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# Decentralisation and the environment: Survey-based and cross-country evidence<sup>1</sup>

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## Abstract

Attitudes towards the environment have evolved over the years around the world, in part due to growing awareness among the population of the challenges posed by climate change. The decentralisation of policymaking, administrative and political responsibilities to the subnational levels of administration may also have played a part to the extent that creates room for bottom-up policy experimentation and citizen participation in policy design, including in areas related to the environment, that may influence people's preferences and attitudes. To shed light on these linkages, this paper provides both individual-level survey-based and aggregate cross-country empirical evidence. Individual-level analysis based on data from the World Values Survey shows that decentralisation contributes to more favourable attitudes to the environment, controlling for personal and household characteristics of respondents, as well as country and cohort effects. Country-level analysis based on national accounts data shows that decentralisation is associated with higher government spending on environment-related programmes, as well as higher collection of environmental taxes in the advanced economies, controlling for conventional public finance covariates.

*Keywords:* decentralisation, environment, public finances, regional autonomy.

*JEL Classification codes:* H11, H23, H77, Q58.

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<sup>1</sup> Authors are responsible for any remaining errors and omissions. The analysis and views presented in this paper are the authors' own and do not necessarily reflect those of the institutions to which they are affiliated.

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## 1. INTRODUCTION

Attitudes towards the environment have evolved over the years around the world, in part due to growing awareness among the population of the challenges posed by climate change.<sup>4</sup> Changing attitudes to the environment may shape public policies to the extent that governments are responsive to people's preferences and needs, including initiatives to protect the environment in a context of both market and policy failures.<sup>5</sup> Additionally, they may also be shaped by policy to the extent that bottom-up initiatives in areas related to the environment may raise awareness among the population about challenges in that area that may in turn influence preferences and attitudes. One such policy driver is the decentralisation of policymaking, administrative and political responsibilities to the subnational levels of administration, because it creates room for bottom-up policy experimentation and citizen participation in policy design that may influence individual preferences and attitudes.<sup>6</sup> By bringing the government closer to the people and as a result making it more responsive to their preferences and needs, decentralisation may also strengthen the link between attitudes and policy.

The regional and local governments indeed play an important role in environmental policymaking (de Mello, 2021d). For example, energy efficiency standards for buildings and land use permits for the protection of green areas are issued in most countries by the subnational governments, not the central administration. The subnational governments are also at the forefront of managing natural disasters, whose risk distribution is influenced by climate change, as well as in the area of adaptation, for instance through public investment (de Mello and Jalles, 2022). Moreover, in many countries the regional governments are spearheading mitigation initiatives related to the introduction of carbon pricing,

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<sup>4</sup> Climate change already poses a systemic risk to the global economy. With the global average surface temperature rising by 1.1 degrees Celsius since 1880, the frequency and severity of climate shocks—ranging from heatwaves and droughts to hurricanes and coastal flooding—have intensified across the world. Looking ahead, extreme weather events are projected to worsen as global annual mean temperatures increase by as much as 4 degrees Celsius over the next century (Stern, 2007; IPCC, 2014).

<sup>5</sup> It can be argued that leaving environmental protection to the market, relying on notions of corporate social responsibility and altruistic consumer and shareholder preferences, will not deliver optimal results. However, nationalising the delivery of environmental protection is likely to fail, because nation states rarely have the depth and quality of information required to instruct all the relevant agents to make appropriate decisions (Hepburn, 2010).

<sup>6</sup> While people who think that, as a general principle, it ought to be the government's responsibility to protect the environment should be more likely to support increasing government spending on the environment, Kulin and Seva (2019) argue that this relationship is dependent on the quality of government.

sometimes ahead of the national administrations. In this area, the experience of California in the United States and British Columbia in Canada are cases in point.

To shed light on the linkages between decentralisation and attitudes to the environment, this paper uses individual-level data from the World Values Survey (WVS). WVS is a large repeated cross-section survey that has been used extensively in the empirical literature on the association between decentralisation and a variety of social preferences and attitudes, including those related to government and related institutions (de Mello, 2004 and 2011; Ligthart and van Oudheusden, 2015; and Tang and Huhe, 2016a). WVS has also been widely used to gauge the drivers of attitudes to the environment (Gelissen, 2007; Torgler and García-Valiñas, 2007; Contorno, 2012; Ma, 2012; Zhou, 2015; Li et al., 2018). WVS started to be collected in 1981 and is now conducted in almost 100 countries using a common questionnaire and including almost 450 thousand respondents. Seven waves are currently available with, on average, over one thousand respondents per country, although not all questions are available for all waves (Inglehart et al., 2014).

The main insight from the individual-level analysis is that people who have been exposed to comprehensive decentralisation tend to have more favourable attitudes to the environment. Rather than asking survey respondents abstract questions about their preferences and attitudes to decentralised governance – a concept that is difficult to grasp even by well-informed individuals – we focus on concrete experience with comprehensive decentralisation through exposure during an individual's adult life to episodes of widespread changes in the policymaking, administrative and political prerogatives of the subnational layers of administration. We construct a chronology of comprehensive decentralisation episodes using the Regional Authority Index (RAI) computed by Hooghe et al. (2010 and 2016) and subsequently updated by Schakel et al. (2018), which covers over 80 countries. Following de Mello (2021a and 2021b), those individuals who were at least 18 years of age during episodes of comprehensive decentralisation in their country of residence are considered to have been exposed to decentralisation in practice, even if they are not aware of the specific features of decentralisation programmes and their institutional underpinnings.

To complement the individual-level analysis, we rely on aggregate country-level data to assess empirically the linkage between decentralisation and environmental policy interventions. Rather than looking at country-specific programmes and experiences, as in most of the empirical literature, we look at

the public finances and measure environmental policy on the basis of the environmental taxes collected by government and actual government spending on environment-related programmes. The empirical literature is indeed sparse on cross-country evidence on the association between decentralisation and environment-related tax and spending policies, a gap that this paper also aims to fill. To do so, we use national accounts data on the public finances of a large set of advanced and developing countries. We also use the chronology of comprehensive decentralisation episodes to compute impulse responses to decentralisation shocks. The main finding from the aggregate cross-country analysis is that decentralisation is indeed associated with higher government spending on environment-related programmes, as well as higher collection of environmental taxes in the case of the advanced economies. The impulse response analysis shows that the increase in government spending is persistent over time following episodes of comprehensive decentralisation.

The paper is structured as follows. Section 2 presents the estimation strategy based on survey-based data, with emphasis on the drivers of people's attitudes towards the environment. It discusses the empirical literature and evidence to date, noting the dearth of evidence on the linkages between decentralisation and attitudes to the environment, before presenting the main findings. Section 3 focuses on the cross-country evidence. Based on national accounts data for a large panel of countries, it supports the hypothesis that decentralisation is associated with more collection of environment-related taxes and more spending on environment-related programmes. Section 4 summarizes the key findings, policy implications and also identifies options for further work.

## **2. THE NEXUS BETWEEN DECENTRALISATION AND ATTITUDES TO THE ENVIRONMENT: EVIDENCE FROM INDIVIDUAL-LEVEL SURVEY DATA**

### **2.1. Insights from the literature**

The empirical literature based on survey data highlights the importance of a number of individual-level drivers of attitudes to the environment, as well as society-level determinants. For example, Franzen and Vogl (2013) use data from the third wave (2010-12) of the International Social Survey Programme (ISSP) for a large set of countries and show that women are more concerned than men about the environment. Older individuals (albeit in a non-linear fashion) and those with higher levels of education also tend to be more concerned about the environment. In addition, the authors find that society-level factors, such as the

level of development, the urbanisation rate and population density of the country of residence of survey respondents influence attitudes. Gelissen (2007) uses data from the 1999-2000 wave of WVS and the European Values Survey (EVS) to identify the main drivers of popular support for environmental protection across countries and also highlight the importance of contextual-level information in addition to personal and household characteristics as drivers of attitudes to the environment.

Survey-based evidence allows for gauging the influence of a wide range of political and social preferences on attitudes to the environment. Using data from WVS and EVS for 1990, 1995, and 1999–2000, Torgler and García-Valiñas (2007) focus on environmental damage in Spain and highlight the importance of political preferences as well as social capital as drivers of attitudes towards the environment. Contorno (2012) estimates multiple regression models for seven advanced economies to measure international environmental concern using data from the 2005 wave of WVS and find that stronger cosmopolitan values are associated with greater concern for the environment in addition to income, education, age, gender and political preferences. Using the 2007 wave of WVS data, Zhu (2015) investigates the impact of income, gender and age on environmental concern using OLS estimates and a nested logistic model. Finally, Li et al. (2018) use data from several waves of WVS between 1994 and 2014 to analyse environmental protection attitudes across regional cultural attributes.

Moreover, the literature emphasises respondents' willingness to pay for preserving the environment as an additional driver of attitudes. In other words, individuals' attitudes to the environment can be gauged by their willingness to forego income or living standards, as well as paying higher taxes and prices for goods and services, to preserve the environment. Indeed, Kimmelmeier et al. (2002) use data from the 1993 wave of the ISSP, which included a module on the environment, and show that income, in addition to individual characteristics, shape attitudes and behaviour. Their main interest is in a variable measuring sacrifice, or how much respondents are willing to pay in terms of higher taxes and prices, as well as to forego material living standards, to preserve the environment. In addition, Meyer and Liebe (2010) use data from the 2007 Swiss Environment Survey to shed light on willingness to pay for a variety of environmental public goods and also show that individual characteristics, such as age, gender, educational status and interpersonal trust, matter for attitudes to the environment, even though their findings vary across a variety of willingness to pay indicators. While Kimmelmeier et al. (2002) and Franzen and Vogl (2013) use cross-level analysis to estimate simultaneously the interplay between individual- and society-level determinants, Meyer and Liebe (2010) focus on survey-level data to shed light on individual-level

determinants of attitudes to the environment. Ma (2012) focuses on willingness to pay in China in terms of environmental taxes/fees based on the 2007 wave of WVS and show that environmental awareness and political trust are among the main factors that influence public opinion support for environmental policies, controlling for personal characteristics and other covariates.

Interestingly, perceptions about other people's attitudes to the environment seem to affect individual choices, given that people expect reciprocity in exchange for their actions, especially when they involve sacrifice, as well as conformity to social norms. For example, Andre et al. (2021) show for a survey experiment for a sample of adults in the United States that willingness to fight climate change, measured through monetary incentives to donate money to support climate change causes, varies across the population depending on individual beliefs about social norms and economic preferences. In particular, willingness to fight climate change rises in proportion to the belief that others would do the same. Related literature also shows that economic preferences affect pro-environmental behaviour in everyday life, such as actions that reduce emissions and pollution in general, in addition to attitudes to the environment. Altruism is one of these preferences (Lades et al., 2021). Self-image concerns also play a part in pro-environmental behaviour (Nyborg et al. 2006). All in all, social norms shape pro-environmental behaviour through a variety of channels, as discussed in the survey of the literature conducted by Farrow et al. (2017).

The literature is nevertheless silent on how the internal structure of government, and in particular the specific features of intergovernmental relations, affects attitudes to the environment. Of particular interest is the association that may exist between the decentralisation of policymaking, administrative and political functions to the subnational level of governments, on the one hand, and attitudes to the environment, on the other. To the extent that decentralisation brings the government closer to the people, potentially making it more responsive to their preferences and needs, decentralisation may strengthen the link between attitudes and policy. At the same time, by making room for bottom-up policy experimentation, decentralisation may create opportunities for local initiatives and policies to influence attitudes. It may also be the case that attitudes may be more easily reflected in policy where people are more actively engaged in the social and political life of the community where they live, which may in turn be facilitated by decentralisation. Shedding light on these linkages requires empirical analysis, which is an objective of this paper, since economic theory offers limited insights into the mechanisms and direction of causality between decentralisation and attitudes to the environment.

## 2.2 Estimating strategy and data

The key hypothesis to be tested is that personal experience with decentralisation affects survey respondents' attitudes towards the environment. Estimation of the determinants of attitudes can be carried out as follows:

$$\text{Prob}(A=K|X) = \Phi(\lambda + X'\alpha) \quad (1)$$

where  $A$  denotes attitudes to the environment, defined as  $A = K$  for  $\mu_{k-1} < A^* \leq \mu_k$ , for  $k = 1, \dots, K$ ,  $\alpha$  is a vector of parameters to be estimated,  $X$  is a vector of exogenous variables, and  $\Phi(\cdot)$  is a logistic function.

The structural version of model (1) can be written as:

$$A^*_{ijt} = \lambda_v + \alpha X_{ijt} + \varepsilon_{ijt}, \quad (2)$$

where  $A_{ijt} = k$  for  $\mu_{k-1} < A^*_{ijt} \leq \mu_k$ , for  $k = 1, \dots, K$  1 if  $A^* > 0$ , and 0 otherwise, with  $i = 1, \dots, I$ ;  $j = 1, \dots, N$ ;  $t = 1, \dots, T$  denoting individuals, countries and survey waves;  $\lambda_v$  captures unobserved fixed effects, with  $v = i, j, t$ , depending on model specification;  $X_{ijt}$  is a vector of covariates; and  $\varepsilon_{ijt}$  is an error term, which is assumed to be independent and normally distributed.

Equation (2) can be estimated by ordered probit, which is a generalization of the widely used probit binary estimator to the case of more than two outcomes of an ordinal dependent variable. Indeed, in most surveys questions are formulated in a manner that allows for a finer description of attitudes and preferences through an ordering of multiple options than a simple binary (yes/no) scale. This is the case of the data used to estimate Equation (2) available from WVS. In particular, WVS provides responses to a question of whether or not survey respondents find it important to look after the environment. In the sixth wave (2010-14) respondents are shown a card with descriptions of people and are asked to indicate for each description whether that person is "not at all like me", "not like me", "a little like me", "somewhat like me", "like me", or "very much like me". The relevant description for the purpose of our analysis is: "Looking after the environment is important to this person; to care for nature and save life resources". The coding of responses implies a 1-6 scale in ascending order of agreement (with 1 indicating "not at all like

*me*” and 6 indicating “*very much like me*”).<sup>7</sup> Missing values, unanswered questions and “don’t know” answers are excluded from the empirical analysis. The descriptive statistics of the data are reported in Appendix A. We are left with over 87 thousand responses in our dataset covering 60 countries. To illustrate, the median response to the question on attitudes to the environment corresponds to a score of 5 (“like me”).

To estimate the nexus between attitudes to the environment and decentralisation using opinion survey data, it is important to measure decentralisation in a manner that varies among individuals, rather than only at the aggregate (country-wide) level, as is the case of the conventional indicators used in cross-country analysis, such as the subnational shares of general government spending or revenue, as well as measure of political and policymaking autonomy of subnational governments.<sup>8</sup> It is also important to gauge concrete experience with decentralisation, rather than abstract attitudes, given that decentralisation is a multi-dimensional concept that is difficult to understand even for well-informed respondents. Decentralisation includes a web of policy, administrative and political functions that can be of exclusive or shared responsibility among the different layers of administration, and the structure of government itself varies considerably across countries.

Against this background, and following de Mello (2021a and 2021b), we use an indicator of personal experience with decentralisation constructed using the Regional Authority Index (RAI) computed by Hooghe et al. (2010 and 2016). The original RAI covers 81 countries over the period 1950-2010 and was subsequently updated through to 2016 (Schakel et al., 2018). The RAI takes the value of 0-30 in increasing order of regional autonomy. Comprehensive decentralisation was then defined as country-year episodes where RAI rose by at least 5 points (reported in Appendix C). Personal experience with decentralisation is gauged by interacting the comprehensive decentralisation indicator with a variable that identifies those individuals who were aged at least 18 years at the time when comprehensive decentralisation took place in the country where they lived. This identification strategy consists of treating the cohort of individuals aged at least 18 years at the time of comprehensive decentralisation, where it occurred, as those who were

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<sup>7</sup> The question is also available in the previous wave of WVS (2005-09), but the wording of the question differs between the two waves. As a result, only the latest wave was considered in the analysis. The latest wave (2017-21) does not include the same set of questions on attitudes to the environment.

<sup>8</sup> See, for example, Martinez-Vazquez et al. (2017), de Mello and Jalles (2020) and de Mello (2021d) for a discussion of the conventional fiscal, policymaking and political decentralisation indicators.

de facto exposed to decentralisation, and hence experienced it in practice, whereas younger individuals are treated as a control group.

WVS also contains information on respondents' personal characteristics, including age, year of birth, ethnicity, marital and head of household status, number of children, level of education and labour market status, as well as a host of social and political attitudes. The large body of empirical analysis discussed above shows that these personal characteristics are important drivers of attitudes to the environment, even though the actual empirical associations may not be robust across studies.

### **2.3. Baseline findings**

The baseline results are reported in Table 1. Model 1 excludes personal experience with decentralisation for ease of comparison with the literature. It shows that a number of personal and household characteristics are strong drivers of attitudes to the environment: older people (albeit non-linearly), married people and heads of household have more positive attitudes to the environment, whereas males tend to care less about the environment. Ethnicity matters, with whites having more positive attitudes to the environment than non-whites, as well as employment status, but whereas civil servants seem to have a positive attitude to the environment, the opposite is true for those in full-time employment. The number of children and educational status do not appear to affect attitudes to the environment. These findings are robust to the inclusion of country effects to control for drivers that are specific to socio-economic, political, institutional and cultural context, as well as cohort effects, reflecting generational changes in attitudes that go beyond the age of survey respondents.

Turning to the policy driver, as hypothesised, personal experience with decentralisation indeed shapes attitudes to the environment (Model 2). People who have been exposed to comprehensive decentralisation in their adulthood (being at least 18 years of age at the time when comprehensive decentralisation took place in their country of residence) seem to care for the environment more than those who have not been exposed in the same manner, as evidenced by the positive and statistically significant coefficient of the decentralisation exposure indicator. As in Model 1, this finding is robust to the inclusion of fixed country and cohort effects. The other personal and household characteristics remain as in Model 1. Moreover, the

non-linear effects of age in Models 1 and 2 suggest that the turning points in attitudes occur at between 48 and 49 years of age.

**Table 1. Decentralisation and attitudes to the environment: Baseline results**

	1		2	
Decentralisation			0.07	**
			(0.028)	
Age	0.03	**	0.03	**
	(0.013)		(0.013)	
Age squared	-0.00	***	-0.00	***
	(0.000)		(0.000)	
Married	0.042	***	0.04	***
	(0.010)		(0.010)	
Head of household	0.02	**	0.02	**
	(0.010)		(0.010)	
Male	-0.05	***	-0.05	***
	(0.009)		(0.009)	
No child	0.01		0.01	
	(0.012)		(0.012)	
Ethnicity (white=1)	0.06	**	0.06	**
	(0.027)		(0.027)	
Education (primary=1)	-0.02		-0.02	
	(0.016)		(0.016)	
Employment (full-time=1)	-0.03	***	-0.02	**
	(0.010)		(0.010)	
Civil servant	0.11	***	0.11	***
	(0.010)		(0.011)	
No. Obs.	87,074		87,074	
No. countries	60		60	
Model	Ordered probit		Ordered probit	
Country effects	Yes		Yes	
Cohort effects	Yes		Yes	
Prob > chi-sq. ( <i>p</i> value)	0.00		0.00	

Note: Standard errors are reported in parentheses. Statistical significance at the 1, 5, and 10 percent levels is denoted by respectively (\*\*\*), (\*\*), and (\*).

## 2.4. Robustness checks

To assess the robustness of the baseline results, a number of variables that are expected to affect attitudes to the environment were added to the set of regressors. They include attitudes to democracy,

participation in local elections and attachment to the local community, as well as confidence in government.

### ***Experience with democracy***

The nexus between decentralisation and attitudes to the environment may be influenced by individuals' democratic values and experience with how democracy works in practice. Both are associated with a host of attitudes that characterise how people relate to the government and perceive the effectiveness of public policies (de Mello, 2021a, 2021b and 2021c).<sup>9</sup> In particular, citizens who have stronger democratic values and have more positive practical experience with democracy are more likely to feel reassured that the political process is fair and gives them voice in the way policy is made and implemented. The literature surveyed above on the drivers of attitudes to the environment indeed suggests that there is a positive association between political preferences and attitudes.

To test this hypothesis, experience with democracy is gauged using WVS responses to a question about how democratically respondents think their country "*is [...] governed today*". This question is available in the sixth wave of WVS, and answers are coded originally on a 0-10 scale ranging from "*not at all*" to "*completely*". For the purpose of the empirical analysis, responses were recoded with the top three categories representing a positive experience with democracy, taking the value of 1 to identify a positive experience, and 0 otherwise. The recoded variable was added to the set of regressors in the baseline regression.

The parameter estimates reported in Table 2 show that people who report a positive practical experience with democracy tend to care more for the environment than their counterparts who do not have the same experience. The baseline finding of a positive association between experience with decentralisation and attitudes to the environment remains robust to the inclusion of the full set of personal and household characteristics, and country and cohort effects.

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<sup>9</sup> Indeed, the literature distinguishes between diffuse support (values) for democracy from specific support (based on experience), which are not incompatible: people can embrace and uphold democratic values while having a more critical attitude to how democracy works in practice (Norris, 1999; Dahlberg and Holmberg, 2014; Magalhães, 2016; Wike and Fetterolf, 2018; Wike et al., 2019). In other words, attitudes to democracy depend on individuals' views about ideal forms of government, while satisfaction with how democracy works in practice emphasises personal experience and is related to more specific support for the political system and what it delivers.

Table 2. **Decentralisation and trust in government: Robustness results**

	Baseline	1	2	3	4					
Decentralisation	0.07 (0.028)	**	0.07 (0.028)	**	0.06 (0.028)	**	0.06 (0.027)	**	0.07 (0.028)	**
Experience with democracy			0.05 (0.009)	***						
Participation in local elections					0.19 (0.009)	***				
Attachment to the local community							0.22 (0.012)	***		
Trust in government									0.33 (0.020)	***
No. Obs.	87,074		87,074		87,074		87,074		84,715	
No. of countries	60		60		60		60		60	
Model	Ordered probit		Ordered probit		Ordered probit		Ordered probit		Ordered probit	
Country effects	Yes		Yes		Yes		Yes		Yes	
Cohort effects	Yes		Yes		Yes		Yes		Yes	
Prob > chi-sq. ( <i>p</i> value)	0.00		0.00		0.00		0.00		0.00	

Note: Standard errors are reported in parentheses. The regressions include the full set of controls included in the baseline regressions. Statistical significance at the 1, 5, and 10 percent levels is denoted by respectively (\*\*\*), (\*\*), and (\*).

### ***Participation in local elections and attachment to the local community***

An additional robustness check was carried out by including in the baseline regression variables measuring WVS respondents' engagement with the civic and political life of their local community. Since the environment is to a large extent a local public good, and people tend to care about the quality of the environment in which they live, there is likely to be a correlation between residents' attachment to, and engagement with, the local community and attitudes to the environment. At the same time, by bringing government closer to the people, decentralisation itself creates the potential for closer engagement of local residents with the civic and political life of the community where they live (de Mello, 2004 and 2021a; Spina, 2014; Barrett and Brunton-Smith, 2014).

The empirical analysis uses WVS responses to a question of whether or not respondents vote in local elections. The question is coded on a 1-3 scale (with 1 indicating "*always*", 2 indicating "*usually*" and

3 indicating “never”) and is available in the sixth WVS wave. WVS also contains responses to a question of whether or not respondents “see themselves as part of the local community”. The question is coded on a 1-4 scale (with 1 indicating strong agreement) and is available in the last two waves. Responses to both questions were recoded so that the top two categories are coded 1 in the recoded variable, and 0 otherwise.

The parameter estimates, also reported in Table 2, show that people who feel more attached to the community where they live and vote regularly in local elections tend to care more about the environment than their counterparts who do not have the same attachment to and engagement with their local community. Moreover, the baseline finding of a positive association between experience with decentralisation and attitudes to the environment remains robust to the inclusion of the local civic/political engagement indicators, as well as the full set of personal and household characteristics, and country and cohort effects.

### ***Confidence in government***

Confidence in government may be associated with concern for the environment to the extent that people believe the government is willing and able to take care of the environment.<sup>10</sup> As in de Mello (2021c), confidence in government is defined using WVS responses to a question of whether or not respondents have confidence in government, as well as a range of government-related institutions. The question is coded on a 1-4 scale (with 1 indicating “a great deal” and 4 indicating “none at all”) and is available in all waves of WVS since 1990, albeit with differences in the wording of the question. The sixth wave adds precision to the question and refers to the national government, or the one “located in your nation’s capital”.<sup>11</sup> To facilitate the interpretation of the results the responses to the question were re-scaled so that they are presented in ascending order, from the lowest to the highest level of confidence.

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<sup>10</sup> The empirical literature on the drivers of attitudes to the environment suggests that people who are more trusting of strangers, who display higher levels of interpersonal trust, also tend to have more concern for public goods, such as the environment (Meyer and Liebe, 2010; Franzen and Vogl, 2013). As Meyer and Liebe (2010) and Franzen and Vogl (2013), we shed further light on this hypothesis by distinguishing interpersonal trust from confidence in government. The results were nevertheless disappointing and are therefore not reported.

<sup>11</sup> A question about confidence in government, without further qualification, was also included in the 1990-1994, 1994-1998, 1999-2004 and 2005-2008 waves.

The parameter estimates, also reported in Table 2, show that confidence in government is indeed positively correlated with attitudes to the environment. This is in line with the evidence reported by Meyer and Liebe (2010) and Franzen and (Vogl, 2013), even though they find less robust results for confidence in government. In addition, the baseline positive association between exposure to comprehensive decentralisation and attitudes to the environment remains robust to controlling for confidence in government, as well as the inclusion in the regression of the full set of personal and household characteristics, as well as country and cohort effects.

### **3. THE NEXUS BETWEEN DECENTRALISATION AND ATTITUDES TO THE ENVIRONMENT: CROSS-COUNTRY ANALYSIS**

#### **3.1. Insights from the literature**

Public finance theory suggests that environmental policy functions should be assigned to the central government because of the public good nature of environmental protection and the economies of scale involved in the provision of these services (de Mello, 2021d). Decentralisation could lead to a regulatory “race to the bottom” among competing jurisdictions to attract investment, which would result in suboptimal environmental outcomes (Gray and Shadbegian, 2004). By the same logic, in the case of natural resource management, decentralisation could lead to faster resource depletion and soil erosion, for example, than in the case of centralised management due to common pool problems. In the case of emissions, outcomes such as air pollution would be worse under decentralised standard-setting due to failure to account for interjurisdictional spillovers. The same argument would apply in the case of water pollution and a host of interventions related to adaptation and mitigation of the effects of climate change.

Notwithstanding these considerations, environmental quality could improve under decentralisation in jurisdictions setting stricter standards (reflecting not least “not in my backyard” preferences) as a result of horizontal competition to the extent that harmful activities can be exported to jurisdictions with more lenient regulations (Revesz, 1999; Cutter and DeShazo, 2007). This improvement would nevertheless be restricted to the exporting jurisdictions, with uncertain spatial and nationwide net effects, and it could lead to increased disparities in outcomes within countries (Sigman, 2014; Xia et al., 2021). Greater regional

disparities may not necessary reflect a race to the bottom in regulations via harmful horizontal competition, to the extent that regulations setting minimum standards apply nationwide, but it may instead be due to a better recognition of spatial heterogeneity in preferences in decentralised settings. More importantly, decentralisation could result in better overall outcomes to the extent that it improves monitoring and supervision by empowering the subnational governments in regulatory matters and exploiting their “informational” proximity to firms (Levinson, 2003).

Most of the empirical literature on decentralisation and the environment focuses on case studies of specific resource management and environmental protection programmes and on the linkages between decentralisation and outcomes in these areas. The literature is by and large inconclusive, in part because of a wide variety of decentralisation programmes and definition of outcomes across studies. For example, Andersson and Gibson (2006) show that the decentralisation of forest management to the local governments in Bolivia as part of a comprehensive decentralisation programme implemented in the mid-1990s has led to a reduction in unauthorized deforestation in those local governments with better governance capabilities. Wright et al. (2016) find supporting evidence when comparing the experiences of Bolivia and Peru, which have different forest management institutional settings. Moreover, several country-specific studies have focused on China and suggest a negative association between fiscal decentralisation and environmental outcomes (He, 2015; Yang et al., 2020), while others have pointed to a positive relationship, including for energy consumption (Elheddad et al., 2020). In the case of the United States, Potoski (2001) shows that decentralisation is associated with a race to the top in adoption of stricter regulations among the states in the area of emissions standards, but Konisky (2007) finds evidence to the contrary. The cross-country evidence reported by Ji et al. (2020) for a sample of advanced economies suggests that fiscal decentralisation is associated with lower emissions of CO<sub>2</sub>.

### **3.2. Estimating strategy and data**

The main hypothesis to be tested is whether or not decentralisation is associated with an increase in collection of environment-related taxes and spending on environmental protection, while controlling for other drivers of environmental decentralisation. This hypothesis can be tested in a reduced-form panel regression with country and time fixed effects as follows:

$$E_{it} = a_0 + a_i + a_t + a_1 D_{it} + a_2 X_{it} + u_{it} \quad (3)$$

where  $E_{it}$  and  $D_{it}$  are, respectively, environmental fiscal variables (on the revenue and spending sides of the budget) and alternative proxies for government decentralisation for country  $i$  at time  $t$  (in years);  $X$  is a vector of relevant drivers of environmental fiscal outcomes;  $a_i, a_t$  denote respectively country and time effects included to control for unobserved cross-country heterogeneity and to control for global shocks (such as the global business cycle or international oil price fluctuations); and  $u_{it}$  is an i.i.d. error term satisfying usual assumptions of zero mean and constant variance. Equation (3) is estimated by OLS with robust standard errors clustered at the country level.

Our dependent variable,  $E_{it}$ , comprises the revenue of environmental taxes and government spending on environmental protection (both expressed in percent of GDP). The indicators of decentralisation,  $D_{it}$ , are based on the functional composition of government spending and revenue, defined as the subnational shares of government spending and revenue. Data are available from the IMF's Government Finance Statistics database and include updates (up to 2019) by Dziobek et al. (2011).<sup>12</sup> For robustness purposes, we also use an alternative measure based on the authority of the regional governments in policymaking and fiscal-financial management: the Regional Authority Index (RAI) available from Hooghe et al. (2016). The indicator covers 81 countries over the period 1950-2010 and considers two broad aspects of regional authority: self- and shared rule. The self-rule components are based on the policy, fiscal-financial and representation autonomy of the subnational governments within their own jurisdictional borders. The shared-rule components measure the extent of joint prerogatives of subnational governments based on their capacity to influence national legislation and policy.<sup>13</sup>

As for the drivers of environmental fiscal outcomes,  $X_{it}$ , there are many dimensions that can be included, which creates difficulties for model selection. We start off with our initial set of potential candidates based on de Mello and Jalles (2020) and carry out model selection analysis to deal directly with

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<sup>12</sup> Our starting sample includes 70 countries with decentralization data from 1990-2019.

<sup>13</sup> These indicators were used by de Mello and Jalles (2020) to identify the drivers of changes in decentralisation since the Global Financial Crisis. This is because, while the fiscal decentralisation indicators provide useful information on the budgetary resources that are available to the subnational governments, their spending commitments and financial obligations, they do not necessarily reflect the policymaking or managerial authority enjoyed by the subnational jurisdictions.

model uncertainty.<sup>14</sup> In particular, we employ the widely used Bayesian Model Averaging (BMA) and the more recent Weighted-Average Least Squares (WALS) proposed by Magnus et al. (2010). Essentially, BMA treats parameters and models as random variables and attempts to summarise uncertainty about the model in terms of a probability distribution over the space of possible models.<sup>15</sup> WALS is claimed to be theoretically and practically superior to BMA and presents two major advantages over it: its computational burden is trivial, and it is based on a transparent definition of prior ignorance (Magnus et al., 2010). The statistical framework is a classical linear regression model with two subsets of explanatory variables: the focus regressors, which contain explanatory variables that should be in the model for theoretical or economic reasons, and the auxiliary regressors, which contain additional (less certain) explanatory variables. WALS relies on preliminary orthogonal transformations of the auxiliary regressors and their parameters, which greatly reduce the computational burden of this model-averaging estimator and allow for exploiting prior distributions corresponding to a more transparent concept of ignorance about the role of the auxiliary regressors.

Our list of regressors includes real GDP per capita, real GDP growth, inflation, output gap, real GDP growth forecasts, public debt-to-GDP ratio, overall fiscal balance, trade openness and terms of trade. These macroeconomic and fiscal variables are available from the IMF's World Economic Outlook (WEO) database. We also consider financial openness and indices of exchange rate stability and monetary policy independence from the Chinn-Ito Trilemma Indices available online. Population density, labour force participation and the share of agriculture value added are available from the World Bank's World Development Indicators, while the disposable income Gini index comes from Solt's (2020) dataset. Descriptive statistics are available in Appendix B.

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<sup>14</sup> It is well known that the inclusion of particular control variables in any regression can wipe out (or change the signs to) a given bivariate relationship (Easterly and Rebelo, 1993). Thus, it is necessary to consider which information to include in such regressions as control variables.

<sup>15</sup> To evaluate the posterior model probability BMA uses the Bayesian Information Criteria (BIC) to approximate the Bayes factors that are needed to compute the posterior model probability, as discussed in more detail in Raftery (1995), Sala-i-Martin et al. (2004) and Malik and Temple (2009).

### 3.3. Baseline results

The BMA and WALs analysis results for both environment-related tax revenue and spending are reported in Tables 3 and 4. Both techniques include coefficient estimates and standard errors (or t-statistics). The output of the BMA analysis includes additionally the posterior inclusion probabilities (pip) for the different variables.<sup>16</sup> In both tables, the selected regressors to be included in the estimation of Equation (3) are denoted in bold.

Table 3. Environmental tax revenue: BMA and WALs results

	BMA			WALS (Laplace prior)		
	coef.	Std. Err.	pip	Coef.	Std. Err.	t
Real GDP pc	-0.03	0.02	<b>1.00</b>	-0.01	0.02	-0.55
Real GDP growth	0.61	1.07	<b>1.00</b>	0.32	1.01	0.31
Inflation rate	2.37	0.85	<b>1.00</b>	2.65	0.84	<b>3.17</b>
Output gap	0.00	0.01	0.11	-0.01	0.01	-1.02
Real GDP growth forecast	-0.08	0.03	<b>0.96</b>	-0.07	0.02	<b>-3.15</b>
Public debt-to-GDP ratio	-0.01	0.00	<b>1.00</b>	-0.01	0.00	<b>-6.31</b>
Overall fiscal balance	0.00	0.00	0.04	0.00	0.01	0.19
Trade openness	-0.79	0.09	<b>1.00</b>	-0.74	0.08	<b>-8.78</b>
Terms of trade	-0.95	0.23	<b>1.00</b>	-0.75	0.21	<b>-3.53</b>
Financial openness	-0.08	0.15	0.30	-0.17	0.13	-1.33
Exchange rate stability	0.26	0.16	<b>0.81</b>	0.47	0.12	<b>3.99</b>
Monetary policy independence	0.01	0.07	0.08	0.20	0.15	1.28
Population density	0.29	0.03	<b>1.00</b>	0.26	0.03	<b>9.09</b>
Labor force participation	-0.23	0.03	<b>1.00</b>	-0.21	0.03	<b>-7.67</b>
Agriculture value added	0.00	0.00	0.05	-0.01	0.01	-0.78
Disposable income Gini	-6.12	0.48	<b>1.00</b>	0.57	-9.51	<b>-10.89</b>

Note: BMA and WALs stand for Bayesian Model Averaging and Weighted Average Least Squares, respectively. BMA's output includes coefficient estimates, their t-statistics and the pip (probability of inclusion). WALs' output includes coefficient estimates and their standard error and t-statistics. Refer to the main text for further details.

<sup>16</sup> The posterior inclusion probability for any particular variable is the sum of the posterior model probabilities for all the models including that variable. The higher the posterior probability for a particular variable the more robust that determinant for environmental fiscal outcomes appears to be.

Table 4. Spending on the environment: BMA and WALS results

	BMA			WALS (Laplace prior)		
	coef.	Std. Err.	pip	Coef.	Std. Err.	t
Real GDP pc	0.0094	0.006	<b>1.00</b>	0.008	0.009	1.26
Real GDP growth	-0.742	0.536	<b>1.00</b>	-0.688	0.428	-1.61
Inflation rate	0.168	0.301	<b>1.00</b>	0.096	0.307	0.31
Output gap	-0.002	0.001	0.05	-0.003	0.003	-0.94
Real GDP growth forecast	0.0209	0.014	<b>0.74</b>	0.023	0.009	2.51
Public debt ratio	0.001	0.0005	<b>0.97</b>	0.001	0.0003	3.74
Overall fiscal balance	-0.002	0.004	0.35	-0.004	0.002	-1.71
Trade openness	0.197	0.034	<b>1.00</b>	0.179	0.031	5.75
Terms of trade	0.0018	0.023	0.04	0.050	0.107	0.47
Financial openness	0.001	0.011	0.04	0.062	0.043	1.42
Exchange rate stability	-0.023	0.046	0.24	-0.058	0.042	-1.39
Monetary policy independence	-0.197	0.069	<b>0.97</b>	-0.218	0.057	-3.79
Population density	0.057	0.010	<b>1.00</b>	0.052	0.009	5.42
Labor force	0.027	0.009	<b>0.96</b>	0.023	0.007	2.94
Agriculture value added	-0.030	0.005	<b>1.00</b>	-0.025	0.004	-5.64
Disposable income Gini	-0.975	0.271	<b>0.99</b>	-1.029	0.225	-4.57

Note: BMA and WALS stand for Bayesian Model Averaging and Weighted Average Least Squares, respectively. BMA's output includes coefficient estimates, their t-statistics and the pip (probability of inclusion). WALS' output includes coefficient estimates and their standard error and t-statistics. Refer to the main text for further details.

On the basis of this model selection, the results of the baseline regressions are reported in Table 5. All models are estimated by OLS and include an intercept, country and time fixed effects, as well as the full set of regressions selected on the basis of the BMA and WALS analysis (not reported). The baseline results show that the decentralisation of both revenue and spending functions to the subnational levels of government is associated with higher spending on environment-related programmes. These baseline results apply to the sub-sample of developed countries in the sample, but the estimations are much less precise for the (much smaller) sub-sample of developing countries (not shown). Moreover, the association between decentralisation and collection of environment-related tax revenue is estimated less precisely than in the case of government spending on the environment, except for the sub-sample of advanced economies.

Table 5. **Decentralisation and environmental fiscal outcomes: Baseline results**

Regressors/dep.var.	(1) Env. taxes	(2) Env. spending	(3) Env. taxes	(4) Env. spending
<b>Baseline results</b>				
Tax revenue decentralisation (t-1)	0.9211 (0.715)	0.8839*** (0.238)		
Spending decentralisation (t-1)			-0.6690 (0.866)	0.8602** (0.349)
Country fixed effects	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes
No. of countries	51	49	32	30
No. of observations	818	853	414	475
R-squared	0.8572	0.7887	0.8983	0.8438
<b>Advanced economies</b>				
Tax revenue decentralisation (t-1)	1.7582** (0.813)	1.0373*** (0.310)		
Spending decentralisation (t-1)			0.1719 (0.750)	1.4149*** (0.445)
Country fixed effects	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes
No. of countries	31	30	17	16
No. of observations	566	603	271	311
R-squared	0.8316	0.7660	0.8847	0.8276

Note: All models are estimated by OLS and include an intercept, the full set of co-variates selected on the basis of the BMA and WALS analysis, as well as country and time fixed effects, which are omitted for reasons of parsimony. The standard errors reported in parentheses are clustered at the country level. \*, \*\*, \*\*\* denote statistical significance at the 10, 5 and 1 percent levels, respectively.

### 3.4. Robustness analysis

To test the robustness of the baseline results, we experimented with an alternative definition of decentralisation based on the aggregate RAI and its self- and shared-rule components. This is the same indicator used to construct the chronology of comprehensive decentralisation episodes used to identify the treatment and control groups of individuals in the survey-based analysis. These indicators enter the regressions for 2010, which reduces the number of observations and therefore calls for caution in interpreting the results. Notwithstanding this caveat, the parameter estimates reported in Table 6 suggest that the collection of environment-related taxes is higher in relation to GDP in countries where the regional governments have greater self-rule autonomy. The parameter estimates for the shared-rule sub-component and the composite RAI are estimated less precisely.

Table 6. Decentralisation and environmental fiscal outcomes: Robustness analysis

Specification	(1)	(2)	(3)	(4)	(5)	(6)
Regressors/dep.var.	Env. taxes	Env. taxes	Env. taxes	Env. spending	Env. spending	Env. spending
L.n_selfrule	0.0170* (0.011)			-0.0072 (0.008)		
L.n_sharedrule		-0.1094 (0.068)			0.0193 (0.028)	
L.n_RAI			0.0126 (0.010)			-0.0055 (0.007)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	528	528	528	521	521	521
R-squared	0.8477	0.8477	0.8474	0.8041	0.8038	0.8040

Note: All models are estimated by OLS and include an intercept, the full set of co-variates selected on the basis of the BMA and WALS analysis, as well as country and time fixed effects, which are omitted for reasons of parsimony. The standard errors reported in parentheses clustered at the country level. \*, \*\*, \*\*\* denote statistical significance at the 10, 5 and 1 percent levels, respectively.

We also explored the dynamic effect of decentralisation on environment-related spending, given the strong results reported in Tables 5 and 6 for government spending as opposed to taxation. We do so using the local projection method proposed by Jordà (2005) to estimate impulse response functions for the episodes of comprehensive decentralisation identified in Appendix C and used in the individual-level analysis reported in Section 2, which we treat as decentralisation shocks.<sup>17</sup> The specification takes the form:

$$y_{t+k,i} - y_{t-1,i} = \alpha_i + \tau_t + \beta_k DEC_{i,t} + \theta' X_{i,t} + \varepsilon_{i,t}, \quad (4)$$

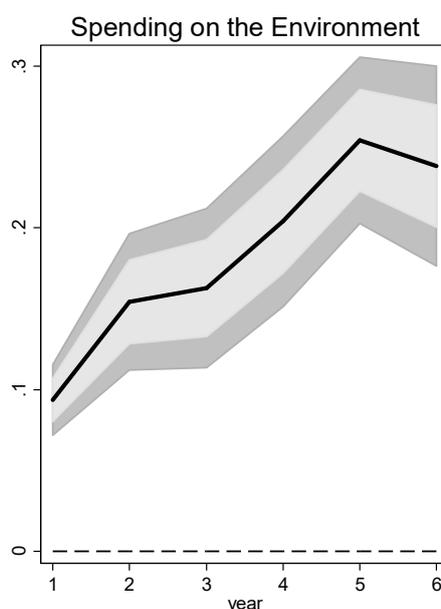
where  $y_{ti}$  denotes spending on the environment (expressed in percent of GDP);  $\beta_k$  denotes the (cumulative) response of the variable of interest  $k$  years after the decentralisation shock;  $\alpha_i$  and  $\tau_t$  are country and time fixed effects, respectively;  $DEC_{i,t}$  denotes the decentralisation shock (reported in Appendix C); and  $X_{i,t}$  is a vector of control variables including two lags of the shock, two lags of real GDP growth and two lags of the relevant dependent variable.

Equation (4) is estimated by OLS. Impulse response functions are obtained by plotting the estimated  $\beta_k$  for  $k = 0, 1, \dots, 6$  with 90 (68) percent confidence bands computed using the standard

<sup>17</sup> This approach has been advocated by Auerbach and Gorodnichenko (2013) and Romer and Romer (2019) as a flexible preferred alternative to (S)VARs.

deviations associated with the estimated coefficients  $\beta_k$ , based on robust standard errors clustered at the country level. The impulse responses show that subnational governments tend to spend more on the environment following episodes of comprehensive decentralisation and that this increase is persistent over time (Figure 1).

**Figure 1. Decentralisation and environmental fiscal outcomes: Dynamic effects  
(Local Projection Method)**



Note: Impulse response functions are estimated for the episodes of comprehensive decentralisation identified in Appendix C. The graph shows the response and both the 90 and 68 percent confidence bands. The x-axis shows years ( $k=1, \dots, 6$ ) after decentralisation shocks; year = 0 is the year of decentralisation. Estimates are based on Equation (4). Standard errors in parentheses are clustered at the country level.

#### 4. DISCUSSION AND CONCLUSIONS

The results from the individual-level survey-based and aggregate cross-country data analyses suggest that decentralisation is associated with more positive attitudes towards the environment and higher government spending on environment-related programmes (and also revenue collection from environmental taxes at least for the sub-sample of advanced economies covered in the empirical analysis). Increases in government spending on the environment also seem to be persistent following episodes of comprehensive decentralisation. These linkages may result from the opportunities for bottom-up policy experimentation and citizen participation in policy design brought about by decentralisation, which may influence attitudes to the environment, as well greater responsiveness of government to changing

attitudes, which in turn influences policy design and the allocation of budgetary resources among competing policy objectives. Disentangling these different causal links is an empirical question for future scholarly work, but it is encouraging that both individual-level survey-based as well as aggregate country-level evidence point to a statistical association between the internal structure of government, attitudes to the environment and policy.

This paper contributes to a growing empirical literature on the association between decentralisation and a variety of societal attitudes, values and preferences, including interpersonal trust (de Mello, 2004) and confidence in government (de Mello, 2021c), just to cite a few. The empirical evidence reported above suggests that the governance and institutional arrangements that bind together the different layers of government have implications that go far beyond those related to the performance of government and the management of the public finances, as envisaged by the earlier literature on fiscal decentralisation (Ter-Minassian, 1997; de Mello, 2000). It suggests that more decentralised settings may put countries in a more favourable position to deal with a host of policy challenges, such as climate change, to the extent that it contributes to shaping more favourable attitudes to the environment and, as a result, allows policymakers to secure public opinion support for policy action in this area. Of course, decentralisation is not, in and of itself, a policy lever that can be deployed primarily in pursuit of environmental objectives, but it is part of the institutional setting in which environment-related policy is designed and implemented, which influences outcomes.

Scholarly work in this area would benefit from enhanced data collection efforts. For example, a finer disaggregation of the aggregate public finance data among the different environment-related tax and spending instruments would allow for more sophisticated hypothesis testing. A finer cross-country comparable repertory of environmental policy instruments, including carbon pricing, subsidies and regulations, as well as their use among the different layers of administration would also help. As for individual-level data, empirical analysis would benefit from more regular dedicated surveys on attitudes towards the environment, as well as complementary data sources, including experimental games.

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## Appendix

Countries covered in the analysis are: Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Turkey, Australia, Brazil, Chile, Colombia, Costa Rica, El Salvador, Honduras, Peru, Cyprus, Israel, Korea, Republic of, Thailand, Mauritius, Albania, Kazakhstan, Bulgaria, China, Ukraine, Slovakia, Estonia, Latvia, Hungary, Lithuania, Mongolia, Croatia, Slovenia, Poland, Romania.

### A. Descriptive statistics: Individual-level analysis

	Mean	St. Dev.	Median	Max	Min	N
Attitudes to the environment	4.5	1.3	5.0	6	1	87,239
Age	41.9	16.6	40.0	102	16	89,385
Married	0.6	0.5	1.0	1	0	89,565
Head of household	0.4	0.5	0.0	1	0	89,565
Male	0.5	0.5	0.0	1	0	89,565
No child	0.3	0.5	0.0	1	0	89,565
Ethnicity (white=1)	0.1	0.3	0.0	1	0	89,565
Education (primary=1)	0.1	0.3	0.0	1	0	89,565
Employment (full-time=1)	0.3	0.5	0.0	1	0	89,565
Civil servant	0.2	0.4	0.0	1	0	89,565

Source: Authors' calculations based on WVS data.

### B. Descriptive statistics: Country-level analysis

	Mean	St. Dev.	Max	Min	N
Real GDP pc	4.34	2.183	11.313	0.351	1649
Real GDP growth	0.029	0.035	0.224	-0.163	1623
Inflation rate	0.096	1.045	40.278	-0.214	1574
Output gap	-0.228	3.057	23.069	16.798	1412
Real GDP growth forecast	3.357	1.800	15.621	-3	1354
Public debt ratio	53.23	35.283	284.069	3.765	1463
Overall fiscal balance	-1.926	4.404	47.383	32.076	1510
Trade openness	0.863	0.503	4.083	0.141	1620
Terms of trade	0.991	0.157	2.312	0.424	1625
Financial openness	0.688	0.343	1	0	1509
Exchange rate stability	0.551	0.299	1	0.003	1650
Monetary policy independence	0.349	0.234	0.958	0	1546
Population density	4.167	1.349	7.287	0.367	1625
Labor force	1.642	1.597	6.695	-2.245	1591
Agriculture value added	5.267	5.673	38.477	0.214	1427
Disposable income Gini	0.327	0.078	0.608	0.190	1601

Source: Authors' calculations based on the datasets mentioned in the main text.

### **C. Comprehensive decentralisation episodes**

Transition economies: Croatia (1993), Czech Republic (2000) and Slovak Republic (2002).

Latin America and the Caribbean: Argentina (1973 and 1983), Brazil (1988), Ecuador (1967), Peru (2003) and Venezuela (1961).

Asia: New Zealand (1974), Indonesia (2001) and South Korea (1991).

Europe: Belgium (1970 and 1989), Finland (1993), France (1982), Greece (1994), Italy (1970), Norway (1975), Spain (1978) and United Kingdom (1999).