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An economic or political Kuznets curve?

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Abstract This paper examines two closely related empirical hypotheses: an economic Kuznets curve and a political Kuznets curve. We find a robust inverted-U relationship between income inequality and political development, but not one between income inequality and economic development. Exploring the cross-section aspect of the panel data, we find that the economic Kuznets curve is sensitive to different control specifications and to different functional specifications, but the political Kuznets curve is robust. Using dynamic panel data estimation, we find that the economic Kuznets curve does not hold up intertemporally while the political Kuznets curve does.

Keywords Kuznets curve · Inequality · Democratization · Economic development · Panel data

1 Introduction

This paper examines two closely related empirical hypotheses: an economic Kuznets curve and a political Kuznets curve. Kuznets (1955) was the first to hypothesize that income inequality initially increases with economic development but subsequently declines with it. Since Kuznets's suggestion, several theories have been put forth to account for it. Anand and Kanbur (1993a) provide an inter-sectoral migration model along the line first suggested by Kuznets (1955). Williamson (1991) suggests that skill-biased technological change first increases wage dispersion, but reduces inequality as skills accumulate. Aghion and Bolton (1997) emphasize that credit market imperfections lead to different investment behaviors among the poor and the rich. Whereas in the beginning this leads the rich to get richer while the poor remain poor, at later stages of economic development, the accumulation of wealth by the rich eventually pushes down the interest rates sufficiently to allow the poor to invest and catch up.

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Some recent theories (Acemoglu and Robinson 2000, 2002; Bourguignon and Verdier 2000; Tam 1999) suggest a closely related idea that income inequality increases at the early stages of democratization, but declines when suffrage becomes more widespread. In Acemoglu and Robinson (2000), with nonconvexity in investment technology, the initial ruling rich elites accumulate wealth but the poor are unable to do so without redistribution. Inequality rises. When inequality reaches a threshold, social unrest and a threat of revolution intensify. These trends result in the extension of the franchise. With the extension of the franchise, the poor become the median voters, redistribution occurs, the poor accumulate capital and inequality falls.[1] In Bourguignon and Verdier (2000), the educated minority, the initial ruling group, could subsidize a fraction of the uneducated and gain from human capital externality. The elite will lose political control if the newly educated voters are numerous enough. Initially, the educated oligarchy will benefit from human capital externality but will not have to redistribute. Such partial democratization leads to the development of a small middle class and an increase in inequality. With further democratization, the rich lose power because the poor become the median voters. Redistribution takes place and inequality falls. In Acemoglu and Robinson (2000) and Bourguignon and Verdier (2000), inequality keeps falling after suffrage has become universal because of the dynamics of (human) capital accumulation among different groups thereafter. However, democratization involves the protection of rights, not just the extension of the franchise. In Tam (1999), the degree of redistribution depends on the political investment of the different groups in the political process. Therefore, for any given franchise, the degree of redistribution could vary with the degree of changes in political investment. After universal suffrage is reached, the increase in the degree of democracy (more political rights), due to political investment of the poor, tilts redistribution even more in favor of the poor and inequality keeps decreasing.

To illustrate the ideas about the two Kuznets curves, we present historical data for the United Kingdom in Table 1.[2] The table shows the following decadal data over the period 1820–1920: the franchise (the number of electorate divided by the adult population over 20 years old), real GDP per capita and two measures of inequality (the Gini coefficient and the income share of the richest 10%). The data are compatible with an economic Kuznets curve. As real GDP per capita increases from around US\$1800 in the 1820s to around US\$3300 in the 1870s,[3] the Gini coefficient rises from 0.40 to 0.63 (similarly, the income share of the richest 10% rises from 0.48 to 0.62). Yet, as real GDP per capita further increases, the Gini coefficient falls to 0.33 (similarly, the income share of the richest 10% falls to 0.32) in the 1920s. However, the data is also compatible with a political Kuznets curve. The franchise stands at around 6% of the adult population before the 1860s and jumps to around 16% of the adult population in the 1870s. But when the franchise is still below 16% of the adult population, that is, when the franchise is still limited to the very rich privileged class, inequality keeps rising from a Gini coefficient of 0.40 to 0.63. Further democratization, however, is accompanied by a reduction in the Gini coefficient from the peak of 0.63 to

[1]Note, however, that in Acemoglu and Robinson's (2000) model, the inequality dynamics is not exactly a political Kuznets curve. In particular, the rise in inequality in the first place has little to do with political development. Inequality peaks right before the franchise is extended. Inequality turns around, however, due to democratization. Bourguignon and Verdier's (2000) and Tam's (1999) models do trace out a political Kuznets curve.

[2]The data come from various sources. The number of electorate is obtained mainly from two sources: Mackie and Rose (1974) and Sternberger et al. (1969). The population over 20 years old data comes from two sources: Banks (1970) and Mitchell (1993). The PPP measures of real GDP per capita data come from Maddison (1995). The inequality data come from Williamson (1985), which cover only England and Wales.

[3]Real GDP per capita data are PPP-adjusted and expressed in 1990 geary-khamis dollars.

Table 1 Historical data for the United Kingdom 1820–1920

Year	Real GDP per capita	Franchise	Gini coefficient	Income share of the richest 10%
1820	$1,756		0.40	0.48
1830		0.04	0.45	0.50
1840		0.06		
1850	$2,362	0.07		
1860		0.08		
1870	$3,263	0.14	0.63	0.62
1880	$3,556	0.16		
1890	$4,099	0.30	0.55	0.58
1900	$4,593	0.28	0.44	0.47
1910	$4,715	0.28	0.33	0.36
1920	$4,651	0.79	0.33	0.36

Notes. Real GDP per capita is PPP-adjusted and expressed in 1990 geary-khamis dollars. Franchise is the number of electorate divided by the adult population over 20 years old. The inequality data covers only England and Wales

about 0.5 on average when the franchise is extended to 30% of the adult population in the 1890s. The Gini coefficient then declines to around 0.33 when the franchise is subsequently extended to around 80% of the adult population in the 1920s.

The single historical time series data of the United Kingdom, however, would not allow us to distinguish between the two empirical hypotheses. In this paper, we explore the empirical robustness of the two Kuznets curves using a panel data set on income inequality compiled by Deininger and Squire (1996). The advantage of using these data is twofold.

First, although a number of studies—(Kuznets 1955; Adelman and Morris 1973; Ahluwalia et al. 1979; Jha 1996)—derive empirical support for the economic Kuznets curve using cross-country evidence, other researchers find that the economic Kuznets curve is fragile. Papanek and Kyn (1986) find that the economic Kuznets curve holds up cross-sectionally in the 1960s but flattens with time. Bourguignon and Morrison (1990) find that the cross-sectional economic Kuznets curve is sensitive to control specifications, while Anand and Kanbur (1993b) find that it is sensitive to functional specifications. However, because different studies use different data sets and the quality of these data sets is usually questionable, it is difficult to draw conclusions from these studies. Deininger and Squire (1996) provide the first systematically comparable cross-country panel data set on inequality. Using these data, we revisit the sensitivity analyses of the economic Kuznets curve, as well as explore the existence and robustness of the political Kuznets curve.

Second, although the Kuznets hypothesis deals with an intertemporal relationship, the bulk of its evidence lies with cross-sectional analysis. The panel data set allows us to explore the time-series aspect of the Kuznets curves. Many researchers (Bruno et al. 1998; Deininger and Squire 1998; Li et al. 1998; Ravallion 1995) have noted the problem of estimating the economic Kuznets curve by means of cross-country regressions. Cross-sectional estimates are likely biased because of potential unobserved country-specific effects. Ideally, evidence for or against the Kuznets hypothesis should be based on time-series data. However, the lack of longitudinal data limits the study of time-series evidence country by country. The Deininger-Squire panel data set, together with the recent innovations in dynamic panel data estimations (Arellano 2003), allows us to provide consistent estimates of the parameters of interest in the Kuznets relations. We make use of such GMM-IV estimation procedures to examine if the economic and political Kuznets curves show up as intertemporal relations in the panel data.

This paper juxtaposes the economic Kuznets curve and the political Kuznets curve and subjects them to a systematic set of empirical analyses to investigate their robustness. In Sect. 3, we make use of the panel data set to examine the cross-sectional aspects of Kuznets curves. We perform several sensitivity analyses.

First, we look into the sensitivity of the Kuznets curves to control specifications. Previous studies have produced mixed results. Bourguignon and Morrison (1990), for example, find that the economic Kuznets curve is fragile while Jha (1996) demonstrates that it is robust to control specifications. These studies, however, use different data sets and control specifications. Barro (2000) is the first to use the Deininger-Squire data set to explore the sensitivity of the economic Kuznets curve to control specifications. He finds that the economic Kuznets curve is robust to the addition of other control variables in a stepwise regression analysis. However, stepwise regressions are well known to be subject to change according to the order in which variables are added. We therefore conduct a sensitivity test by applying an extreme-bounds analysis (EBA) (Leamer 1983; Levine and Renelt 1992). We find that the economic Kuznets curve does not survive the sensitivity test. The economic Kuznets curve is particularly fragile when the income share of the poor is used as the dependent variable. It does not even pass a weaker sensitivity test devised by Sala-i-Martin (1997). On the other hand, the sensitivity tests suggest that the political Kuznets curve is robust in light of different control specifications.

Second, we investigate whether the Kuznets curves are sensitive to different functional forms of the inverted-U relationship. As Anand and Kanbur (1993b) argue, in the absence of strong theoretical justification for the log-quadratic form, it is prudent to estimate alternative functional forms that could generate an inverted-U relationship. In the case of the economic Kuznets curve, we find that while some functional forms support the inverted-U shape, others do not. In fact, some functional forms suggest a U-shaped (instead of an inverted-U) relation that is also significant under the sensitivity test devised by Sala-i-Martin (1997). We therefore reconfirm Anand and Kanbur's finding using a much higher-quality and larger data set. The political Kuznets curve, on the other hand, remains robust under all tested functional forms.

Third, one important implication of the original Kuznets hypothesis is that long run economic growth is bound to bring about durable reduction in inequality eventually. Estimation of the turning point of the Kuznets curve is therefore interesting. Such estimates convey valuable information about the threshold of economic development to be reached in order for inequality to decline, but only if these estimates are precise. We therefore investigate the range of estimates of the turning points of the Kuznets curves. We find that for the economic Kuznets curve, among the functional forms that suggest an inverted-U relation, the estimated turning point of the inverted-U covers too wide a range to be useful in determining when inequality will eventually fall. The position of the turning point is too imprecise to have any practical value, for example, in projecting when inequality will turn around using the Kuznets curve as was carried out by the World Bank in its World Development Reports (1978, 1979, 1980). On the contrary, the estimates of the turning point of the political Kuznets curve cover a much narrower range.

In Sect. 4, we turn to the time series aspects of the Kuznets curves in the panel data. One weakness of cross-sectional results lies in its failure to account for country-specific effects. To resolve such heterogeneity problem, Deininger and Squire (1998) perform *static* panel data estimates that allow for country-specific effects by using regression in first differences rather than in levels. They find that the economic Kuznets curve does not survive intertemporally. Ravallion (1995) obtains similar results using another data set. The results of these empirical studies are suggestive, but not conclusive. First, Bruno et al. (1998) and Li et al. (1998) demonstrate that inequality is highly persistent in the Deininger-Squire data set. Besides, the regressors in the Kuznets curves are likely to be endogenous. Therefore, the within-group estimates by Deininger and Squire (1998) and Ravallion (1995), which do not control for dynamic effects or for endogeneity, are likely biased as well. To deal with both dynamic effects and the problem of endogeneity, as well as country- and time-specific effects, we follow the *dynamic* panel data estimation approach summarized in Arellano (2003) and pioneered by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). These estimation methods allow us to compute consistent estimates in a short panel like the Deininger-Squire data set. Making use of these GMM-IV procedures, we confirm the suggestion by recent empirical research about the fragility of the economic Kuznets curve as an intertemporal relation. On the other hand, we find support for an intertemporal political Kuznets curve.

The layout of the paper is as follows. Section 2 describes the data employed in the current study. Section 3 provides three sensitivity tests for the Kuznets curves in cross-sectional regressions. Section 4 explores the intertemporal nature of the Kuznets curves by applying dynamic panel data analysis. Having established the fragility of the economic Kuznets curve and the robustness of the political Kuznets curve using the Bollen-Gastil index, we further investigate in Sect. 5 the robustness of the political Kuznets curve by using a different democracy index. We conclude in Sect. 6.

2 The data

The inequality measures come mainly from the "high-quality" subset of the Deininger-Squire (1996) data set. The data consist of Gini coefficients (GINI) and quintile shares. We use the quintile shares to calculate the income share of the poorest 40% (POOR) and the income share of the richest 20% (RICH).

We first turn to the cross-sectional analysis of the panel data in Sect. 3. To highlight the comparison with Barro (2000), we also include the subset of Deininger-Squire data that fails to be classified as "high-quality" because of its inability to identify the primary source. The resulting expanded data consists of an unbalanced panel of 84 countries. We adjust for definitional differences because the Gini coefficients and quintile shares were measured differently in each country and at different times. We follow Barro (2000) to include two dummies in the regressions. The first dummy variable equals one if the inequality measure is based on income net of taxes or on expenditures, but zero otherwise. The second dummy variable equals one if the inequality data refers to individuals and zero if the data refers to households.

On the other hand, in the time-series exploration of the panel data in Sect. 4, we only consider the high-quality subset of countries in the data set that have 4 or more observations in order to highlight comparison with Deininger and Squire (1998) and to avoid the problem of too unbalanced a panel in dynamic panel data estimation. This creates a panel of 54 countries. We also follow Deininger and Squire (1998) to take into account definitional difference in the Gini coefficient (by increasing the expenditure-based Gini coefficient measure by 6.6 points).

To test the economic Kuznets curve, we use data on real GDP per capita. The PPP-adjusted measures of the real GDP data come from Summers and Heston (1993). In the benchmark specification, we use the log of real GDP (LGDP) and its square (LGDP^2). To test the political Kuznets curve, we use an index of democracy that is widely used in the economics literature. The index is a combined index of Bollen (1990) and Gastil et al. (various years). The Bollen data exist for two years: 1960 and 1965. The Gastil index has been published yearly since 1972. The combined index is appropriately converted to make them comparable and is obtained from Barro (2000). The index $\in [0, 1]$ with 0 indicating a fully autocratic regime and 1 indicating a fully democratic regime. In the benchmark specification, we use the index (DEMOC) and its square (DEMOC^2).

Other variables used are openness, education, socio-demographic factors and financial development. To facilitate comparison with Barro (2000), we use ten control variables in Sect. 3. For our measure of openness (OPEN), we use the ratio of exports plus imports to GDP. The data is obtained from Summers and Heston (1993). Because openness might have different effects on inequality depending on the level of economic development, we use the interaction of openness with log real GDP per capita (OPEN*LGDP) as an additional independent variable. For education data, we use primary education attainment (PYR), secondary education attainment (SYR) and higher education attainment (HYR). Our socio-demographic variables include the log of population (LPOP), urbanization (URB) and an ethnolinguistic fractionalization index (FRAC). FRAC is one minus the probability of meeting someone of the same ethnolinguistic group in a random encounter and is a measure of population heterogeneity in ethnicity and language. All data on education attainment and socio-demographic variables are obtained from Barro and Lee (1994). For measures of financial development, we use two variables. The first measures the size of the formal financial intermediary sector relative to economic activity, in other words, "financial depth". The measure of financial depth is given here by the ratio of liquid liabilities of the financial system to GDP (LLY). The second measure is the amount of credit allocated to private enterprises by the financial system relative to the size of the economy. This measure (PRIVY) equals the ratio of claims on the nonfinancial private sector to GDP. The data on both measures are obtained from IMF (2000) and World Bank (2004). To facilitate comparison with Li et al. (1998), we use two control variables in Sect. 4. These are the secondary school enrollment ratio (SEC), which is obtained from Barro and Lee (1994) and World Bank (2004) and financial depth (LLY) as defined above. Table 2 provides descriptive statistics of the data used in the present analysis.

3 Exploring the cross-sectional aspect of the panel data

In this section, we examine the cross-sectional evidence of the economic and political Kuznets curves using the panel data. Following Barro (2000), we estimate a system of three equations using seemingly unrelated regressions (SUR). Inequality measures (GINI, POOR or RICH) around 1970, 1980 and 1990 form the dependent variables. The data contain an unbalanced panel of 84 countries. SUR does not consider country-specific effects or dynamics of the dependent variable. Therefore, even though we are using a panel data set, the estimation method is essentially cross-sectional.

3.1 Sensitivity analysis I—control specifications

We first subject both the economic and political Kuznets curves to a sensitivity analysis with regards to the addition of control variables. Table 3 provides regression results for the economic Kuznets curve. GINI is the dependent variable. Barro (2000) demonstrates that the economic Kuznets curve is robust to the addition of control variables in a stepwise regression analysis. We perform a similar stepwise regression analysis in Table 3, but change

Table 2 Descriptive statistics of the data

	Number of observations	Mean	Standard deviation	Maximum	Minimum
GINI	205	0.407	0.097	0.632	0.210
POOR	172	0.164	0.047	0.266	0.053
RICH	172	0.465	0.086	0.663	0.322
DEMOC	414	0.508	0.329	1.000	0.000
GDP	378	US$3,977	US$4,108	US$18,399	US$285
OPEN	365	68.12	46.17	423.41	5.00
PYR	311	3.148	1.966	8.212	0.028
SYR	313	1.067	0.959	5.088	0.009
HYR	315	0.180	0.203	1.451	0.000
LPOP	384	8.877	1.647	13.935	5.318
URB	385	0.442	0.249	1.000	0.022
FRAC	339	0.414	0.298	0.930	0.000
LLY	324	0.367	0.259	1.593	0.004
PRIVY	325	0.236	0.191	1.353	0.007

Note. Real GDP per capita is PPP-adjusted and expressed in 1985 US$

the order of appearance of the variables in Barro (2000).[4] In regression (3.1), only LGDP and LGDP^2 are used to capture the economic Kuznets curve. The coefficient on LGDP is positive and significant while the coefficient on LGDP^2 is negative and significant. However, regressions (4.2) to (4.11) show that the economic Kuznets curve is not robust. The coefficients on LGDP and LGDP^2 are statistically insignificant in 6 out of the 10 specifications. This contrasts with Barro (2000). Essentially, stepwise regression results are subject to changes when the order of appearance of control variables changes.

In Table 4, we repeat the stepwise regression analysis with the political Kuznets curve. Recent theories (Acemoglu and Robinson 2001; Tam 1999) provide details about what data to be used. First, the political Kuznets curve holds with either prefisc or postfisc income inequality measures. Only prefisc data should be used if redistribution takes the form of lump-sum taxes and transfers. However, redistribution usually takes the form of distortionary taxes or of access to education. In this case, either prefisc or postfisc data could be used. Secondly, Acemoglu and Robinson (2001) warn about the difference between consolidated democracy and unconsolidated democracy, the latter of which takes place due to short run triggers such as recession and can be reversed when circumstances become favorable to a coup. If the level of inequality is a reflection of the long-run relative political power among groups, only consolidated democratization will have an inverted-U shape effect on inequality. Thus, we use the decadal average (60s, 70s and 80s) of a democracy index (DEMOC) in what follows.[5] The coefficients for the political Kuznets curve are all significant at the 5% level, regardless of control specifications.

[4]Following Barro (2000), we use the contemporaneous measures of the control variables.

[5]To eliminate measurement error, we could also use contemporaneous measure of the democracy index but instrument for it in the regression. Indeed, the regression result is similar whether we use decadal averages in SUR or contemporaneous measure in SUR-IV regressions.

Table 3 SUR for the economic Kuznets curve in an unbalanced panel of 84 countries over 1960–1990

Independent variables	Dependent variable: GINI										
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)
LGDP	0.331	0.258	0.191	0.177	0.171	0.179	0.206	0.173	0.293	0.324	0.335
	(2.98)*	(2.27)*	(1.65)	(1.46)	(1.32)	(1.38)	(1.66)	(1.44)	(2.43)*	(2.77)*	(2.84)*
$LGDP^2$	−0.023	−0.019	−0.013	−0.010	−0.010	−0.010	−0.012	−0.012	−0.019	−0.020	−0.021
	(−3.38)*	(−2.71)*	(−1.85)	(−1.32)	(−1.16)	(−1.22)	(−1.54)	(−1.50)	(−2.48)*	(−2.73)*	(−2.80)*
OPEN		0.0003	0.004	0.005	0.005	0.005	0.003	0.003	0.003	0.004	0.004
		(1.98)*	(2.74)*	(3.58)*	(3.56)*	(3.48)*	(2.15)*	(1.93)	(1.89)	(2.81)*	(2.84)*
OPEN*LGDP			−0.0004	−0.0006	−0.0006	−0.0005	−0.0004	−0.0003	−0.0003	−0.0005	−0.0005
			(−2.56)*	(−3.46)*	(−3.45)*	(−3.34)*	(−2.21)*	(−2.05)*	(−1.99)*	(−2.96)*	(−2.99)*
PYR				−0.020	−0.020	−0.022	−0.023	−0.024	−0.014	−0.013	−0.013
				(−4.07)*	(−4.05)*	(−4.25)*	(−4.82)*	(−5.11)*	(−2.56)*	(−2.45)*	(−2.45)*
SYR					−0.001	−0.010	−0.007	−0.007	−0.010	−0.016	−0.017
					(−0.127)	(−0.88)	(−0.71)	(−0.65)	(−0.96)	(−1.56)	(−1.65)
HYR						0.055	0.067	0.047	0.029	0.041	0.045
						(1.38)	(1.72)	(1.23)	(0.78)	(1.16)	(1.26)
LPOP							−0.016	−0.018	−0.015	−0.017	−0.018
							(−3.67)*	(−4.23)*	(−3.28)*	(−3.65)*	(−3.79)*
URB								0.118	0.107	0.106	0.099
								(2.99)*	(2.59)*	(2.56)*	(2.34)*
FRAC									0.052	0.063	0.070
									(2.19)*	(2.68)*	(2.97)*
LLY										0.008	−0.011
										(0.32)	(−0.32)
PRIVY											0.054
											(1.19)
Sample size	187	183	183	167	167	167	167	167	154	145	143
Adjusted R^2	0.32	0.32	0.35	0.47	0.47	0.47	0.52	0.54	0.54	0.56	0.56

Notes. The regression system consists of three equations, where the dependent variables are the Gini coefficients around 1970, 1980 and 1990. The estimation method is seemingly unrelated regression (SUR). The t-statistics are reported in the parentheses. The asterisk* denotes significance at the 5% level

Table 4 SUR for the political Kuznets curve in an unbalanced panel of 84 countries over 1960–1990

Independent variable	Dependent variable: GINI										
	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)	(4.7)	(4.8)	(4.9)	(4.10)	(4.11)
DEMOC	0.339	0.318	0.259	0.293	0.292	0.285	0.297	0.285	0.282	0.252	0.265
	(3.50)*	(3.20)*	(2.83)*	(3.17)*	(3.16)*	(3.07)*	(3.30)*	(3.29)*	(3.05)*	(2.69)*	(2.84)*
DEMOC^2	−0.357	−0.342	−0.242	−0.227	−0.226	−0.220	−0.248	−0.242	−0.257	−0.224	−0.222
	(−4.38)*	(−4.10)*	(−3.08)*	(−2.85)*	(−2.81)*	(−2.73)*	(−3.18)*	(−3.22)*	(−3.25)*	(−2.76)*	(−2.73)*
OPEN		0.000	0.005	0.005	0.005	0.005	0.003	0.004	0.003	0.004	0.005
		(0.36)	(5.62)*	(4.64)*	(4.42)*	(4.28)*	(2.75)*	(3.38)*	(3.18)*	(3.89)*	(4.07)*
OPEN*LGDP			−0.0006	−0.0005	−0.0005	−0.0005	−0.0003	−0.0004	−0.0004	−0.0005	−0.0005
			(−5.63)*	(−4.53)*	(−4.29)*	(−4.22)*	(−2.89)*	(−3.62)*	(−3.43)*	(−4.15)*	(−4.30)*
PYR				−0.016	−0.016	−0.017	−0.019	−0.023	−0.014	−0.013	−0.014
				(−3.89)*	(−3.61)*	(−3.80)*	(−4.47)*	(−5.39)*	(−2.70)*	(−2.51)*	(−2.68)*
SYR					−0.001	−0.008	−0.006	−0.009	−0.014	−0.016	−0.019
					(−0.11)	(−0.77)	(−0.59)	(−0.94)	(−1.53)	(−1.71)	(−1.92)
HYR						0.043	0.054	0.036	0.030	0.033	0.039
						(1.11)	(1.46)	(0.99)	(0.82)	(0.93)	(1.08)
LPOP							−0.017	−0.018	−0.018	−0.019	−0.019
							(−3.77)*	(−4.27)*	(−3.77)*	(−3.90)*	(−3.96)*
URB								0.109	0.104	0.113	0.104
								(3.17)*	(2.69)*	(2.91)*	(2.63)*
FRAC									0.038	0.042	0.051
									(1.69)	(1.86)	(2.20)*
LLY										0.004	−0.005
										(0.15)	(−0.15)
PRIVY											0.033
											(0.72)
Sample size	188	183	183	167	167	167	167	167	154	145	143
Adjusted R^2	0.23	0.23	0.35	0.48	0.48	0.48	0.53	0.57	0.56	0.57	0.56

Notes. The regression system consists of three equations, where the dependent variables are the Gini coefficients around 1970, 1980 and 1990. The estimation method is seemingly unrelated regression (SUR). The t-statistics are reported in the parentheses. The asterisk * denotes significance at the 5% level

Because the stepwise regressions may be subject to change according to the order in which variables are added, we conduct an extreme bounds analysis (EBA) following Leamer (1983) and Levine and Renelt (1992). We also test if the Kuznets curves are sensitive to the dependent variable used. We use two alternative measures of (in)equality: the income share of the poor (POOR) and the income share of the rich (RICH). The Kuznets curves should be U-shaped when POOR is used as the dependent variable and inverted-U when RICH is used. We use all combinations of the ten control variables, thus producing 1024 regressions for each Kuznets curve with each dependent variable. Table 5 reports the results.

The top panel of Table 5 shows the result when GINI is the dependent variable. In the first two rows, we show the estimates, the t-statistics and the p-values of the coefficients on DEMOC and DEMOC^2 at its highest and lowest estimates among all specifications. In the last column of the top panel, we report the number of times the coefficients are not statistically significant at the 5% level. As shown, the political Kuznets curve is robust. The lowest and highest estimates of both coefficients are all statistically significant and have the correct signs. Only 1 estimate of the coefficient on DEMOC out of all possible (1024) specifications is statistically insignificant at the 5% level, but the p-value that corresponds to that estimate is 0.051, which is marginally insignificant. The coefficient on DEMOC^2 is significant under all specifications. In the next two rows, we show the result for the economic Kuznets curve. As shown, the economic Kuznets curve is less robust. The extreme bounds estimates on the coefficients for LGDP and LGDP^2 are not statistically significant even at the 10% level.

The middle and bottom panels of Table 5 report the corresponding results when POOR and RICH are used as the dependent variable, respectively. The political Kuznets curve is again robust. Only 1 estimate of the coefficient on DEMOC^2 out of all possible specifications is statistically insignificant at the 5% level, but the p-value that corresponds to that estimate is 0.06, which is again marginally insignificant. The coefficient on DEMOC is significant under all specifications. In contrast, the economic Kuznets curve is less robust. The results using RICH as the dependent variable is similar to the results using GINI in the top panel. However, when POOR is used as the dependent variable, the economic Kuznets curve is more fragile: 154 times the coefficient on LGDP and 155 times the coefficient on LGDP^2 are not significant at the 5% level.

Arguably, however, the EBA is too extreme a test to pass: if the distribution of the estimates of a coefficient has some positive and negative support, one is bound to find a regression that violates the extreme bounds test if enough regressions are run. We therefore proceed to perform a sensitivity analysis devised by Sala-i-Martin (1997), "the SM test", in what follows. The idea is to look at the entire distribution of the estimates of each coefficient, rather than the extreme bounds. However, the immediate problem is that, even though each individual estimate follows a Student's t distribution, the estimates themselves do not. Sala-i-Martin (1997) operates under two different assumptions: the distribution of the estimates is normal and the distribution of the estimates is non-normal. Under the normality assumption, one can calculate the mean and variance of the distribution. The mean is the weighted average of all point estimates, using the ratio of the likelihood of each specification to the sum of the likelihood of all specifications as the weight. Similarly, the variance is the weighted average of all estimated variances using the same likelihood weight. The "p-value" can then be computed using the mean and variance of the normal distribution. Under the non-normality assumption, one can also calculate the "p-value": find the CDF(0) (or $1-\text{CDF}(0)$) for each specification and then find the weighted average of the CDF(0)s again using the likelihood weight.

Table 5 Sensitivity analysis (EBA) for the Kuznets curves

		Estimate	t-stat	p-value	Frequency of insignificance
Dependent variable: GINI					
DEMOC	Minimum	0.184	1.99	0.049	1/1024
	Maximum	0.429	4.22	0.000	
$DEMOC^2$	Minimum	−0.410	−5.07	0.000	0/1024
	Maximum	−0.170	−2.00	0.048	
LGDP	Minimum	0.140	1.10	0.273	40/1024
	Maximum	0.535	4.43	0.000	
$LGDP^2$	Minimum	−0.036	−4.77	0.000	29/1024
	Maximum	−0.009	−1.08	0.280	
Dependent variable: POOR					
DEMOC	Minimum	−0.276	−4.81	0.000	0/1024
	Maximum	−0.123	−2.04	0.043	
$DEMOC^2$	Minimum	0.101	1.89	0.061	1/1024
	Maximum	0.231	4.70	0.000	
LGDP	Minimum	−0.266	−3.90	0.000	154/1024
	Maximum	−0.036	−0.59	0.554	
$LGDP^2$	Minimum	0.002	0.49	0.626	155/1024
	Maximum	0.017	4.09	0.000	
Dependent variable: RICH					
DEMOC	Minimum	0.318	3.08	0.003	0/1024
	Maximum	0.578	5.92	0.000	
$DEMOC^2$	Minimum	−0.505	−6.57	0.000	0/1024
	Maximum	−0.267	−3.09	0.003	
LGDP	Minimum	0.182	1.66	0.100	18/1024
	Maximum	0.525	4.57	0.000	
$LGDP^2$	Minimum	−0.034	4.82	0.000	13/1024
	Maximum	−0.012	−1.52	0.131	

Note. For the frequency of insignificance, the level of significance is at the 5% level

Table 6 reports the results of this control-specification sensitivity analysis. The first two columns report the weighted mean and standard error of each coefficient under the normality assumption of the distribution of the estimates as discussed above. The last column reports the "p-value" under the non-normality assumption. The top three panels report the SM test result on the two Kuznets curves, using GINI, POOR and RICH as the dependent variable, respectively. The political Kuznets curve, as expected, passes this specification test whichever dependent variable is used. On the other hand, though the economic Kuznets curve does not pass the EBA, it passes the SM test if GINI or RICH is used as the dependent variable. However, the economic Kuznets curve does not pass the SM test if POOR is used as the dependent variable.[6]

[6]To highlight the robustness of the political Kuznets curve, we also carry out an EBA of the ten control variables (not shown here). Each control variable is entered with the political Kuznets curve and then the rest

Table 6 A control specification sensitivity analysis (the SM test)

	Weighted mean estimate	Weighted mean standard error	p-value (non-normal)
Dependent variable: GINI			
DEMOC	0.296	0.088	0.001
DEMOC^2	−0.270	0.076	0.002
LGDP	0.285	0.106	0.013
LGDP^2	−0.021	0.007	0.005
Dependent variable: POOR			
DEMOC	−0.190	0.050	0.000
DEMOC^2	0.164	0.042	0.000
LGDP	−0.098	0.055	0.082
LGDP^2	0.007	0.003	0.037
Dependent variable: RICH			
DEMOC	0.403	0.086	0.000
DEMOC^2	−0.332	0.073	0.000
LGDP	0.303	0.113	0.014
LGDP^2	−0.020	0.007	0.009

Table 7 Six functional specifications of the inverted-U relation

Specification	Functional form	Implied signs of coefficients	Implied turning point for the political Kuznets curve	Implied turning point for the economic Kuznets curve ($)
(1)	$a \cdot x + b \cdot x^2$	$a > 0$ and $b < 0$	$-a/2b$	$\exp(-a/2b)$
(2)	$a \cdot \exp(x) + b \cdot \exp(2x)$	$a > 0$ and $b < 0$	$\ln(-a/2b)$	$-a/2b$
(3)	$a \cdot x + b/\exp(x)$	$a < 0$ and $b < 0$	$\ln(b/a)$	b/a
(4)	$a \cdot x + b \cdot \exp(x)$	$a > 0$ and $b < 0$	$\ln(-a/b)$	$-a/b$
(5)	$a/\exp(x) + b/\exp(2x)$	$a > 0$ and $b < 0$	$\ln(-2b/a)$	$-2b/a$
(6)	$a \cdot \exp(x) + b/\exp(x)$	$a < 0$ and $b < 0$	$\ln(\mathrm{sqrt}(b/a))$	$\mathrm{sqrt}(b/a)$

3.2 Sensitivity analysis II—functional specifications

Another critique of the original Kuznets curve is that its existence is sensitive to the functional specification of the inverted-U relationship. Anand and Kanbur (1993a) show that if the underlying structural process that drives the original Kuznets curve is the dual economy mechanism, and if one uses the Gini coefficient as the dependent variable, the correct functional form for the inverted-U relation is actually not quadratic in the log. Moreover, Anand

of the nine control variables are entered in all combinations. All of the variables, except LPOP, are not robust. Using the SM test, four coefficients become significant. These include LPOP, PYR, OPEN and OPEN*LGDP.

and Kanbur (1993b) show that the existence of the economic Kuznets curve is sensitive to the functional specification of the inverted-U relationship. We ask if such criticisms still apply to the economic Kuznets curve with the current panel data and investigate if the political Kuznets curve is also subject to such criticisms.

Following Anand and Kanbur (1993b), we use six different non-linear functions to capture the inverted-U relationship. These are listed in the first column of Table 7, where $x =$ DEMOC for the political Kuznets curve and $x =$ LGDP for the economic Kuznets curve. The second column of Table 7 lists the requirement of the signs of the coefficients in order to have an inverted-U relationship. The third and fourth columns give the expression in the coefficients to calculate the turning point for the political and economic Kuznets curves.

Table 8 shows the regression results for the two Kuznets curves with the six different functional specifications. To stay close to the analysis by Anand and Kanbur (1993b), in the top panel of Table 8, we do not use any control variables. We report the estimated coefficients, whether the signs of coefficients are correct and the estimated turning point. As shown, the political Kuznets curve is robust. The coefficients all have the correct signs and are statistically significant. On the other hand, the economic Kuznets curve disappears in two specifications. In the second functional specification, the coefficients have the wrong signs, which suggest a U-shaped effect. Similarly, the fourth functional specification, though having the correct signs of coefficients, gives an estimated turning point at US$108 (1985) that falls outside the range of the sample. Therefore, the empirical result suggests that inequality is decreasing in real GDP per capita.

In the bottom panel of Table 8, we again test the two Kuznets curve with the six different functional specifications, but we add control variables to take into account the problem of omitted variables. We use the more robust variables (variables that pass the SM test) that we obtain in footnote 6: these include OPEN, OPEN*LGDP, PYR and LPOP. With these controls, the political Kuznets curve is still not sensitive to functional specifications. The coefficients all have the correct signs and are statistically significant. On the other hand, the economic Kuznets curve again disappears in two specifications. In the second and fifth functional specifications, the coefficients have the wrong signs. This time, however, both specifications suggest inequality is increasing in real GDP per capita. Moreover, none of the estimates is statistically significant at the 5% level.

The existence of the economic Kuznets curve is therefore questionable in the face of different functional specifications. With different functional specifications and controls, the relationship between inequality and real GDP per capita could be decreasing, increasing, inverted-U or U-shaped. On the other hand, the political Kuznets curve is robust to different functional specifications.[7]

3.3 Sensitivity of turning point estimates

In this subsection, we analyze the sensitivity of the turning point estimates of the Kuznets curves. If the estimates of the turning point are imprecise, the Kuznets curves will not be useful, even if they exist, in determining when inequality eventually turns around.

[7] We also perform the SM test for the various functional specifications (not shown here). The political Kuznets curve is robust under all specifications. The p-value from the SM test is an order smaller than 0.01 under all functional specifications. On the other hand, the economic Kuznets curve does not survive the SM test in three out of six functional specifications. More seriously, under Specification (2), though it passes the SM test, the mean estimated coefficients actually have the opposite sign. This means that, under Specification (2), we actually have a "significant" U-shaped relation between GINI and real GDP per capita!

Table 8 Regression results of the Kuznets curves due to different functional specifications

Dependent variable: GINI									
No control variable									
The economic Kuznets curve					The political Kuznets curve				
Specification	Estimated a	Estimated b	Signs?	Estimated turning point	Specification	Estimated a	Estimated b	Signs?	Estimated turning point
(1)	0.331*	−0.023*	correct	US$1253	(1)	0.441*	−0.447*	correct	0.475
(2)	−1.61E-5	3.85E-10	wrong	U-shaped	(2)	0.476*	−0.135*	correct	0.554
(3)	−0.086*	−100.00*	correct	US$1167	(3)	−0.923*	−1.472*	correct	0.447
(4)	1.13E-3	−1.05E-5*	correct	US$108	(4)	0.866*	−0.515*	correct	0.502
(5)	221.40*	−94631*	correct	US$855	(5)	1.556*	−1.177*	correct	0.393
(6)	−1.10E-5*	−10.908	correct	US$996	(6)	−0.267*	−0.716*	correct	0.475
Control variables: OPEN, OPEN*LGDP, PYR, LPOP									
The economic Kuznets curve					The political Kuznets curve				
Specification	Estimated a	Estimated b	Signs?	Estimated turning point	Specification	Estimated a	Estimated b	Signs?	Estimated turning point
(1)	0.181	0.011	correct	US$5320	(1)	0.302*	−0.249*	correct	0.606
(2)	1.57E-7	4.35E-12	wrong	increasing	(2)	0.284*	−0.072*	correct	0.676
(3)	−0.018	−65.83	correct	US$3720	(3)	−0.483*	−0.865*	correct	0.583
(4)	0.026	−3.07E-6	correct	US$8346	(4)	0.513*	−0.273*	correct	0.630
(5)	−3.294	−21562	wrong	increasing	(5)	0.795*	−0.680*	correct	0.537
(6)	−7.84E-7	43.595	correct	US$7457	(6)	−0.133*	−0.449*	correct	0.606

Notes. Specifications (1) to (6) and the corresponding coefficients a and b are as listed in Table 7. The asterisk * denotes significance at the 5% level. If the signs of the estimated coefficients are incorrect, there might not be a turning point. In such cases, we denote whether the estimated coefficients imply an increasing or decreasing function

Table 9 Sensitivity of turning point estimates due to control variable specifications

	Dependent variable: GINI Descriptive statistics of the estimates of turning points	
	In the political Kuznets curve	In the economic Kuznets curve
Number of estimates	1024	1024
Mean	0.521	US$1,800
Standard deviation	0.041	US$735
Maximum	0.648	US$6,884
Minimum	0.407	US$553
Sample Coverage	11%	61%
	Dependent variable: POOR Descriptive statistics of the estimates of turning points	
	In the political Kuznets curve	In the economic Kuznets curve
Number of estimates	1024	1024
Mean	0.592	US$3,068
Standard deviation	0.041	US$3,460
Maximum	0.720	US$62,071
Minimum	0.473	US$325
Sample Coverage	11%	87%
	Dependent variable: RICH Descriptive statistics of the estimates of turning points	
	In the political Kuznets curve	In the economic Kuznets curve
Number of estimates	1024	1024
Mean	0.559	US$2,043
Standard deviation	0.032	US$631
Maximum	0.653	US$5,213
Minimum	0.472	US$582
Sample Coverage	10%	42%

Note. Sample coverage is the percentage of the sample covered by the mean + two standard deviations of the estimates of the turning point

We examine the sensitivity of the turning point estimates with different control specifications. We use the same benchmark functional specification as in Sect. 3.1. Table 9 provides the descriptive statistics of the 1024 estimates of the turning point in either Kuznets curve with each dependent variable. The top panel shows the results when GINI is the dependent variable. The first column reports the mean, the standard deviation, the maximum and minimum of the estimates of the turning point, as well as the percentage of the sample covered by the mean ± two standard deviations range of the estimates, for the political Kuznets curve. The second column reports the corresponding entries for the economic Kuznets curve. The middle and bottom panels show the corresponding results when POOR and RICH are used as the dependent variable, respectively.

To visualize what the descriptive statistics mean, we show in Fig. 1 the histograms of the pooled time-series cross-country sample data of the index of democracy and log real GDP per capita. The left histogram is for the index of democracy, while the right histogram is for log real GDP per capita data. In each histogram, we darken the area where the turning point of the Kuznets curve could be in accordance with the range given by the mean ± two standard deviations of the estimates, when GINI is the dependent variable. As demonstrated there, the turning point of the political Kuznets curve lies within a narrow range (which covers 11% of the sample) while the turning point of the economic Kuznets curve lies within a much wider range (which covers 61% of the sample).

The comparison in the bottom panel with RICH as the dependent variable is similar to that in the top panel. On the other hand, the comparison is much more drastic when POOR is used as the dependent variable. The turning point of the political Kuznets curve again lies within a narrow range: the mean ± two standard deviations range covers 11% of the sample while the maximum-minimum range covers 18% of the sample. In contrast, the turning point of the economic Kuznets curve lies within an even wider range: the mean ± two standard deviations range covers 87% of the sample while the maximum-minimum range covers 99% of the sample!

4 Exploring the time-series aspect of the panel data

4.1 The panel data methodology

The cross-sectional results above find support for a political Kuznets curve but not for an economic Kuznets curve. However, one should be cautious about interpreting the results as support for an intertemporal relationship between political development and income inequality. The inability to account for unobserved heterogeneity will likely bias the estimates in cross-sectional regressions. Panel data estimation will shed light on whether the empirical evidence in cross-sectional results should or should not be doubted. To this end, we build on previous theoretical and empirical results to formulate our panel data estimation model.

According to some previous research that use the Deininger-Squire panel data (e.g., Li et al. 1998), the Gini coefficient is very stable in time and does not show any trend in most countries while it varies substantially among countries. Real GDP per capita, however, does not share such intertemporal and cross-sectional properties, but exhibits substantial time trend in many countries. Li et al. (1998), however, do not directly put the economic Kuznets curve to test by employing panel data estimation. Bruno et al. (1998) and Li et al. (1998) demonstrate that inequality is highly persistent in time. Moreover, there are also structural reasons to include lagged inequality as determinants of current inequality (Acemoglu and Robinson 2000; Bourguignon and Verdier 2000).

For the above reasons, we apply a dynamic panel data estimation method instead of static panel data estimates. The within-group estimations performed by Deininger and Squire (1998) and Ravallion (1995), which only account for heterogeneity, are likely biased because the lagged dependent variable is correlated to the error term in the differenced data. Besides, because the regressors are likely not strictly exogenous, lags should be used as instruments but not leads (see Arellano 2003, Chap. 8). Moreover, if the regressors are predetermined, an efficient estimation will simultaneously include regressions in levels and regressions in difference (Arellano and Bover 1995; Blundell and Bond 1998). Lagged differences should serve as instruments in the level regressions whereas lagged levels should serve as instruments in the difference regressions. We use such GMM-IV system estimation to take into account country- and time-specific effects, as well as the persistence of the dependent variable and the endogeneity of the regressions. The consistency of such estimation depends on

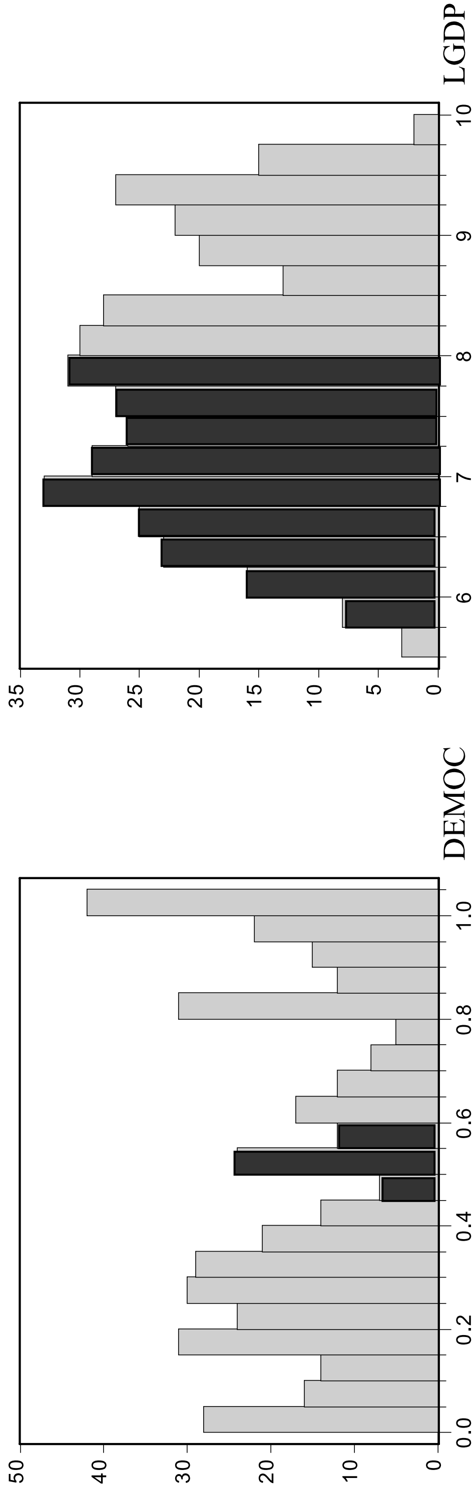

Fig. 1 Histograms for DEMOC and LGDP and the range of estimated turning points of the Kuznets curves

whether the instruments in the regressions are valid. We provide the Sargan over-identifying restrictions test to assess the validity of the instruments. We also test for serial correlation of the error term. Our specification contains only lag-1 dependent variable in the regression. Therefore, first-order serial correlation of the error term is expected, but second-order serial correlation is not. Otherwise the model is mis-specified.

4.2 The panel data analysis

To facilitate comparison with recent panel data research on the Kuznets curve, including Deininger and Squire (1998) and Li et al. (1998), who use the same panel data, we use the unbalanced panel of 54 countries over the period 1960 to 1995. These countries have at least four years of observations over that period. We use the nearest-to-year data for 1960, 1965, 1970, 1975, 1980, 1985, 1990 and 1995 to form a system of eight equations in time. Besides, we use the same control specifications as in Li et al. (1998) to include secondary school enrollment ratio (SEC) and financial depth (LLY). Moreover, though the GMM-IV-SYS approach is the correct methodology to estimate the dynamic panel data model, we also perform other estimations for the sake of comparison. Therefore, in addition to the GMM-IV-SYS estimate, we perform an OLS estimate on the pooled data and a within-group estimate.

Table 10 reports the results of the panel data estimation of the Kuznets curves. The first three columns show the results for the economic Kuznets curve. The first column shows the OLS regression result of the pooled data. As in some of the cross-sectional results in the previous section, we observe a significant inverted-U relationship between inequality and economic development. The second column shows the within-group (WG) regression result. Similar to the findings of Deininger and Squire (1998) and Ravallion (1995), we find that the economic Kuznets curve disappears when country-specific effects are accounted for. This suggests that the OLS result is likely biased. However, the within-group estimates are themselves inconsistent because of the dynamic nature of the dependent variable and the endogeneity problem of the regressors. The third column shows the GMM-IV system estimates, which correctly take into account the problem of heterogeneity, endogeneity and dynamics. We find that the estimated coefficients for the economic Kuznets curve are insignificant. The GMM-IV system result therefore reaffirms the suggestion of Deininger and Squire (1998) and Ravallion (1995) that cross-country results are elusive and the economic Kuznets curve does not hold up intertemporally.

The next three columns present the results for the political Kuznets curve. The first of these columns shows the OLS regression result of the pooled data. Because we are using nearest-to-year data, we might be seriously mismeasuring the degree of *consolidated* democracy by the DEMOC data, as Acemoglu and Robinson (2001) argue. Measurement error gives rise to attenuation bias. Therefore, the insignificant result for the political Kuznets curve is not surprising. The within-group estimates take into account heterogeneity but exacerbate measurement error bias. Therefore, the insignificant result for the political Kuznets curve is again not surprising. The GMM-IV method, on the other hand, does not only correctly account for country- and time-specific effect, endogeneity of regressors and the dynamics of the dependent variable, but proper instruments also take care of measurement error problem. The dynamic panel data estimate demonstrates that the political Kuznets curve is a significant intertemporal relationship.

The last three columns combine the economic and the political Kuznets curves. The results again show that while the economic Kuznets curve is significant under OLS, it becomes insignificant with panel data estimation. On the other hand, the political Kuznets

Table 10 Panel data estimates for the Kuznets curves

Independent variables	Dependent variable: GINI								
	Economics			Political			Both		
	OLS	WG	GMM-IV	OLS	WG	GMM-IV	OLS	WG	GMM-IV
GINI(-l)	0.836	0.152	0.699	0.836	0.143	0.629	0.822	0.113	0.599
	(22.7)*	(1.16)	(10.1)*	(22.4)*	(1.18)	(8.85)*	(21.1)*	(0.96)	(7.88)*
DEMOC				6.294	12.422	18.669	6.002	13.902	17.996
				(1.37)	(1.87)	(2.57)*	(1.33)	(2.07)*	(2.56)*
$DEMOC^2$				−4.717	−6.270	−14.166	−4.122	−6.991	−13.146
				(−1.18)	(−1.07)	(−2.29)*	(−1.05)	(−1.21)	(−2.23)*
LGDP	11.809	8.291	9.379	0.902	0.034	1.422	12.451	15.811	14.779
	(2.43)*	(0.88)	(1.00)	(1.41)	(0.02)	(1.17)	(2.36)*	(1.62)	(1.69)
$LGDP^2$	−0.661	−0.539	−0.464				−0.707	−0.966	−0.831
	(−2.28)*	(−0.94)	(−0.86)				(−2.20)*	(−1.61)	(−1.62)
SEC	−5.327	−4.288	−11.474	−5.647	−6.730	−12.445	−5.564	−6.510	−12.554
	(−2.99)*	(−1.07)	(−2.76)*	(−3.00)*	(−2.08)*	(−2.94)*	(−3.01)*	(−1.88)	(−3.10)*
LLY	−0.554	6.172	−1.012	−0.436	8.158	2.139	−0.260	8.588	1.784
	(−0.38)	(2.03)*	(−0.37)	(−0.34)	(3.27)*	(0.79)	(−0.17)	(3.20)*	(0.66)
Sargan test			0.985			1.00			1.00
Serial correlation									
1st order			0.054			0.059			0.062
2nd order			0.142			0.090			0.097
# countries	46	39	39	46	39	39	46	39	39
#obs.	150	143	143	150	143	143	150	143	143

Notes. OLS is ordinary least square regression applied to the pooled data. WG is the within-group static panel data estimation that accounts for fixed country-specific effects. GMM-IV is the dynamic panel data estimation that uses general method of moments with instrumental variables in a system of equations in differences instrumented by lag-2 and more levels and equations in levels instrumented by lag-1 differences. For the Sargan test of over-identifying restrictions in GMM-IV, we report the level of significance of the test. For the serial correlation test, we report the level of significance of 1st and 2nd order serial correlations. The asterisk * denotes significance at the 5% level curve stands out as a significant relationship intertemporally according to the GMM-IV system estimate.

Lastly, in all the GMM-IV system results, the Sargan test of over-identifying restrictions is not rejected. Therefore, this supports the consistency of the GMM-IV system estimator and the validity of the instruments in the regressions. Furthermore, the existence of first order correlation is consistent with the construct of the model, which is an AR(1) process. The failure to reject the null hypothesis of the absence of second-order serial correlation demonstrates that the dynamic modeling of the regression is not mis-specified.

5 More on the political Kuznets curve

In the previous sections, we have established the fragility of the economic Kuznets curve and the robustness of the political Kuznets curve using the Bollen-Gastil index as our measure of the degree of democracy. Because of the potential measurement issues of the degree of democracy by subjective indices (Munck and Verkuilen 2002), we investigate whether the existence and robustness of the political Kuznets curve are peculiar to the particular measure of democracy index we use. We therefore repeat our sensitivity tests using an alternative democracy index in the Polity III dataset developed by Jagger and Gurr (1996). Although the Bollen-Gastil index is widely used in the economics literature, the Polity III dataset is popular among political scientists.[8]

To economize on space, we report the results without showing the tables. Similar to the results using the Bollen-Gastil index, the political Kuznets curve using the Polity III data passes the SM test. When GINI is used as the dependent variable, the weighted mean estimates (standard errors) are 0.179 (0.064) and −0.195 (0.064) on the linear and squared terms. The (non-normal) p-values are 0.010 and 0.012 respectively. Similarly, when POOR is used as the dependent variable, the weighted mean estimates (standard errors) are −0.098 (0.034) and 0.103 (0.034) on the linear and squared terms. The (non-normal) p-values are 0.005 and 0.003 respectively. When RICH is used as the dependent variable, the weighted mean estimates (standard errors) are 0.152 (0.060) and 0.148 (0.060) on the linear and squared terms. The (non-normal) p-values are 0.014 and 0.017 respectively. In all cases, the p-values are less than 0.05.

In terms of the functional specifications, the political Kuznets curve using the Polity III dataset has the correct signs in all specifications, as shown in Tables 7 and 8. Most of the coefficients are significant at the 5% level. The rest are significant at the 10% level. The estimated turning points according to the different functional specifications range from 0.273 to 0.640, which cover 10% of the sample.

The position of the turning point of the political Kuznets curve using the Polity III dataset also lies within a narrow range in the benchmark functional specification when different control specifications are used. In the 1024 control specifications, using GINI as the dependent variable, the turning point of the political Kuznets curve has a mean estimate of 0.399 and a standard deviation of 0.059, and lies within a narrow range: the mean ± two standard deviations range covers 7% of the sample while the maximum-minimum range covers 10% of the sample. Similar results are obtained when POOR or RICH is used as the dependent

[8]The democracy index in Polity III is an index that ranges from 0 (non-democratic) to 10 (fully democratic). To make comparison with the Bollen-Gastil index we use, we rescale the Polity III data to become an index that ranges from 0 to 1.

variable. The results are therefore comparable to those shown in Table 9 with regard to the political Kuznets curve when the Bollen-Gastil index is used.

Lastly, the political Kuznets curve using the Polity III dataset remains robust in the dynamic panel analysis. In the GMM-IV dynamic panel similar to those shown in Table 10, the coefficients (t-stat) are 11.548 (2.82) and −11.910 (−2.89) on the linear and squared terms of this democracy index. When both the economic and political Kuznets curves are entered in the estimation, again the political Kuznets curve remains robust with coefficients (t-stats) being 11.518 (2.99) and −11.707 (−3.18) on the linear and squared terms of this democracy index while the coefficients of the economic Kuznets curve are insignificant.

6 Conclusion

In this paper, we find consistent support for a political Kuznets curve. We find that the level of democracy has an inverted-U effect on inequality. The political Kuznets curve is found to be more robust than the economic Kuznets curve. In cross-sectional regression, we find that the political Kuznets curve is robust to the addition of control variables while the economic Kuznets curve is not, especially when the income share of the poor is used as the dependent variable. The political Kuznets curve is not sensitive to different functional specifications of the inverted-U relationship, but the economic Kuznets curve could be inverted-U, U-shaped, monotonically increasing or decreasing depending on the functional specifications. Moreover, the inferred turning point in the political Kuznets curve has a much narrower range than the inferred turning point in the economic Kuznets curve. The former is therefore superior in its prediction about when the trend of inequality will eventually be reversed. Last, but not least, the dynamic panel data estimates rejects the economic Kuznets curve as an intertemporal relationship but confirms the robustness of the political Kuznets curve intertemporally. The existence and robustness of the political Kuznets curve is not sensitive to the democracy index being used either.

The findings are therefore consistent with recent theories by Acemoglu and Robinson (2000, 2001, 2002) and Bourguignon and Verdier (2000). The political Kuznets curve could also explain why the original economic Kuznets curve might appear as a specious relationship in the data. For one, economic and political developments are potentially positively correlated due to the Lipset's hypothesis (Lipset 1959; Friedman 1962). Therefore, if the true relationship is indeed the political Kuznets curve, and economic development is only a proxy for political development, the economic Kuznets curve will sometimes be observed but it will be fragile. For another, Acemoglu and Robinson (2002) suggest that the economic Kuznets curve observed historically in all European countries need not be a feature of all development processes. In their model, under certain initial conditions, an "autocratic disaster" may occur, at which time democratization may not take place to produce the downward sloping side of the Kuznets curve. In other words, the existence of the economic Kuznets curve is contingent on successful democratization. On the other hand, the political Kuznets curve is itself a contingent result and will therefore be robust, because *if* democratization indeed takes place, redistribution will result and the reversal in inequality will occur.

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