 7 per cent of births, ranging from less than one per cent to 31 per cent, while education of the parents' generation ranged from two to nearly eleven years. Further details can be found in Appendix I Table AI.1 and Hatton (2014) [H14].

[Insert Table 2 about here]

3.3 Measures of Democracy

We use the two main measures of democracy, which go back far enough in time. One is the Polity4 index (Marshall et al. 2014), which is a continuous variable ranging from -10 (extreme autocracy) to +10 (full democracy). The other is the index provided by Boix, Miller and Rosato (2013) [BMR13], which is a dichotomous variable. BMR13 improves on the definitions used in the other indices and it includes a minimal suffrage requirement of 50% of the male population. The most recent release (version 3, 2018) includes the criterion of female suffrage (50% or more of the adult female population allowed to vote) as an additional criterion to classify a political regime as a democracy. As Table 2 shows, over the years covered by our dependent variable, Polity4 ranges from extreme autocracy to full democracy, while the BMR index classifies 60 per cent of the observations as democratic. Although our main focus is on these, we also utilise data from the V-Dem (version 9) dataset, which provides a broader range of features linked

with democracy, in order to examine the relative strength of these different facets as classified by experts on political regimes.

To improve the precision of the index of democracy, and reduce its noise, Acemoglu et al. (2019) propose a method which considers the consistency of classifications through multiple sources and produces a customised dummy variable. We follow this approach by constructing a dummy variable (Combined BMR & Polity), which combines information on democratic status from Polity4 and BMR13. Full details of the steps in constructing the index are reported in Appendix I, AI.2. This is a conservative strategy that runs the risk of considering as non-democratic a country that could have been democratic, while strongly limiting the misclassification in the opposite direction. Defining democratic status in this way could create measurement bias due to the erroneous inclusion of democracies in the control group, which is likely to bias *downwards* the postulated positive effect of a health dividend from democratisation. As we have a panel of 5-year periods for heights, an alternative Combined BMR & Polity measure is built by looking at the years in which a country has been democratic from $t-4$ to t. If the number of years is equal to or greater than 3 (average 0.6 or greater) then the country is classified as democratic.

Finally, to evaluate whether there is a *height premium* from shifting from minimal requirements for democracy (male franchise extension) to higher standards of democratic quality (both male and female franchise extension), we employ a yet more "demanding" measure of democracy. This requires that at least half of adult women have the right to vote, using data from the most recent version (3.0) of the BMR data (2018). We also calculate an averaged version for each five-year period, (t-4, t), and a dichotomous version equal to 1 if the average is 0.6 or greater. It is worth noting that the effect of this harmonised democratic variable is robust to raising the threshold to 0.8 and 1 (online Appendix AII.2).

4. Results

4.1 Baseline Results

Our baseline estimates exploit the staggered timing of the democratic transitions for the countries in the sample, and they include dummy variables for country and year. The coefficients are displayed in Table 3 with robust standard errors in parentheses.[4] We focus on two measures of democracy, namely Combined BMR & Polity and BMR definitions, using the smallest sample available with either of these definitions. This allows us to avoid the possibility that any differences in the coefficient estimates might be due, not to different definitions, but to varying sample sizes from adding or subtracting the controls.

[Insert Table 3 about here]

Panel A reports regression results without controls (columns 1 to 4), while panel B (columns 5 to 8) shows the results with the three control variables. The coefficients in column (1) of panel A indicate that a democratic transition from 0 to 1 resulting from the Combined BMR & Polity dummy is associated with an increase in height of about 0.73cm, slightly lower than the average decadal increase in heights, yet the coefficient is significant at the 1% level. In column (2), where we use the 5-year average dummy, we find a slightly larger and significant effect of 0.79cm. Columns (3) and (4) show the results obtained from BMR (3.0) when using the more demanding definition of democracy, where both male and female suffrage is required. Including the requirement that at least half of women have the right to vote reduces the number of cases where

[4] Given the small number of countries, we have not clustered the standard errors at that level. However, as noted below, in Appendix II section A11.10 we report estimates with wild bootstrapped standard errors and find that our key coefficient remains significant at the conventional level.

countries are classified as democracies. The coefficient rises from 0.73 to 1.15 from column (1) to column (3) and the increase, though smaller, is also present when using the $(t-4, t)$ averaged dummy variables, with the transition effect increasing from 0.79cm (column 2) to 0.98cm (column 4). These results indicate a strong link between democracy and health.

Panel B of Table 3 includes the controls for per capita income, infant mortality and the education of the parents' generation. As expected, per capita income and years of parental education both exhibit a positive association with heights, but they are overshadowed by the inclusion of democracy. In contrast, the coefficient on infant mortality is negative and highly significant, implying that a reduction in infant mortality has a positive effect on height. This result underlines the importance of the disease environment as an influence on growth during early childhood, which has been the focus of previous studies (Bozzoli et al., 2009; Hatton 2011, 2014). As expected, the inclusion of these variables reduces the size of the coefficient on democracy, suggesting that some of the effect of democracy comes through its influence on the more proximate determinants of height. However, the democracy coefficient remains uniformly positive, statistically significant, and economically relevant, as predicted by our hypothesis.[5] These results further support the importance of female political empowerment for health and heights.

[5] Given that both per capita income and parental education are not significant, our estimates exhibit a downward bias through the over-specification of the model.

4.2 Models with Lags and Leads

Dynamics could be an important feature of the link between democracy and height. Lags could be important if health and height adjust only slowly to the advent of democracy as some studies have suggested (Gerring et al., 2012; Lott and Kenny, 1999). Alternatively, lags of income per capita might give rise to both transitions to democracy and increases in height, with the potential to dampen or eliminate the direct effect of democracy. Similarly, leads of income could attenuate the persistent effect of democracy. In Table 4 we investigate these dynamics using the Combined BMR & Policy democratic dummy in the presence of the three controls including current income per capita.

[Insert Table 4 about here]

Columns (1) and (2) show that while the first and second lags of democracy take positive coefficients neither is significant. The coefficient on the current value of democracy is of a similar magnitude to that in Table 3 (column 6) and it remains significant although at a somewhat reduced level. This suggests that the advent of democracy was associated with a distinct discontinuity in height which we examine further below. The other main effect is to reduce the significance of the coefficient on infant mortality. Columns (3) and (4) add one lag and one lead of per capita income, neither of which is significant, while the other coefficients, including the main democratic effect, are slightly altered. This indicates that our key result is not a spurious consequence of omitted income dynamics. The findings are similar when a second lag and lead of income is added in (columns 5 and 6) although the number of observations is now reduced.

5. Robustness Checks

5.1 Pseudo-Event Study

Our regression estimates provide strong support for a distinct discontinuity in the effect of democracy on height. Here we further explore whether such an increase in height takes place precisely at the point when a change in the binary version of democracy switches on. We study this by including in the regression a variable, 'Time', that counts the periods before and after the switch to democracy, where democratization is set at time $t = 0$ for all countries in the sample, using the original BMR binary indicator.[6] Table 5 reports the results with the three control variables included. The first four columns present the results with and without year dummies and with and without country fixed effects. In each case the coefficient on the interaction term (post-democracy) is positive and significant at the 1% level. This indicates that there is a distinct break in the trend after the advent of democracy. A distinct break can be observed even with both year effects and country fixed effects included (column 4). In each of these cases the main effect of the BMR indicator remains significantly positive with the same order of magnitude as estimated previously, while the positive post-democracy interaction term suggests a significant cumulative effect.

[Insert Table 5 about here]

Columns (5) and (6) of Table 5 report the coefficients with linearly detrended height as the dependent variable, with and without the time trend and its interaction. Column (6) gives the same coefficient on democracy as in column (4), which also includes country and year fixed effects. Visual support for this finding is provided in Figure 2,

[6] This includes cases where there has been more than one switch for a given country (Greece, Italy, Portugal, Spain). In these cases the backward and forward counts start again from each reversal.

which is simply based on the dynamics of linearly detrended heights data, averaged across the sample, and the democratization date. It shows the evolution of linearly detrended heights within a window that spans up to 30 years (three periods before and three after the transition) and it indicates a sharp acceleration after the advent of democracy. The results using deviations from quadratic and cubic trends are compared and illustrated in online Appendix AII.1. They substantially confirm the results obtained by using linearly detrended heights series.

[Insert Figure 2 about here]

5.2. Placebo Test

Given that we find that the closest association is between height and the transition to democracy at the time of a cohort's birth, and to test further the robustness of our estimates, we perform a placebo test using random assignment of the democratic dummies. This is done for periods spanning from 10 or 15 years around the time of the actual democratization. The resulting coefficients for the Combined BMR & Polity dummy and its component dummy indicators BMR and Polity are presented in Table 6. Estimates are run with bootstrapped standard errors from 1,000 repetitions. For each of the democracy measures, the results show that the placebo coefficients are insignificant and small in magnitude. Even with randomisation over the narrowest window of two periods before and after (+/- 10 years), in columns (1) to (3), the coefficients remain insignificant. This result suggests a major discontinuity at the time of the switch to democracy.

[Insert Table 6 about here]

5.3 Instrumental Variables

Two-way fixed effects will fail to control for time-varying omitted variables that may be correlated with both heights and democracy, giving rise to possible endogeneity bias in the coefficient. To allay those concerns we employ a novel instrumental variable. This is the log of the total area colonised by each European country averaged from time *t-9* to *t*. One advantage of this measure is that it varies widely between the countries in our dataset and over time, with major episodes of decolonisation occurring in the twentieth century. But it requires some justification.

We argue that the exploitation of overseas territories, where democratic rights were denied, imposed constraints on the introduction of democracy in the metropolis. This rationale is explained in greater detail in Appendix III. In brief, our argument for the validity of this instrument is: (a) that colonial rule entrenched restricted democratic rights at home, and hence that the loss of colonist status promoted democratisation and franchise extension in the metropolis; (b) that decolonisation was largely driven by social movements in the colonies, reinforced by shifts in geopolitics, world wars and global economic development; and (c) that decolonisation had no direct effects on heights in the metropolis or effects on heights which could have been mediated by omitted variables affecting both democratisation and heights.

At first sight this contradicts the literature that sees democracy as generated by societal dynamics within a country rather than by external forces. For example, democratic reforms could be a response to the threat of revolution (Acemoglu and Robinson, 2000; Aidt and Jensen, 2014), or more prosaically to growing prosperity and widening education (Lipset, 1959; Barro, 1999). Alternatively, they could be a response to worsening health conditions combined with improved health technologies requiring the expansion of public good provision (Lizzeri and Persico, 2004). In that case health outcomes and democracy could be determined simultaneously. While we aim to account

for some of these influences by including controls, they are not the only possible determinants of the onset of democracy. Our argument is that divestiture of colonies is *one* external factor influencing the timing of democratic reform.

[Insert Table 7 about here]

Table 7 presents the results of instrumental variables estimation without controls (panel A) and with controls (panel B). The coefficients on democracy are uniformly positive, highly significant, and somewhat larger than the comparable OLS estimates in Table 3. Although we find an increase in the size of the coefficients on exposure to democracy, we cannot reject that the variable is exogenous in any of the regressions according to the Hausman-Wu test. The coefficients reported in panel B are only very slightly smaller than those in panel A, providing little evidence that decolonisation influenced heights except through its effect on democracy. It is worth noting also that the first stage coefficients have significance levels that are well above the accepted minimum, supporting the relevance of the instrument. In online Appendix III we report a range of tests, including instrument independence tests and reduced-form estimates, all of which support the validity of our instrument.

5.4 Further Robustness Checks

In online Appendix II we submit our baseline model to a number of further tests. These include using versions of the democracy variable derived from alternative constructions, and with different thresholds of the Polity4 scores (section AII.2). Using an alternative different dataset, we test different suffrage thresholds (AII.3). We also explore adding a dummy for the introduction of the secret ballot in national elections, which turns out to be negative while the main democracy variable retains its significance

(AII.4). To further test our baseline results in Table 3 we conduct a falsification test and evaluate the effect of reversals in democratic status (AII.5); we examine the consistency of our results by adding linear and quadratic trends as controls (AII.6); and by adding separate dummies for war periods (AII.7), all of which support our specification. We also experiment with a democratic dummy that captures the period of childhood beyond the first few years, which gives coefficients comparable in magnitude to those in Table 3 (AII.8). In addition, we show that dropping observations country-by-country and period-by-period has only modest effects on the democracy coefficient and thus the results are not dependent on influential outlier observations (AII.9). And to allay concerns about within-country error dependency in presence of a small number of clusters (Cameron et al. 2008, 2011), we show that our results of Table 3 are robust to the use of wild-clustered and bootstrapped standard errors (AII.10).

6. Mechanisms

To further test the credibility of the estimated link between democracy heights, we explore two main channels through which the advent of democracy improved health and stature. These are the expansion of government-provided health and social services and the reduction of inequality. The most obvious expansion of health services came through the introduction of universal health coverage, mainly government-financed, as noted above for Greece and Spain. This is represented by a dummy variable taking the value 1 from its introduction. Alternatively, we use a wider measure, central government expenditure on social services as a percentage of GDP, which increases more gradually over time and covers a wider range of health-related public provisions. As noted above, reduction in inequality is one possible channel through which democracy could influence health outcomes. This is represented by two alternative measures, the Gini coefficient of

income and the share of the top 20 per cent of income recipients. The sources and construction of these variables are detailed in Hatton (2014).

As a standard methodology, and following Acemoglu et al. (2019), we employ a two-step estimation procedure using the following structure:

$$mech_{it}^{k} = \rho_0 + \rho_1 Demo_{it}^{j} + (\boldsymbol{\rho_2 X'\gamma}) + \pi_i + \tau_t + \varepsilon_{it} \quad (2)$$

$$hei_{it} = \iota_0 + \iota_1 \widehat{mech}_{it}^{k\ OLS} + (\boldsymbol{\iota_2 X'\gamma}) + \alpha_i + \kappa_t + \mu_{it} \quad (3)$$

where the dependent variable, $mech_{it}^{k}$, is the mechanism variable as measured in the panel for country i at period t. k is a specific indicator, depending on which of the mechanisms is used in the regression, and j indicates which of the four possible treatment (democracy) variables is used. We first regress the mechanism on the $Demo_{it}^{j}$ variable (Equation 2), both with and without the three control variables ($\boldsymbol{\rho_2 X'\gamma}$) and including the two-way fixed effects. Then, in Equation 3, we take the estimated mechanism, $\widehat{mech}_{it}^{k\ OLS}$, and with robust and bootstrapped standard errors, we estimate the effect of the part of the mechanism explained by the democratic treatment on heights.

[Insert Table 8 about here]

The results of using this procedure are reported in Table 8 for two measures of democracy, the Combined BMR & Polity and the BMR female & male suffrage dummies, and with the three control variables included. In the lower panel the association between universal health coverage and democracy is significantly positive when female suffrage is included in the definition of democracy but not otherwise (columns 1 and 2). This suggests that female enfranchisement was important for the development of health services, as has often been noted. In contrast, the link between expenditure on social services and democracy (columns 3 and 4) is only marginally significant for the narrower

definition of democracy, perhaps because it does not capture local government expenditure. The GINI coefficient of inequality is strongly and negatively associated with democracy. The link with the share of the top 20 per cent is weaker, suggesting the greater importance of redistribution further down the income distribution.

The second stage coefficients in the upper panel of Table 8 all give strongly significant coefficients. As would be expected the coefficients for universal health coverage and expenditure on social services are positive while those on the two measures of inequality are both negative. Unsurprisingly, these indicate that height is strongly influenced both by health-related government provision and by inequality. We should note, however, that these mechanism variables are correlated, as each depends to some degree on democracy. As a result, the effect of democracy working through these different channels will sum to more than their reduced form effect in Table 3. As shown in online Appendix II (AII.10) very similar results are obtained in the absence of the three control variables.

7. Heterogeneity

The effects of democracy on health may be heterogeneous across different locations, times, and specific events. In that case our results would lack generality. In this section we explore heterogeneity in three different dimensions: across countries, over time, and between different aspects of democracy.

7.1 Spatial Heterogeneity

Democratisation may have stronger or weaker effects on height in different countries. Differential effects could be associated with degrees of political centralisation, pre-existing power relations, and the ability of elites to resist the social consequences of democratic rule. One recent study finds that the effects of democracy on child mortality

vary between countries and across continents (Ramos et al., 2020). To examine such differences on a smaller geographic scale, we divide our 15 countries into three regional groups North, Centre and South, for which trends in average height were somewhat different, as illustrated in Figure 1. We interact a dummy for one of the three regions with one of two measures of democracy. Table 9 presents results without and with controls. The two measures of democracy correspond with those in columns (2) and (4) of the baseline estimates in Table 3 although the number of observations differs. The coefficients on the interaction terms vary in sign but are generally insignificant. The only exception is a marginally significant negative coefficient in column (11) for the interaction with southern Europe when using the Combined BMR & Polity democratic dummy. In every case the main effect remains significant with magnitudes comparable with those in Table 3. We conclude that the results are not driven by one European region, and they support the positive effect of democracy on height in each of the three regional groups.

[Insert Table 9 about here]

7.2 Period Heterogeneity

The link between democracy and health could have varied across broad historical eras both because health technology advanced and because democracy itself evolved. In his widely cited analysis, Huntington (1991, 1993) identified three waves of democratisation, each with different characteristics. Figure 3 plots average values for our countries using the BMR index. Also shown in the figure is the mean of the electoral democracy (polyarchy) index scaled from zero to one from the V-Dem database discussed further below. Although the range differs between these two measures there is a strong correspondence between period-to-period movements. This illustrates that our data

covers the first two waves identified by Huntington: the first up to the 1920s and the second in the 1940s and 1950s, with some reversal in between, and the beginning of the third wave.

We use the BMR index, as illustrated in Table 1, to identify the periods corresponding to each of these waves, and we create a dummy variable for the years in each wave.[7] We then construct interactions between the first and second wave dummies and three dichotomous indexes of democracy, first demeaning both variables (as suggested by Balli and Sørensen, 2013) in order to preserve the main effect in the regression.

[Insert Table 10 about here]

The results of this analysis are presented in Table 10, with and without the three controls. The Combined BMR & Polity measure of democracy is used in columns (1) and (2) and can be compared with the results reported in columns (2) and (6) of Table 3. Its components, the BMR and Polity indexes, are used separately in columns (3) and (4) and in columns (5) and (6) respectively. The interaction terms are insignificant for all three measures of democracy, suggesting that neither the first nor the second wave involved significant deviations from the main democratic effect. While the coefficient on the main effect remains positive, it becomes less significant for the separate component measures of democracy, notably the BMR index.

Although the two waves of democracy do not produce significantly different impacts on heights, they involved advances along different democratic dimensions with different social consequences. The first wave involved broader participation and deeper

[7] We use the BMR index because it matches the methodology used by Huntington (1991, 1993) to classify waves (both use the Dahl (1971) classification as operationalised in BMR13). But the Huntington method of classification is quite sensitive to the definition of democracy and so the precise timing of these waves is disputed. For example, Doorenspleet (2000) produced a revised version dating the first wave from 1893 to 1924 and the second wave from 1944 to 1957.

engagement of civil society in the polity, with a focus on alleviating extreme poverty and combating infectious diseases. The second stage involved greater responsiveness of the government to higher-level needs of its citizens leading to the development of the welfare state and especially the expansion of health coverage. The third wave of democratisation was particularly concentrated among countries that were predominantly Catholic and where the church emphasised the rights of the poorer segments of society (Huntington, 1991, pp. 72-85; Anderson and Jensen, 2019). While this may have accentuated the effects of democratisation on well-being in the third wave, our results suggest that democracy also had strong effects in the first and second waves. To explore this issue further we turn to more nuanced versions of democracy.

7.3 Event-Type Heterogeneity

We explore the distinct characteristics that emerge in different phases of democratic development using the high-level democratic dimensions of the V-Dem index (Version 9), which is explained in more detail in online Appendix AII.11. The five main components are (1) Electoral: free and fair elections, (2) Liberal: constraints on the exercise of executive power, (3) Participatory: engagement of civil society beyond the full franchise, (4) Deliberative: decisions based on reasoned dialogue, and (5) Egalitarian: equal treatment across social groups. Each of these components is an index scaled from zero (complete absence) to one (full extent). The electoral, liberal and participatory indices are closest to the ingredients of our other measures of democracy.

[Insert Table 11 about here]

In Table 11 we use each of these alternative features in turn as the democracy variable without controls (panel A) and with controls (panel B). In order to account for

the changing importance of these features over time (and across waves), we also include interactions with a dummy variable for post-1945, so that if one becomes more (less) important the interaction coefficients would be significantly positive (negative). The coefficients are generally larger than those for other measures of democracy, as each V-Dem variable is continuous between zero and one rather than a dummy, zero or one, so the range is typically smaller. But none of the post-war interactions is remotely significant, which supports the idea that, while these democratic components advanced at different times, their impact was similar before and after 1945.

Focusing on the main effects in the odd-numbered columns, the electoral, liberal, and participatory features of democracy all give positive and significant coefficients. Consistent with our earlier findings on the inclusion of suffrage, the participatory dimension of democracy delivers the largest coefficients. The coefficients on the deliberative aspect of democracy are weaker, especially in the presence of the interaction. And all the coefficients on the egalitarian element of democracy fail to achieve significance, which is surprising considering the result on inequality as a mechanism in Table 8. But the lower precision for deliberative and egalitarian aspects of democracy may be due to the restricted number of observations for the earlier decades. We conclude that different features of democracy each contributed something to improving childhood health, although the effects of the deliberative and egalitarian dimensions are not clear-cut.

Conclusion

Relying on unique historical data on human stature in Western Europe over more than a century, we study the effect of democratization on human stature. Height reflects physical well-being during childhood of those who survived, which is not captured by declining child mortality rates, and is difficult to locate with accuracy when life

expectancy is considered. Our estimates strongly support a link between democratic progress and improving average well-being as captured by heights. We find that the transition from autocracy to democracy increases the average adult height by about 0.7cm, which is 6.4% of the difference in height between birth cohorts of the early 1870s and the late 1970s. Our interpretation is that transitions of political institutions towards liberal democracy have enhanced, and in some cases created, the conditions that lie behind physical well-being during childhood, the benefits of which extend through adult life.

Accounting for female voting rights increases the effect on height to about 1cm or 9% of the total increase over the century. This supports the argument that the inclusion into formal participation of political and collective decision making of wider segments of the population, especially females, is a key underlying feature. It strengthened political agency and created the prerequisites reforms that helped to realise the popular desire for improved health and well-being leading to increased health and height.

Our results survive placebo tests as well as robustness checks, such as different specifications, the inclusion of controls, and several other tests. Examining the channels of influence, we find that democratic institutions reduced inequality and tended to prioritise reforms that improve health and well-being such as the expansion of health care coverage. Although democracy advanced through different stages at different times in different countries, we find a remarkably consistent effect on health and height throughout the 1860-1980 period.

The results presented here are limited by the available data. We are unable to provide estimates of the effect of democracy on female heights. But over a period of more than a hundred years, and in the absence of strong bias towards male children found in some Asian countries, the trends are likely to have been similar. And while we have not examined the effects of improved health due to democracy on subsequent growth in

income, education and living standards, it seems likely that this is one among a range of factors that contributed to long-run economic growth.

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Tables and Figures

Table 1. Development of Democratic Status (5-year benchmarks) - BMR

iso3c	AUT	BEL	DEU	DNK	ESP	FIN	FRA	GBR	GRC	IRL	ITA	NLD	NOR	PRT	SWE
1860	0	0	0	0	0		0	0	0		0	0		0	0
1865	0	0	0	0	0		0	0	1		0	0		0	0
1870	0	0	0	0	0		1	0	1		0	0		0	0
1875	0	0	0	0	0		1	0	1		0	0		0	0
1880	0	0	0	0	0		1	0	1		0	0		0	0
1885	0	0	0	0	0		1	1	1		0	0		0	0
1890	0	0	0	0	0		1	1	1		0	0		0	0
1895	0	1	0	0	0		1	1	1		0	0		0	0
1900	0	1	0	0	0		1	1	1		0	1		0	0
1905	0	1	0	1	0		1	1	1		0	1	1	0	0
1910	0	1	0	1	0		1	1	1		0	1	1	0	0
1915	0	1	0	1	0		1	1	0		0	1	1	1	1
1920	1	1	1	1	0		1	1	0		1	1	1	1	1
1925	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1
1930	1	1	1	1	0		1	1	1	1	0	1	1	0	1
1935	0	1	0	1	1	1	1	1	1	1	0	1	1	0	1
1940	0	1	0	1	0	1	0	1	0	1	0	1		0	1
1945	0	1	0	1	0	1	0	1	1	1	0	1		0	1
1950	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
1955	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
1960	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
1965	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
1970	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1
1975	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1
1980	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note: Distribution of the BMR democratic dummy across the 15 countries in the sample. For more information on how this index is obtained, please see Table AI.1, section AI.2, and Boix, C., Miller, M. and Rosato, S. (2013).

Table 2. Descriptive Statistics

Variables	N	Mean	SD	Min	Max
Height	308	171.57	4.77	162.21	182.7
Income per capita (log)	300	8.22	0.64	7.07	9.61
Infant Mortality	307	9.96	6.92	0.76	30.9
Parental Education	298	6.57	1.89	2.07	10.76
Combined BMR & Polity democratic dummy (t)	272	0.59	0.49	0	1
Combined BMR & Polity democratic dummy, average (t-4, t)	256	0.57	0.5	0	1
BMR democratic dummy female & male suffrage (t)	301	0.41	0.49	0	1
BMR democratic dummy female & male suffrage. (t-4, t)	301	0.4	0.49	0	1
Polity	279	3.77	6.77	-9.4	10
Polity Dummy	279	0.66	0.47	0	1
BMR	294	0.60	0.49	0	1
BMR (t-4, t)	293	0.57	0.5	0	1

Notes: Descriptive statistics. For variable definitions, see Table AI.1.

Table 3. Baseline Regressions: 2WFE Estimates of Heights Exposure to Democracy

In all regressions the dependent variable is adult male height in cm: (t-4, t) average				
Democratic dummy used for treatment)	Combined BMR & Polity democratic dummy		BMR democratic dummy female & male suffrage	
	At time t	*Average (t-4, t)*	*At time t*	*Average (t-4, t)*
Panel A	(1)	(2)	(3)	(4)
Exposure to	0.726***	0.794***	1.151***	0.984***
Democracy	(0.222)	(0.225)	(0.264)	(0.263)
Observations	256	256	256	256
R-squared	0.974	0.975	0.976	0.975
Country dummies	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓
Controls	×	×	×	×
Panel B	(5)	(6)	(7)	(8)
Exposure to	0.623***	0.698***	0.936***	0.788***
Democracy	(0.207)	(0.213)	(0.260)	(0.257)
Income (log)	0.448	0.420	0.396	0.353
	(0.465)	(0.473)	(0.448)	(0.465)
Infant Mortality	-0.091***	-0.092***	-0.092***	-0.094***
	(0.028)	(0.028)	(0.028)	(0.028)
Parental Education	0.135	0.129	0.067	0.084
	-0.094	(0.093)	(0.096)	(0.096)
Observations	247	247	247	247
R-squared	0.976	0.976	0.977	0.976
Country dummies	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓
Controls	✓	✓	✓	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. Democratic dummies are generated by combining the information from Polity4 and BMR13 (Combined BMR & Polity) and by using the BMR13 democracy indicator including requiring both male and female suffrage (BMR democratic dummy female & male suffrage). For more details on the construction of these variables, see Appendix I AI.2. In panel B we include controls, all drawn from H14; see Appendix I, Table AI.1 for details on definitions and original sources. We report, respectively, (a) the estimated coefficient, (b) the robust standard errors in parentheses below (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). All regressions contain both country and year dummies.

Table 4. Baseline Extended with Lags of Democratic Dummy, Lags and Leads of Income per capita

The dependent variable is adult male height in cm: (t-4, t) average						
	(1)	(2)	(3)	(4)	(5)	(6)
Combined BMR & Polity	0.727**	0.620**	0.675**	0.572**	0.907***	0.559**
Dummy	(0.278)	(0.271)	(0.297)	(0.231)	(0.249)	(0.197)
Combined BMR & Polity D,	0.236	0.011	0.237	0.089	-0.038	0.128
First lag	(0.219)	(0.413)	(0.309)	(0.383)	(0.324)	(0.409)
Combined BMR & Polity D.		0.510		0.472		0.395
Second lag		(0.325)		(0.325)		(0.463)
Income per capita (log)					-0.147	0.114
Second lead					(0.972)	(1.181)
Income per capita (log)			0.870	1.250	1.185	1.274
First lead			(1.104)	(1.059)	(1.125)	(1.066)
Income per capita	0.124	0.102	-0.359	-0.373	-0.445	-0.362
	(1.019)	(1.055)	(1.424)	(1.020)	(1.427)	(1.154)
Income per capita (log)			-0.280	-0.697	0.308	-1.120
First lag			(0.951)	(0.851)	(0.825)	(1.316)
Income per capita (log)					-0.370	0.497
Second lag					(0.392)	(1.177)
Infant Mortality	-0.099*	-0.115	-0.086*	-0.100	-0.088*	-0.110**
	(0.055)	(0.070)	(0.044)	(0.061)	(0.046)	(0.045)
Parental Education	0.076	0.036	0.135	0.096	0.157	0.119
	(0.204)	(0.207)	(0.199)	(0.204)	(0.193)	(0.184)
Observations	222	192	209	180	185	167
R-squared	0.978	0.979	0.978	0.980	0.979	0.979
Linear comb. Democracy Combined Dummy	0.963	1.142	0.912	1.133	0.869	1.082
p-value	*0.025*	*0.015*	*0.035*	*0.017*	*0.065*	*0.025*
Country dummies	✓	✓	✓	✓	✓	✓
Year Dummies	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. The democratic dummy combines information from Polity4 and BMR13 (Combined BMR & Polity). For more details on the construction of these variables, see Appendix I AI.2. Income and other controls are taken from H14; see Appendix I, Table AI.1 for details on definitions and original sources. We report, respectively, (a) the estimated coefficient, (b) the robust standard errors in parentheses below (*** p<0.01, ** p<0.05, * p<0.1). All regressions contain both country and year dummies.

Table 5. Quasi-Event Study: Trends Before and After Democratisation

In all regressions the dependent variable is adult male height in cm: (t-4, t) average						
	Original heights measure				Linearly detrended heights	
	(1)	(2)	(3)	(4)	(5)	(6)
Democracy	1.056***	0.466**	1.002***	0.464**	0.485***	0.464**
(BMR Dummy)	(0.334)	(0.234)	(0.323)	(0.221)	(0.185)	(0.221)
Time	-0.329***	-0.133***	-0.420***	-0.0716*		-0.0716*
	(0.0484)	(0.0338)	(0.0538)	(0.0400)		(0.0400)
Interaction: Time ×	0.373***	0.213***	0.471***	0.119***		0.119***
BMR Dummy	(0.0481)	(0.0314)	(0.0548)	(0.0405)		(0.0405)
Income (log)	2.459***	2.471***	3.672***	1.224**	0.878*	1.224**
	(0.340)	(0.261)	(0.386)	(0.484)	(0.470)	(0.484)
Parental Education	0.744***	0.237**	0.647***	0.182**	0.192**	0.182**
	(0.0974)	(0.0996)	(0.110)	(0.0908)	(0.0906)	(0.0908)
Infant Mortality	-0.329***	-0.344***	-0.420***	-0.177***	-0.105***	-0.177***
	(0.0284)	(0.0239)	(0.0495)	(0.0344)	(0.0271)	(0.0344)
Observations	284	284	284	284	284	284
R-squared	0.876	0.964	0.891	0.973	0.948	0.950
Country FE	×	✓	×	✓	✓	✓
Year FE	×	×	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. The democratic dummy is from BMR13. Controls are from H14; see Appendix I, Table AI.1 for details on definitions and original sources. The Time variable is a "counter" variable defined as the number of years before (negative) and after (positive) the switch to democracy, which takes into account jumps in timing deriving from having an unbalanced panel. If there is a reversal, then the count begins again from the next switch to democracy. We report(a) the estimated coefficients, and (b) the robust bootstrapped errors in parentheses below (*** p<0.01, ** p<0.05, * p<0.1).

Table 6. Placebo Tests, with Random Assignment of Treatment Around Actual Democratisation

In all regressions the dependent variable is adult male height in cm: (t-4, t) average						
Window around actual treatment *in years*	Window 1 (narrow) (years: -10, -5; +5, +10)			Window 2 (wide) (years: -15, -10, -5; +5; +10; +15)		
Democracy measure used for placebo treatment	Combined BMR & Polity *(t-4, t)*	BMR Dummy	Polity Dummy	Combined BMR & Polity *(t-4, t)*	BMR Dummy	Polity Dummy
	(1)	(2)	(3)	(4)	(5)	(6)
Democracy (Placebo assigned)	0.192	0.226	0.020	-0.098	-0.032	-0.252
	(0.912)	(1.209)	(0.098)	(-0.442)	(-0.155)	(-1.211)
Observations	249	282	258	249	281	259
R-squared	0.974	0.971	0.974	0.972	0.971	0.972
Country dummies	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. The democratic dummy is generated by combining the information from Polity4 and BMR13 (Combined BMR & Polity), or alternatively, separately from BMR13 and Polity4. For more details on the construction of these variables, see Appendix I, Table AI.2. Controls are from H14; see Appendix I, Table AI.1. The placebo test is based on the random assignment of years around the time of democratisation as noted in each heading. We report (a) the estimated coefficient, (b) the robust bootstrapped errors based on 1,000 replications in parentheses below (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). All regressions contain both country and year dummies.

Table 7. Instrumental Variable Estimates

In all regressions the dependent variable is adult male height in cm: (t-4, t) average				
Measure of Democracy used for treatment	Combined BMR & Polity democratic dummy		BMR democratic dummy female & male suffrage	
	At time t	*Average (t-4, t)*	*At time t*	*Average (t-4, t)*
Panel A	(1)	(2)	(3)	(4)
Exposure to Democracy	1.035***	1.102***	1.649***	1.688***
	(0.337)	(0.355)	(0.552)	(0.567)
Observations	255	255	255	255
R-squared	0.974	0.974	0.975	0.974
Year dummies	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Controls	×	×	×	×
Min. Eig.	63.34	55.20	28.96	26.18
F-stat	72.25	65.69	31.75	29.25
1st stage coef.	-0.044***	-0.041***	-0.028***	-0.027***
	(0.005)	(0.005)	(0.005)	(0.005)
Durbin p-val	0.368	0.404	0.383	0.239
Hausman-Wu p-val	0.410	0.445	0.425	0.281
Panel B	(5)	(6)	(7)	(8)
Exposure to Democracy	0.967***	1.035***	1.577***	1.640***
	(0.355)	(0.378)	(0.583)	(0.611)
Income (log)	0.381	0.348	0.278	0.119
	(0.440)	(0.459)	(0.426)	(0.485)
Infant Mortality	-0.087***	-0.089***	-0.087***	-0.090***
	(0.027)	(0.026)	(0.026)	(0.026)
Parental Education	0.137	0.129	0.024	0.033
	(0.087)	(0.085)	(0.097)	(0.096)
Observations	247	247	247	247
R-squared	0.976	0.976	0.976	0.975
Year dummies	✓	✓	✓	✓
Country dummies	✓	✓	✓	✓
Min Eigenvalue	58.49	50.32	26.75	23.29
F-stat	65.30	57.65	28.62	25.62
1st stage IV coef.	-0.043***	-0.041***	-0.027***	-0.026***
	(0.005)	(0.005)	(0.005)	(0.005)
Durbin p-value	0.314	0.362	0.273	0.169
Hausman-Wu p-value	0.360	0.408	0.319	0.211

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. Democratic dummies are generated by combining the information from Polity4 and BMR13 (Combined BMR & Polity democratic dummy t and (t-4, t)) and by using the BMR13 democracy indicator including stricter conditions for democracy classification requiring both male and female suffrage (BMR democratic dummy female & male suffrage, t and (t-4, t)). For more details on the construction of these variables, see Appendix I, AI.2. Controls are from H14, see Appendix I Table AI.1. The instrument (IV) is the log of the moving average (t-9, t) of the total area colonised by country *i* in year *t* (Colonial Area), and originally expressed in km^2. Colonial relationships in dyadic form are taken from WM06. In all regressions we report the 1st stage F-statistic, the minimum eigenvalue, and the 1st stage coefficient. For full 1st stage results, see online Appendix III Table AIII.3. We report (a) the estimated coefficient, (b) the robust standard errors in parentheses below (*** p<0.01, ** p<0.05, * p<0.1). All regressions contain both country and year dummies. The H_0 for Durbin and Hausman-Wu tests is that the variable is exogenous. The p-values do not reject H_0.

Table 8 Estimation of Mechanisms on Height using a Two-step Procedure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2nd step							
2nd Stage	Introduction of Universal Coverage (dummy)		Central government expenditure on social services (%GDP)		Gini coefficient		Income share of top 20 per cent	
Coef.	9.854***	2.449***	0.852***	1.939***	-0.431***	-0.695***	-0.867***	-1.587***
	(3.261)	(0.762)	(0.306)	(0.632)	(0.150)	(0.216)	(0.297)	(0.507)
R-squared	0.976	0.972	0.978	0.975	0.976	0.972	0.976	0.972
	1st step							
1st Stage	Combined BMR & Polity dummy Effect on Universal Coverage		Combined BMR & Polity dummy Effect on Central government expenditure on social services (%GDP)		Combined BMR & Polity dummy Effect on Gini Index		Combined BMR & Polity dummy Effect on Income share of top 20 per cent	
	Male Suffrage	*Female & Male Suffrage*	*Male Suffrage*	*Female & Male Suffrage*	*Male Suffrage*	*Female & Male Suffrage*	*Male Suffrage*	*Female & Male suffrage*
Coef.	0.071	0.300***	0.769*	0.344	-1.620***	-1.056***	-0.806**	-0.462*
	(0.059)	(0.069)	(0.441)	(0.470)	(0.359)	(0.321)	(0.322)	(0.246)
R-squared	0.723	0.704	0.879	0.861	0.968	0.966	0.935	0.937
Observations	247	291	243	286	247	291	247	291
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. Treatment variables are democratic dummies generated by combining the information from Polity4 and BMR13 (Combined BMR -Polity) and by using the BMR13 democracy indicator requiring both male and female thresholds for suffrage (BMR female & male suffrage). For more details on the construction of these variables, see Appendix I, Table AI.2. Controls (Parental Education, Income per capita (log), and Infant Mortality) are from H14; see Appendix I Table AI.1. Mechanism variables taken from H14: Universal Coverage is a dummy for universal health coverage; the central government expenditure on social services (%GDP); the Gini income inequality index; the income share of the top 20 per cent. Robust standard errors are reported in parentheses below the coefficients; *** p<0.01, ** p<0.05, * p<0.1. Standard errors in the second stages are bootstrapped with 1,000 repetitions. All regressions contain country and year dummies.

Table 9. Testing for Heterogeneous Effects of Democracy by European Region

In all regressions the dependent variable is adult male height in cm: (t-4, t) average												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Democracy measure	Combined BMR & Polity democratic dummies. (t-4, t)						BMR female & male suffrage. (t-4, t)					
Exposure to	0.993***	0.930***	0.639***	0.649**	0.814***	0.564**	0.873***	0.787***	0.888***	0.821***	0.936***	0.589**
Democracy	(0.243)	(0.222)	(0.244)	(0.257)	(0.249)	(0.232)	(0.220)	(0.209)	(0.248)	(0.274)	(0.270)	(0.252)
Demo × Southern	-0.554	-0.640*					0.105	-0.231				
Europe	(0.348)	(0.338)					(0.373)	(0.350)				
Demo × Central			0.409	0.129					0.030	-0.201		
Europe			(0.264)	(0.325)					(0.240)	(0.300)		
Demo × Northern					-0.075	0.529					-0.096	0.435
Europe					(0.268)	(0.326)					(0.255)	(0.327)
Observations	256	247	256	247	256	247	301	291	301	291	301	291
R-squared	0.975	0.977	0.975	0.976	0.975	0.977	0.969	0.972	0.969	0.972	0.969	0.972
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	×	✓	×	✓	×	✓	×	✓	×	✓	×	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. Here we use Combined BMR & Polity democratic dummies, and BMR female & male suffrage democratic index to be compared with columns 2 and 4 of Table 3. The grouping in regions follows the graphical breakdown used in Figure 1 showing the trends by European region defined as: Northern (Finland, Denmark, Norway, Great Britain, Ireland, and Sweden), Central (Austria, Belgium, Germany, France, and the Netherlands), and Southern (Greece, Spain, Italy, and Portugal). Controls (Parental Education, Income per capita (log), and Infant Mortality) are from H14; see Appendix I Table AI.1. We report (a) the estimated coefficient, (b) the robust standard errors in parentheses below (*** p<0.01, ** p<0.05, * p<0.1). All regressions contain both country and year dummies.

Table 10. Testing Interactions of Democracy with 'Huntington Waves'

In all regressions the dependent variable is adult male height in cm: (t-4, t) average						
	(1)	(2)	(3)	(4)	(5)	(6)
Democracy is:	Combined BMR & Polity democratic dummies		BMR Dummy		Polity Dummy	
Exposure to Democracy	0.819***	0.699**	0.467*	0.442*	0.632**	0.563**
	(0.304)	(0.287)	(0.273)	(0.248)	(0.278)	(0.258)
Democracy × Hunt. Wave1	-0.0167	0.161	0.0722	0.147	-0.124	-0.0891
(both variables within demeaned)	(0.582)	(0.550)	(0.512)	(0.469)	(0.576)	(0.532)
Democracy × Hunt. Wave2	-0.131	-0.196	0.557	0.341	0.183	0.0729
(both variables within demeaned)	(0.585)	(0.557)	(0.581)	(0.533)	(0.580)	(0.558)
Observations	256	247	293	283	264	255
R-squared	0.975	0.976	0.968	0.971	0.974	0.976
Country FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Controls	×	✓	×	✓	×	✓
Joint Estimate: *Demo + Demo x Wave 1*	0.803	0.860	0.539	0.589	0.509	0.474
St. Error: *Huntington Wave 1*	0.430	0.411	0.381	0.361	0.402	0.406
t -statistic: *Huntington Wave 1*	1.867	2.095	1.413	1.630	1.266	1.167
Joint Estimate: *Demo + Demo x Wave 2*	0.688	0.504	1.023	0.783	0.815	0.636
St. Error: *Huntington Wave 2*	0.522	0.490	0.500	0.463	0.502	0.492
t -statistic: *Huntington Wave 2*	1.318	1.027	2.046	1.692	1.622	1.292

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. Treatment variables are the democratic dummy generated by combining the information from Polity4 and BMR13 (Combined BMR & Polity) and the dummies separately from BMR13 and Polity4. For more details on the construction of these variables, see Appendix I, AI.2. Controls (Parental Education, Income per capita (log), and Infant Mortality) are from H14; see Appendix I Table AI.1. The placebo test is based on the random assignment of years around the time of democratisation as noted in each heading. We report (a) the estimated coefficient, (b) the robust bootstrapped errors based on 999 replications in parentheses below (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). All regressions contain both country and year dummies.

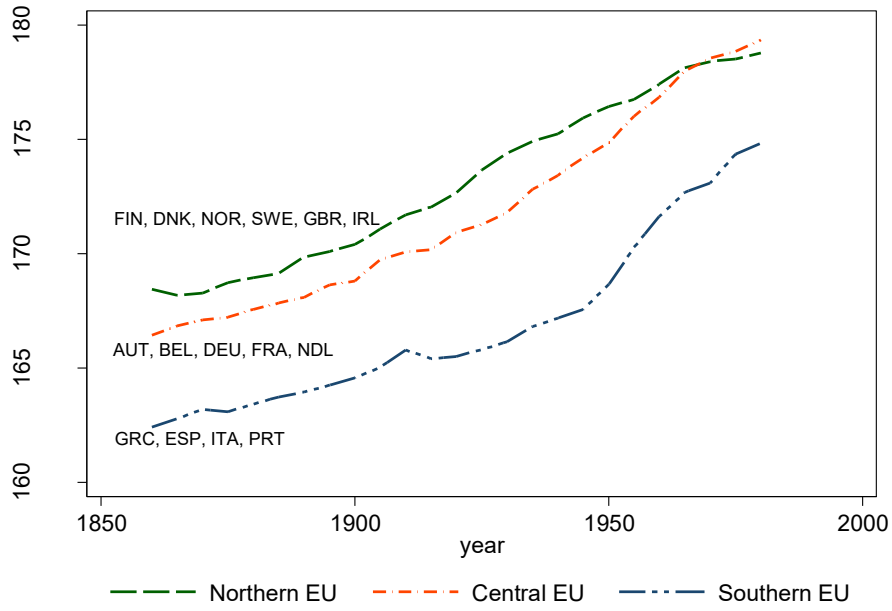
Table 11. Results using V-Dem Components and Interactions with Post-WWII Dummy

In all regressions the dependent variable is adult male height in cm: (t-4, t) average										
High-Level Democratic index from V-Dem	Electoral		Liberal		Participatory		Deliberative		Egalitarian	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposure to V-Dem dimension	1.583***	1.740***	1.765***	1.885***	2.192***	2.518***	1.500**	1.434*	1.217	1.031
	(0.544)	(0.565)	(0.608)	(0.639)	(0.765)	(0.812)	(0.737)	(0.777)	(0.832)	(0.908)
V-Dem. × Post 1945 dummy		0.666		0.440		1.375		-0.229		-0.626
		(0.931)		(1.019)		(1.327)		(1.437)		(1.731)
Observations	249	249	247	247	249	249	181	181	181	181
R-squared	0.974	0.974	0.974	0.974	0.974	0.975	0.972	0.972	0.972	0.972
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	×	×	×	×	×	×	×	×	×	×
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Exposure to V-Dem dimension	1.377**	1.470***	1.613**	1.623**	2.098**	2.199***	1.565**	1.278	1.254	0.781
	(0.577)	(0.560)	(0.622)	(0.625)	(0.813)	(0.827)	(0.739)	(0.798)	(0.854)	(0.972)
V-Dem × Post 1945 dummy		0.436		0.039		0.469		-1.083		-1.697
		(0.922)		(0.989)		(1.311)		(1.504)		(1.824)
Observations	240	240	238	238	240	240	180	180	180	180
R-squared	0.976	0.976	0.975	0.975	0.976	0.976	0.974	0.974	0.973	0.974
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is a five-year average of adult male height in cm aligned with birth years for 15 European countries from HB10. The measures of democracy are the five high-level indexes from the V-Dem dataset. For definitions and descriptive statistics of the indexes, see Appendix I Table AI.1, and for further detail, online Appendix II AII.12. Controls (Parental Education, Income per capita (log), and Infant Mortality) are from H14; see Appendix I Table AI.1. We report (a) the estimated coefficients, and (b) the robust standard errors in parentheses below (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). All regressions contain both country and year dummies.

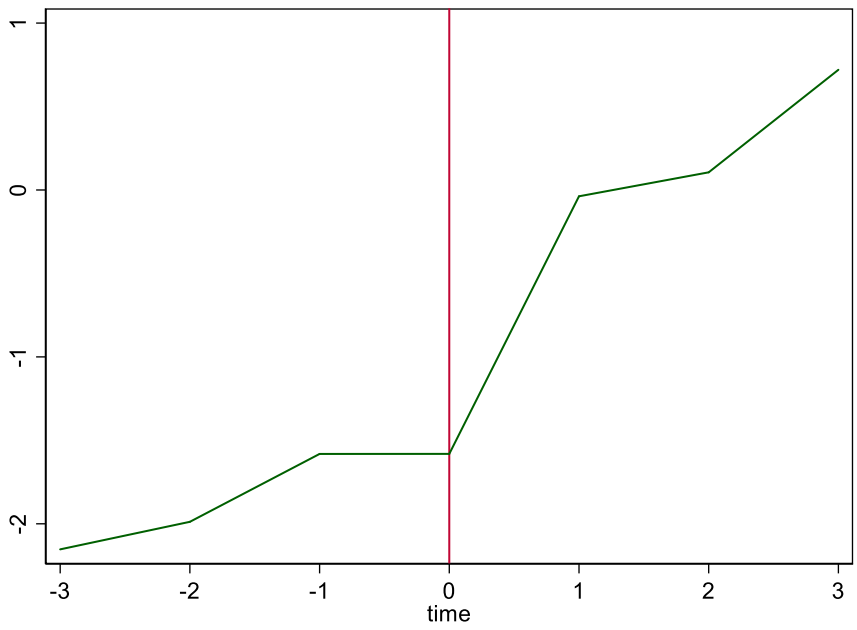
Figures

Figure 1. Heights Trends by European Regions (South, Centre, and North)



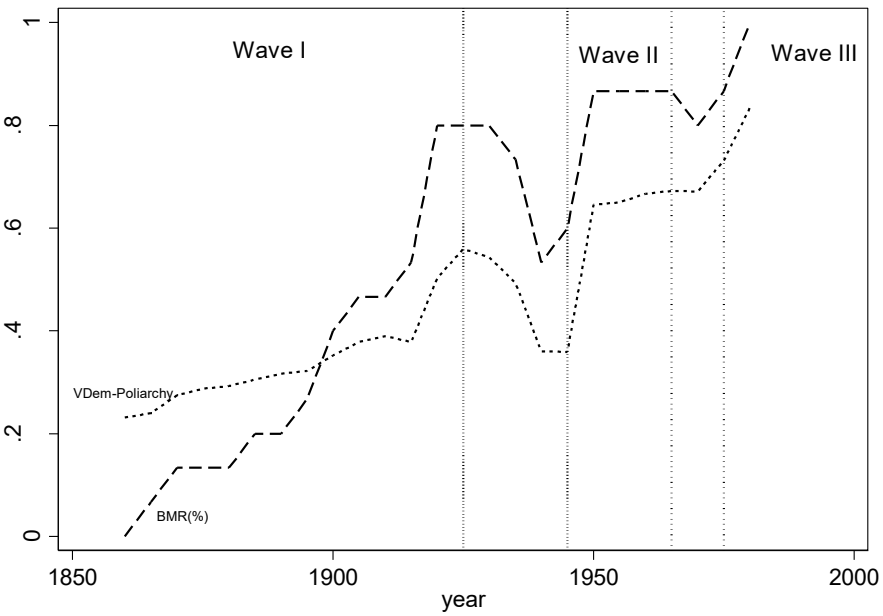
Notes: Average heights in cm, 1856-60 to1976-80, for three European regions: Northern (Finland, Denmark, Norway, Great Britain, Ireland, and Sweden), Central (Austria, Belgium, Germany, France, and the Netherlands), and Southern (Greece, Spain, Italy, and Portugal) Europe. Data source is [HB10].

Figure 2. Change in Heights over a 30-year Window before/after Democratization Events



Sources: Authors' calculations of a progression in linearly detrended heights over a -15/+15-year period around democratization at time = 0; see text.
Notes: (i) The values on the Y-axis are sample-averaged height differences, expressed in cm, from a linear trend in heights. (ii) The timing on the x-axis represents 5-year changes before/after the democratization event happened.

Figure 3: Waves of Democracy in Europe



Sources: For the BMR index see Appendix I, Table AI.1; for the V-Dem Polyarchy Index see Appendix II, AII.12. As the BMR index is a 0-1 dummy, the value on the y-axis is the proportion of countries (out of the 15 in the sample) which are classified as democracies in each year. The V-Dem polyarchy aggregate index of democracy is a continuous index in the (0,1) support. The value on the y-axis is the average across the fifteen countries in our sample for each year.

Appendix I

Variable Definitions, Descriptive Statistics, Methods and Results

AI.1. European Historical Data: Sources and Definitions

Variables	Sources and Definitions
	HB10, H14
Height	The five-year average male height at around age 21 measured in cm. Note: that these are dated at year of birth, not the year when height was measured. The HB10 sample originally comprises 308 observations of heights from a sample of 15 European countries for the 1860-1980 period.
Income (log)	Log of per capita GDP: this is the log of the five-year average of real GDP per capita originally from Maddison, see Hatton (2014, H14).
Infant Mortality	Infant mortality is deaths aged less than one divided by births, expressed in per cent; see H14 for sources.
Parental Education	Parental years of education is an estimate of the number of years of education of the parent's generation i.e., fifteen years before the start of the period (so for 1880-5 it is for the cohort of 1866-70); see H14 for sources and construction.
	Polity4 dataset.
Polity	Original polity score (polity variable) from the Polity4 dataset. This is a score from -10 (full autocracy) to +10 (full democracy) obtained by adding a series of dummy and categorical variables set as basic components in the Polity dataset.
Polity Dummy	Polity dummy. Obtained by classifying the dummy equal to 0 if the polity score is negative and equal to 1 for a weakly positive polity score.
	BMR13
BMR	Dummy variable for democracy as defined in BMR13. This according to the joint occurrence of two dimensions/three criteria (*verbatim* from BMR13, p.9): *I. Dimension: Contestation* (1) Criteria: The executive is directly or indirectly elected in popular elections and is responsible either directly to voters or to a legislature. (2) Criteria: The legislature (or the executive if elected directly) is chosen in *free and fair* elections. *II. Dimension: Participation* (3) Criteria: The majority of *adult men* has the right to vote.
BMR (t-4, t)	The (t-4, t) version means the original dummy is averaged over the last five years and transformed to 1 if the average is ≥ 0.6 (i.e., more or equal than three years in democratic status to be considered a democracy) in the main specifications. Results are robust to increasing the threshold to 0.8 and 1. For more details, please see next section.
BMR democratic dummy female & male suffrage	BMR dummy with the additional condition that, together with male suffrage, also at least half of adult women population have the right to vote.
BMR democratic dummy female & male suffrage (t-4, t)	The (t-4, t) version means the original dummy is averaged over the last five years and transformed to 1 if the average is ≥ 0.6 (i.e., more or equal than three years in democratic status to be considered a democracy) in the main specifications. Results are robust to increasing the threshold to 0.8 and 1. For more details, see next section.
	Polity4 and BMR13. Our dummy measures for democracy
Combined BMR & Polity democratic dummy (t)	Dummy obtained by combining the Polity and BMR13 data.
Combined BMR & Polity democratic dummy. Average (t-4, t).	The (t-4, t) version means the original dummy is averaged over the last five years and transformed to 1 if the average is ≥ 0.6 (i.e., more or equal than three years in democratic status to be considered a democracy) in the main specifications. Results are robust to increasing the threshold to 0.8 and 1. For more details, see next section.
	Instrumental Variable: Colonial Area (more detail in Appendix AIII.??)
Instrumental Variable (IV), colonial area	Colonial relationships in dyadic form are from Wimmer and Min (2006) [WM06]. The instrument is calculated as the average from time t-9 to time t of the log of the territory (originally expressed in square kilometres) covered by the colonies of each country.
	High-Level components of the V-Dem index (more detail in online Appendix II AII.12)
Electoral	Embodies the core value of making rulers responsible through electoral competition in free and fair elections.
Liberal	Protection of individual and minority rights against the tyranny of the state and the majority.
Participatory	Active participation of all citizens in all political processes, electoral and non-electoral.
Deliberative	Political decisions motivated by public reasoning focused on the common good.
Egalitarian	Protection rights and freedoms of individuals across social groups with equal access to resources and power.

AI.2. Detailed Construction of the Combined BMR & Polity Index

The construction of our dichotomous combined measure of democracy follows a three-step procedure.

(1) Generate Polity dummies from Polity scores. The first step reduces the polity index to a dichotomous measure by taking the value 0 for threshold, as in Acemoglu et al. (2019). The raw Polity score is calculated by adding a series of subcategories defining a country as democratic and constrained to be no larger than ten and below 0, and then by subtracting from this first total a series of subcategories defining a country as autocratic and constrained to be between 0 and 10. As a result, the range goes from 10 for a strongly democratic country, to – 10 for strong autocracies. The dummy thus takes the value 1 when the Polity index is positive or zero, and 0 when negative.

(2) Generate the combined dummy variable for democratisation. The second step leads to the construction of the Combined BMR & Polity democratic dummy and can be divided into the following three sub-steps 2a- 2c.

a. We first classify a country as a democracy/non-democracy only when both the dichotomised Polity dummy obtained in step 1 and the BMR index agree;
b. We do not classify a country when one or both sources do not express a classification;
c. We classify a country as non-democratic when the two sources do not agree.

(3) Harmonise the combined measure by (3a) making a 5-year average and (3b) choosing a threshold value above which the average value is rounded to 1 (above or equal threshold) or 0 (below threshold). The third and last step harmonises our measure (Combined BMR & Polity obtained from steps 1 and 2), with the 5-year spans of the heights data. We take the five years (from t-4 to t) average of the combined dummy variable obtained in step 2. By construction this variable can take values of 0, 0.2, 0.4, 0.6, 0.8, and 1. For the construction of the main dummy variable we replace the average value with 0 for values below 0.6, and with 1 for values greater than or equal to 0.6.[8] This produces our Combined BMR & Polity dummy variable.

[8] We take into consideration only cases where there are non-missing values in the last four years. We also use five-year averaged versions of the variable which divide the sum based on the years available in the case where these are less than 5. Results produced by using these smoothed variables are very similar to the ones reported in the paper. This is mainly because we do not have missing values, apart from the periods involving the World Wars.