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Social R&D: Does academic freedom contribute to improved societal outcomes?

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ABSTRACT

The economics literature views R&D as an important conduit for growth because it generates new ideas that can be translated into technological innovations. Some of this R&D occurs in universities, making academic freedom an important part of this process. This literature ignores the potential role that academic research in the social sciences plays toward achieving non-commercial societal outcomes. We bridge this gap by proposing that academia generates social R&D. We posit that greater degrees of academic freedom allow for social R&D to flourish and be transformed into policies that improve societal conditions. We test our hypothesis by studying the relationship between academic freedom and inequality using panel data of 132 countries over the 1967–2018 period. We measure academic freedom using an index developed by the V-Dem Institute. Our econometric analysis suggests that an increase in the index is associated with a decrease in inequality. We employ instrumental variable and interactive fixed effects techniques to try to lend support to the causal relationship between academic freedom and inequality. We argue that this negative relationship can be explained by academia, predominantly the social sciences, exerting pressure on governments to enact policies that redistribute wealth. We find evidence in support of this mechanism using data from other sources.

1. Introduction

The economics literature places academic freedom within endogenous growth theory (Romer, 1990). Essentially, if economic growth is a function of human capital and R&D, then a vibrant and free academic community, free to undertake R&D, is an important conduit for growth. Academic freedom, therefore, is deemed important because it generates new ideas that can be translated into technological innovations, leading to new products and economic growth (Jaffe, 1989; Aghion et al., 2008; Berggren and Bjørnskov, 2021). In this setting, academics are thought of as engineers, physicists or computer scientists developing new products, such as Wifi, with significant real-world commercial applications.

While these areas of innovation are important, the existing literature ignores the potential role that research in the social sciences can play toward achieving non-commercial societal outcomes. This paper bridges this gap by proposing that academia also generates a type of social R&D, which focuses on improving societal conditions. Innovations in economics, political science and sociology can translate into new policies that aim to address social problems.[1] We posit that greater degrees of academic freedom allow for social R&D to flourish and be transformed into policy. Societies with a greater degree of scholarly freedom will arguably be more likely to explore social issues critically, assess situations using both quantitative and qualitative data, and discuss their findings openly with a view to influence public debates. We present a conceptual model that discusses the channels through which academic freedom may influence social policy. Here university-government collaboration leads to the creation of new knowledge, which is reinforced and shared through formal and informal cross-institutional linkages. We then test our hypothesis by studying the relationship between inequality and academic freedom across countries. We argue that inequality is a relevant dependant variable in this setting given the preoccupancy that this issue has received in both classical and modern research (Christiansen and Jensen, 2019).

Inequality, for example, has been analysed in association with trade, economic growth, and education, while a large field in political economy looks at institutional factors and labor market characteristics (Roser and Cuaresma, 2016). Researchers have also stud-

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[1] This is, of course, an important goal of many modern academic departments (Oliver and Cairney, 2019).

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ied different forms of inequality, including gender, ethnic-based, intergenerational, and geographical (Arrow, 1998; Erikson and Goldthorpe, 2002; Ponthieux and Meurs, 2015; Veenstra, 2011). Inequality has fuelled debates in social science and addressing it has influenced policy levers such as tariffs, taxes, subsidies and employment policies (Chaudhuri et al., 2018; Diamond and Saez, 2011). More generally, discussions on inequality and how to address it are central to the classical theories of Marx, Weber, Rousseau, Kuznets, Stolper and Samuelson, and several others (Christiansen and Jensen, 2019).

Our econometric analysis uses cross-country panel data consisting of 1497 observations from 132 countries over the period 1967 to 2018. Academic freedom is proxied with the index developed by the V-Dem Institute (Kinzelbach et al., 2021; Spannagel et al., 2020). The Academic Freedom Index (AFI) provides an aggregated measure that captures the *de facto* realization of academic freedom ranging from 0 (low) to 100 (high). It is made up of the following five indicators: (i) freedom to research and teach, (ii) freedom of academic exchange and dissemination, (iii) institutional autonomy, (iv) campus integrity, and (v) freedom of academic and cultural expression. The index is developed by asking approximately 2000 country experts to rate each of the indicators using a 5-point Likert scale. We match the AFI to inequality (Gini coefficient) data from the World Bank's World Development Indicators. This data set also provides us with a list of controls, normally included in regressions as determinants of inequality. In robustness exercises, we also employ an alternative data set that provides us with a longer time series (1902–2018). We use four alternative inequality indicators based on the share of income or wealth held by the richest 10 and 1 per cent, respectively. The wealth data is available for 8 countries, while the income data is available for 147 economies. The longer time coverage of these data means that we are only able to use a limited number of controls due to unavailability.

Our baseline analysis relies on standard country-level fixed effects regressions. In robustness exercises, we address potential endogeneity bias using instrumental variable (IV) as well as interactive fixed effects (IFE) techniques. Endogeneity is potentially problematic because greater inequality could lead to less demand for tertiary studies, naturally curtailing the academic sector. We use data on publications of scientific and technical journal articles per country by year as instruments for academic freedom. We show evidence to suggest that our instrument choice is adequate, albeit potentially weak. Our baseline regressions suggest that an increase in the AFI by one standard deviation is associated with a statistically significant decrease in the Gini coefficient by 0.10 index points. Our IV, IFE estimates and robustness exercises give consistent results.

We argue that the negative relationship between academic freedom and inequality can be explained by academia, predominantly the social sciences, exerting pressure on governments to enact policies that redistribute wealth. We test this mechanism by examining the relationship between academic freedom and institutional environment using data from the Worldwide Governance Indicators and the Country Policy and Institutional Assessment (CPIA). Our analysis shows a positive and statistically significant relationship between academic freedom and control of corruption, rule of law, regulatory quality, voice and accountability, gender equality, and policies for social protection. Those findings are broadly supportive of our hypothesis.

We contribute to a small literature on the economic consequences of academic freedom. As argued above, the existing literature can be placed within the broader endogenous growth literature (Romer, 1990) that treats academia as a conduit between innovation and total factor productivity. For example, Aghion et al. (2008) study the respective advantages and disadvantages of academic and private-sector research and identifies, theoretically, the process by which an idea transitions from academia to the private sector. These authors' definition of academic freedom differs from ours in that it focuses on freedom to pursuit ideas, even if those may have little potential commercial value. The value of those ideas to an economy is simply put that often the potential commercial worth of a new idea cannot be ascertained until an idea is well developed. Academic freedom, in this case, from coercion from the private sector, ensures that academia can produce innovations without clear commercial relevance at inception.

Berggren and Bjørnskov (2021) provide an empirical assessment of the relationship between academic freedom, labor productivity, and total factor productivity growth using panel-data of 127 countries over the 1960–2015 period. They find that productivity is unrelated to academic freedom, unless the latter is interacted with the quality of judicial institutions. They show that marginal effect of academic freedom on productivity is positive and increasing when the quality of the judicial system is sufficiently high. Their findings suggest that institutional quality is vital for academic innovations to be employed by the private sector.

We contribute to this literature by looking at a previously unexplored association between academic freedom and social equity, namely inequality. Our approach is also different to previous studies in that our premise does not focus on the value of academic research to firm-level productivity and technological innovation, but on the influence that academia may have on social policy. As such, our approach recognises that universities produce innovative material in subjects such as economics, sociology, geography, political science, and anthropology. Our focus is, therefore, not on R&D resulting in technological innovation, but rather on social R&D resulting in policy innovation.

As such, we also contribute to a broader literature on academic freedom in social science.[2] This literature can be categorised into two interrelated components: (i) normative and (ii) positive. The latter component can be further divided into two additional categories: (i) the determinants and (ii) consequences of academic freedom. The broad philosophical and normative literature focuses on the benefits of academic freedom to researchers, students, and society. This literature addresses issues such as the history of academic freedom in Europe and elsewhere (Thorens, 2006; Mama, 2006) as well as its broad societal implications, in particular its role in reinforcing free speech and democracy (Bok, 2021).[3] While this study focuses on a positive, not normative, analysis of academic freedom, its normative implications are clear – academic freedom is an important conduit for social progress, leading to policy innovation and societal betterment.

The positive literature can be further divided into two strands. The first focuses on outcomes of academic freedom. Above we discussed the literature on economic growth and academic freedom as well as our contribution to this literature. Other studies in this field focus on less well-defined societal implications. For example, Eicher et al. (2018) suggest that academic freedom improves social infrastructure, which is broadly defined as the institutions and government policies that determine the economic environment. We contribute to this literature by more specifically highlighting a relationship between academic freedom and a societal outcome of policy relevance and academic interest – inequality. The second strand of the positive literature focuses on the determinants of academic freedom. Not surprisingly, the existing literature finds that political institutions positively affect academic freedom. Berggren and Bjørnskov (2022) find that democracy improves academic freedom. More specifically, they argue that bicam-

[2] There is also a related literature on academic efficiency or productivity (for a review see Rhaiem 2017). While freedom and efficiency are likely correlated, this relationship has not been empirically explored.

[3] For a comprehensive review of this literature see Karran (2009).

eral legislatures and judicial accountability promote academic freedom. Overall, their findings suggest that limiting the power of the state strengthens and gives a voice to academia.

The rest of the paper is structured as follows. Section 2 presents a basic conceptual framework. Section 3 discusses the empirical strategy and data. Section 4 summarises our results and the final section concludes.

2. Conceptual framework

The conceptual framework adopted in this study is used to explain channels through which university research can influence social policy. To do so, we build on a well-establish literature that discusses how the university-government nexus leads to firm-level innovation. The underlying framework through which collaboration leads to innovation is based on the Triple Helix model (Etzkowitz and Leydesdorff, 1998, 2000; Abbas et al., 2019).

According to the Triple Helix-III model, university-government collaboration leads to the creation of new knowledge (innovation), which is used by firms in the creation or adaptation of new products. Conceptually, this process is similar to the one described in the endogenous growth literature (Romer, 1990). The Triple Helix III model, however, suggests that the underlying mechanism is that innovation leads to university spin-off firms, tri-lateral initiatives for knowledge-based economic development, and strategic alliances among firms, government laboratories, and research groups (Etzkowitz and Leydesdorff, 2000). In essence, this is the process of commercialization of ideas, which is summarised in Appendix Fig. A1.

In our version of Triple Helix, university-government collaboration loops back to influence government policy. We argue that formal and informal collaboration is crucial to this process. Conceptually, our model can be described using Fig. 1 below.

In Fig. 1, close collaboration between the government and universities leads to the creation of new knowledge, which in turn, influences policy. Collaboration, here, can mean either formal or informal cross-institutional (i.e., government-academia) linkages. Some examples of these linkages include cross-institutional (i) membership of research societies, (ii) attendance to conferences, (iii) joint work, and (iv) presentations at university seminars and government meetings. Other channels could reflect those present in industry with, for example, the creation of strategic alliances among government bodies, civil society, and academic research groups.

We now discuss this collaboration process more formally by conceptually addressing the mitigating role that academic freedom plays. We do so with a simple model with two sectors: (i) government and (ii) the academy.

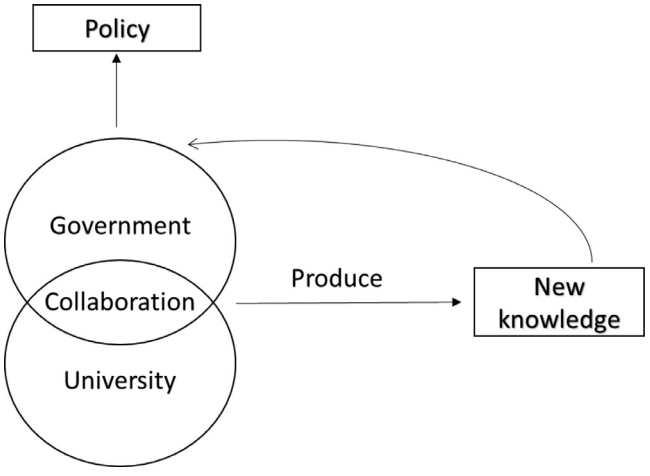

Fig. 1. Conceptual Model.

In the academy, academic j produces a socially valuable idea (i.e., a new policy) at period t with probability p. The probability of an idea being successful depends on the number of researchers who can openly collaborate, discuss, and disseminate their work – that is, on academic freedom. Altogether the number of socially implementable ideas, I, is given by

$$I_t = p(AF)\sum_{j=1}^{N} i_t^j, \tag{1}$$

where i_t^j denotes an idea by academic j in period t, AF denotes academic freedom, and $p'(AF) > 0$. The adoption of I_t into policy by the government sector depends on the ability of the academic sector to openly discuss their ideas, findings, and recommendations with the government sector. In other words, this depends on academic freedom. More formally, adoption (∇) is given by

$$\nabla = f(AF,\ I_t(AF)). \tag{2}$$

Eq. (2) suggests that the adoption of academic ideas into social policy by the government unambiguously increases with academic freedom via two mechanisms acting both on the supply of and demand-side for ideas. In practice, there are likely to be a host of factors that also determine ∇, including the complementarity of I_t with the government's ideology and pool of existing policies, the capacity of the government to implement any new policies, and the quality of the public sector. Varying these factors will lower ∇, although we would not expect that these variables significantly conflate the relationship between AF and ∇.

In practice, ∇ and I_t are unobserved to the econometrician. Therefore, to test whether AF indeed leads to an increase in ∇, we need to make an assumption about ∇ leading to improved societal outcomes.[4] The remainder of this paper focuses on inequality under the assumption that academics are recommending, influencing and advocating for redistributive policies. This assumption is based on the notion that in economics, sociology, anthropology, and political science, inequality has traditionally played a central role influencing research from Jean-Jacques Rousseau and Karl Marx to Simon Kuznets and Thomas Piketty and, in most of these writings, (too much) inequality is perceived as bad from a societal perspective (Christiansen and Jensen, 2019).

3. Empirical strategy and data

3.1. Model specification and estimation strategy

To investigate the relationship between academic freedom and inequality, we specify the following model:

$$INEQ_{it} = \beta_0 + \beta_1 AF_{it} + \beta_2 \boldsymbol{X}_{it} + \upsilon_{it} \tag{3}$$

where subscripts i and t denote country and year, respectively. The dependant variable, $INEQ$, is income inequality. AF denotes academic freedom, discussed in more detail below. $\boldsymbol{X}$ is a vector of control variables commonly employed in empirical investigations of inequality (Roine et al., 2009). These variables include GDP per capita and its quadratic term, population, trade, government expenditure and savings. υ_{it} is the error term.

For our baseline regression, we estimate Eq. (3) using a panel fixed effects (FE) estimator. However, we acknowledge that our empirical results might suffer from endogeneity. For instance, societies with higher levels of inequality could potentially curtail academic freedom by limiting broad demand for tertiary studies.

[4] This essentially suggests that the pool of ideas is effective.

These societies could also exert political pressure on the academic sector not to question the *status quo*, again limiting academic freedom. In addition, as is the case with most empirical studies, it is impossible to control for the universe of explanatory variables in the model. This gives rise to omitted variable bias.

To address these concerns, we resort to two methods. First, we use two instrumental variables (IV) for academic freedom. Our main IV is the number of publications in scientific and technical journal articles. We expect that this variable meets the exclusion restriction, given that it is unlikely that the number of scientific publications directly affects inequality. Moreover, the IV is relevant, given that publications are correlated with academic freedom. Academic freedom is likely impacted by the number of publications coming out of that country, albeit the *a priori* expectation as to the relationship between these two variables is ambiguous.[5] We adopt patent applications as alternative IV. The literature shows that while patent policy will impact inequality, the number of patent application is not (at least directly) related to inequality (Chu, 2010). Similar to our main IV, academic freedom is likely associated with the number of patent applications in a country and exhibit first-stage F-statistics that support our intuition. The results presented in Appendix 3 reinforce our core findings.

Our second approach to deal with potential endogeneity relies on an interactive fixed effects (IFE) structure for the error term. We denote that $v_{it} = f_t^{'}\lambda_i + \varepsilon_{it}$, where $f_t^{'}\lambda_i$ possesses a factor structure as in Pesaran (2006) and Bai (2009), and ε_{it} is a normally distributed mean-zero error term. Panel data with interactive fixed effects have been broadly applied in various contexts (see, e.g., Bai et al., 2009; Kapetanios et al., 2011; Casas et al., 2021; Awaworyi Churchill et al., 2021a, 2021b). This approach takes into account typical issues associated with panel model estimation such as cross-sectional dependence, non-stationary properties of the variables, and endogeneity (Casas et al., 2021). The IFE model address endogeneity by allowing the common effects to vary across countries, and simultaneously allowing them to exhibit an arbitrary degree of correlation among themselves and with the individual-specific regressors (Pesaran, 2006).[6] Intuitively, IFE models address endogeneity by incorporating an interactive effects structure for the error term that takes into account common shocks likely to be correlated with both academic freedom, inequality and other covariates.

3.2. Data

The baseline models rely on a cross-country panel data set covering 132 countries at low-, middle- and high-income levels over the period 1967 to 2018. These countries are chosen based on the availability of data.[7] Our main measure of inequality is the Gini coefficient from the World Bank's World Development Indicators (WDI). The Gini coefficient measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.

Data on academic freedom (*AFI*) come from Kinzelbach et al. (2021) and Spannagel et al. (2020) (V-Dem Institute). Following a UNESCO *Recommendation concerning the Status of Higher-Education Teaching Personnel* adopted in 1997, Spannagel et al. (2020) designed an index that provides an aggregated measure that captures the *de facto* realization of academic freedom. The index, ranging from 0 (low) to 100 (high),[8] consists of five indicators on academic freedom: (i) freedom to research and teach, (ii) freedom of academic exchange and dissemination, (iii) institutional autonomy, (iv) campus integrity, and (iv) freedom of academic and cultural expression. Approximately 2000 country experts were asked to answer the following questions using a five-point Likert to create each component of the index. (i) To what extent are scholars free to develop and pursue their own research and teaching agendas without interference? (ii) To what extent are scholars free to exchange and communicate research ideas and findings? (iii) To what extent do universities exercise institutional autonomy in practice? (iv) Campus integrity is fundamentally undermined by extensive surveillance and severe intimidation, including violence or closures. (v) Is there academic freedom and freedom of cultural expression related to political issues? The index is obtained through aggregation by point estimates drawn from a Bayesian factor analysis model. A high value of the index means a high level of academic freedom. Unless otherwise specified, data on other variables are sourced from the World Bank's World Development Indicators database.[9]

For robustness checks, we use data from the World Inequality Database to obtain information over a longer period (1902–2018).[10] We use four types of indicators: (i) income share of the top 10 per cent, (ii) income share of the top 1 per cent, (iii) wealth share of the top 10 per cent, and (iv) wealth share of the top 1 per cent. Net personal wealth is the total value of financial and non-financial assets (i.e., housing, land, deposits, bonds) held by households minus their debts. Data on income inequality are available for 147 countries over the period1902 to 2018. Data on wealth inequality are only available for 8 countries (China, France, India, Republic of Korea, Russia, South Africa, the United Kingdom and the United States) mostly from 1995. Long-term data on academic freedom is sourced from Kinzelbach et al. (2021) and Spannagel et al. (2020), while controls come from the Maddison Historical Statistics 2020 Release.[11] Appendix Table A1 presents summary statistics and a detailed description for each of the variables.

4. Results

4.1. Baseline results

Panel A in Table 1 presents the baseline results for the relationship between academic freedom and the Gini coefficient with different combinations of explanatory variables. The results in Column 1 show the estimate of academic freedom from a panel fixed effect (i.e., country fixed effects) model. Column 2 conducts an identical analysis, but with the full set of explanatory variables using both country and time fixed effects. Column 3 is identical to Column 2 but includes democracy as additional covariate. Democracy is measured using the Polity2 variable compiled by the Centre for Systemic Peace (CSP).[12] The measure captures political regime authority spectrum on a 21-point scale ranging from −10 (hereditary monarchy) to +10 (consolidated democracy). Following the recommendations in Angrist and Pischke (2008), democracy does

[5] On the one hand, countries with higher level of academic freedom foster rigorous research environment thus potentially leading to more publications. On the other hand, a negative correlation may stem when governments with a greater extent of control over academia exert pressure on universities to publish a high number of studies, albeit not in high quality outlets. The first stage regression results are consistent with the second interpretation.

[6] Interested readers are referred to Bai (2009) and Pesaran (2006) for a detailed explanation on panel data model with an interactive factor structure.

[7] Appendix Table A2 provides a list of countries included in the sample.

[8] For ease of interpretation, we multiple the original index by 100 so that it has the same range with Gini coefficient.

[9] https://databank.worldbank.org/source/world-development-indicators (accessed on November 1, 2021)

[10] https://wid.world/wid-world (accessed on October 26, 2021)

[11] https://www.rug.nl/ggdc/historicaldevelopment/maddison (accessed on November 1, 2021)

[12] http://www.systemicpeace.org/inscrdata.html (accessed on November 1, 2021).

Table 1
Inequality versus academic freedom, fixed effects, IV and IFE results.

Dependant variable: gini efficient			
Panel A: Baseline results			
	(1)	(2)	(3)
Estimation method		Panel FE	
Academic freedom	−0.046**	−0.041**	−0.059***
	[−0.116]	[−0.103]	[−0.150]
	(0.019)	(0.018)	(0.016)
Other controls	No	Yes	Yes
Time FE	No	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	1493	1497	1442

Panel B: IV 2SLS and IFE estimation		
	(1)	(2)
Estimation method	IV 2SLS	IFE
Instrument	Publications	–
Academic freedom	−0.339*	0.031***
	[−0.874]	[−0.078]
	(0.191)	(0.012)
Other controls	Yes	Yes
First-stage F	10.202	–
Time FE	Yes	Yes
Country FE	Yes	Yes
Interactive FE	–	Yes
Observations	1174	1484

Notes: Other controls include GDP per capita and its quadratic term, population, trade, government expenditure and savings. In addition to these covariates, Column (3) in Panel A controls for democracy. Data on democracy is obtained from the Centre for Systemic Peace (CSP). Publications, defined as scientific and technical journal articles, is sourced from the World Development Indicators (WDI), the World Bank and is available for the period 2000–2018. Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. ***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.
Abbreviations: FE – Fixed Effects; IV 2SLS – Instrument Variable Two Stage Least Squares; IFE – Interactive Fixed Effects.

not enter our preferred specification (Column 2) because it is potentially a 'bad control'.[13]

Across the three columns, academic freedom is negatively associated with the Gini coefficient. In Column 1, the estimated coefficient on academic freedom is statistically significant at 5 per cent level and suggests that a standard deviation increase in academic freedom is associated with 0.12 standard deviation decrease in the Gini coefficient. In Column 2, the estimated coefficient is statistically significant at the same level and shows that a standard deviation increase in academic freedom is associated with 0.10 standard deviation decrease in the Gini coefficient. In Column 3, we show evidence that a standard deviation increase in academic freedom is associated with a 0.15 standard deviation decrease in the Gini coefficient. In this case, the coefficient estimate is statistically significant at the 1 per cent level.

4.2. Results from IV and IFE models

As noted earlier, our baseline results may suffer from endogeneity. We report two sets of results in Panel B in Table 1 that deal with this potential concern: (i) 2SLS results in Column 1, where academic freedom is instrumented using *publications*; and (ii) IFE results in Column 2. The first-stage *F* statistics from the 2SLS regressions are above the Stock-Yogo threshold of 10, but not above the latest recommended level of 104 (Lee et al., 2022). Therefore, below, we address this concern with an Anderson-Rubin (AR) test of weak instruments. Those results support our core findings.

[13] 'Bad controls' are variables that are themselves outcome variables. In this case, democracy is a likely outcome of academic freedom.

Column 1 in Panel B shows that a standard deviation increase in academic freedom is associated with 0.87 standard deviation decrease in the Gini coefficient.[14] Using IFE estimation, we obtain a similar finding – a standard deviation increase in academic freedom is associated with a 0.08 standard deviation decrease in the Gini coefficient. Across the two columns, the coefficient on academic freedom is negative and statistically significant, reinforcing the findings from the baseline results.

Appendix Table A3 shows a set of instrumental variable results using patent applications (Column 1, Panel A) as instruments. We again show evidence to suggest that this instrument choice meets the Stock-Yogo thresholds and that instrumented academic freedom is negatively associated with inequality. In Column 2, Panel A of Table A3 we show IV results using both publications and patents as instruments. The results are consistent and similarly sized. Finally, Panel B of Table A3 shows the first stage results of all the instrumental variables exercises. The results give further impetus to the use of this instrument set.[15]

While our first-stage F-statistics suggest that our instrumental variable strategy identifies our model, these statistics are near the recommended cut-off (10). This can be particularly problematic in light of recent evidence in Lee et al. (2022) that shows that confidence intervals from IV estimates will be biased all the way up to a first-stage statistic of 104.7. One way to address this concern is to perform an Anderson-Rubin (AR) test of weak instruments. The AR test produces a range of values to test the assumption of instrument relevance over a wide range of hypothesized values of the instrumented coefficient estimate of interest (beta). Fig. 2 shows that it is extremely unlikely that instrument weakness is affecting our results – the figure shows evidence for *publications* (left) and patent applications (right).

4.3. What aspect of freedom influences inequality?

As mentioned above, the AFI is made up of five components, each measured using a Likert scale. In this section, we decompose the AFI to investigate which of its dimensions is influencing inequality. We estimate identical version of Column 2 in Table 1, alternatively replacing academic freedom with each of its components. The results are presented in Appendix Table A5, where each column focuses on one component of the index as follows: (1) freedom to research and teach, (2) freedom of academic exchange and dissemination, (3) institutional autonomy, (4) campus integrity, and (5) freedom of academic and cultural expression.

Altogether, the results show a negative relationship between inequality and each component of academic freedom. Moreover, Columns 2, 3 and 4 show evidence that freedom to research and teach, freedom of academic exchange and dissemination, and institutional autonomy are negatively and significantly associated with the Gini coefficient.

4.4. Results using the longer-term data set

In this section we test whether our core results hold when using alternative measures of inequality. The top panel in Ap-

[14] It is worth pointing out that IV approach estimates the local average treatment effect (LATE), that is, the treatment effect for the subset of the sample that are treated. It is an average "local" to countries whose inequality changes when they experience increase or decrease in academic freedom. Therefore, this causal effect cannot be compared with the average treatment effect (for the entire sample) if could be consistently estimated by the Ordinary Least Square (OLS) type of regression. To save space, results from first stage IV 2SLS estimation are presented in Column (1) of Panel B at Appendix 3.

[15] Appendix Table A4 shows the IV and IFE results with democracy as an additional control. The IV results are consistent, while those from the IFE model are insignificant.

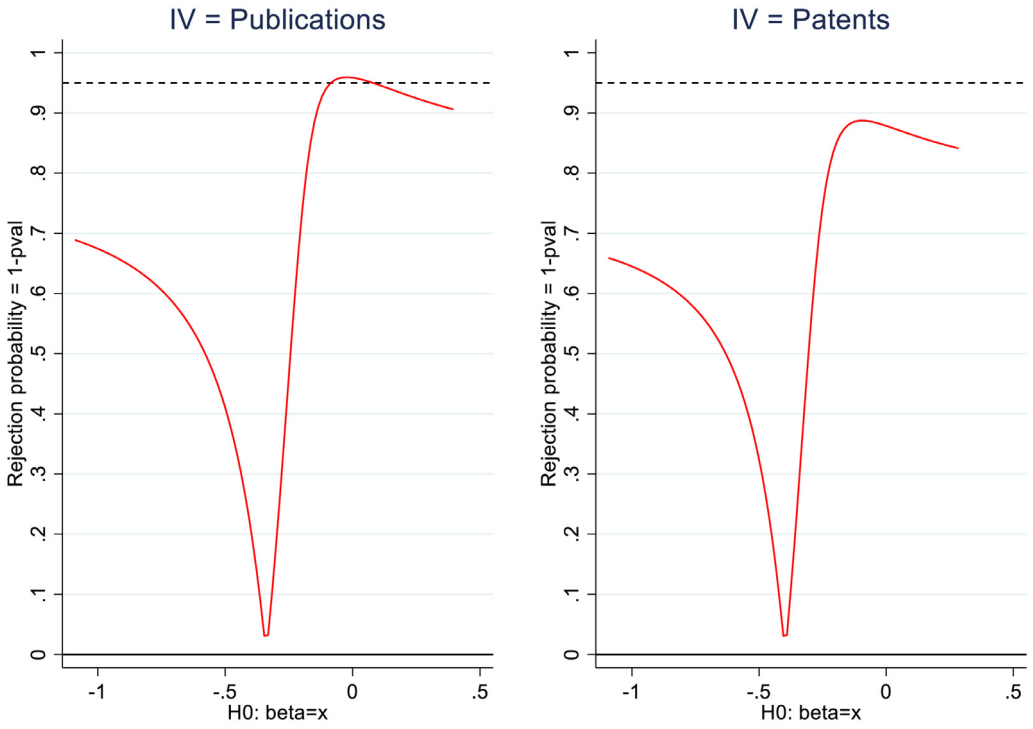

Fig. 2. Results from Anderson-Rubin test of weak instruments.
Notes: Results are obtained from instrumental variable regressions with two-way fixed effects. The dependant variable is the Gini coefficient. Patents, publications refer to patent applications, scientific and technical journal articles, respectively. All regressions include the following controls: GDP per capita and its quadratic term, population, trade, government expenditure and savings. Standard errors clustered at the country level. IV refers to instrumental variables.

pendix Table A6 shows the results focusing on the income share of the richest 10 (column 1) and 1 (column 2) per cent, respectively. These data are available for 147 countries over the period 1902 to 2018. The bottom panel shows their wealth counterparts, which have data available mostly from 1995 for eight countries.

The top panel exhibits a negative, albeit imprecisely estimated, relationship between academic freedom and the income share held by the richest 10 and 1 per cent, respectively. The bottom panel shows a negative and statistically significant relationship between academic freedom and wealth inequality. As an additional test, we also re-estimated the top panel using data covering the 1968–2018 period, which coincides with the data available for the analysis using the Gini index. Those results are consistent with those found in Panel A, Table A6.

It is important to highlight that while our core results and robustness exercises are consistent, the Gini coefficient and income shares do not measure inequality in the same way. Therefore, we should not, *a priori*, expect identical results. The Gini captures inequality of the entire income distribution, while income shares focus on the rich (10%) and super-rich (1%). It is possible, therefore, that differences between our core results and those in Panel A of Table A6 are owed to policy changes stemming from academic freedom being more successful at impacting changes to the middle of the income distribution, rather than its top. Simultaneously, income and wealth shares measure different things. It is plausible that academics influence policies aiming at wealth redistribution, such as inheritance taxes, rather than income taxes. Indeed, there is an established and potentially influential academic literature that shows that wealth inequality is much more prominent than income inequality (De Nardi, 2004). The latter may have, potentially, resulted in targeted policy initiatives.

4.3. Mechanisms

We sustain that academic freedom lowers inequality because social scientists study societal problems and are able to exert pressure on governments to enact policies. If our hypothesis is correct, then we should find some evidence to suggest that academic freedom may be influencing policy. One way to test this proposition is to use indicators associated with better policy effectiveness and social inclusion. To do so, we employ data from the World Bank's Worldwide Governance Indicators (WGI) and Country Policy and Institutional Assessment (CPIA). The WGI project reports six dimensions of governance for countries and territories across the globe over the period 1996 to 2020. These dimensions are: (i) voice and accountability; (ii) political stability and absence of violence/terrorism; (iii) government effectiveness; (iv) regulatory quality; (v) rule of law; and (vi) control of corruption.[16] These are widely used measures of institutional quality, which capture governance perceptions as reported by survey respondents, nongovernmental organizations, commercial business information providers, and public sector organizations (Kaufmann et al., 2011). The CPIA assesses the "*conduciveness of a country's policy and institutional framework to poverty reduction, sustainable growth, and the effective use of development assistance*" against a set of 16 criteria grouped in four clusters: (i) economic management; (ii) structural policies; (iii) policies for social inclusion and equity; and (iv) public sector management and institutions.[17] We focus on the third cluster and employ the following measures: (i) gender equality, (ii) social protection and labor, and (iii) environmental sustainability. The ade-

[16] http://info.worldbank.org/governance/wgi (accessed on October 26, 2021).
[17] https://datacatalog.worldbank.org/search/dataset/0038988 (accessed on October 26, 2021).

Table 2
Academic freedom versus governance and social policy measures, panel FE results.

Panel A

	Dependant variable: wgi indicators				
	(1)	(2)	(3)	(4)	(5)
	Control of corruption	Rule of law	Regulatory quality	Voice and accountability	Government effectiveness
Academic freedom	0.005***	0.006***	0.004**	0.015***	0.002
	[0.102]	[0.133]	[0.106]	[0.400]	[0.046]
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Other controls	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	1207	1207	1204	1204	1204

Panel B

	Dependant variable: cpia indicators		
	(1)	(2)	(3)
	Gender equality	Social protection	Sustainability
Academic freedom	0.009*	0.006*	0.020***
	[0.284]	[0.289]	[−0.104]
	(0.005)	(0.003)	(0.007)
Other controls	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	168	165	168

Notes: Other controls include GDP per capita and its quadratic term, population, trade, government expenditure and savings. WGI (World Governance Indicators), which is available for the period 1996–2018, is obtained from the World Bank (http://info.worldbank.org/governance/wgi, accessed on October 26, 2021). CPIA (Country Policy and Institutional Assessment), which is available from the period 2005–2018, is also obtained from the World Bank (https://datacatalog.worldbank.org/search/dataset/0038988, accessed on October 26, 2021). Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. *** and **indicate statistical significance at the 1 per cent and 5 per cent levels, respectively.
Abbreviations: FE – Fixed Effects, WGI – World Governance Indicators; CPIA - Country Policy and Institutional Assessment.

quacy of policies toward each measure is assessed by country experts at the World Bank using a scale of 1(low) to 6 (high).

The results of our exercise, displayed in Table 2, show that academic freedom is positively associated with institutional quality and social inclusion. Using the WGI indicators, a standard deviation increase in academic freedom is associated with 0.005, 0.006, 0.004 and 0.015 increase in control of corruption, rule of law, regulatory quality, and voice and accountability, respectively. We obtain similar findings with the CPIA indicators. A standard deviation increase in academic freedom is associated with 0.009, 0.006 and 0.020 increase in gender equality, social protection, and sustainability.[18]

In Table A7 in the Appendix, we replicate Table 2 using instrumental variables. Panel A shows evidence to suggest that academic freedom positively influences control of corruption, regulatory quality, voice and accountability, and government effectiveness. In all cases the first-stage F statistics are comfortably above 10, but below 104. In Panel B we show evidence of positive, albeit insignificant, associations between academic freedom and the CPIA indicators, although in all instances we marginally fail the first stage F-test. Altogether, the findings in Table 2 and A7 are broadly suggestive that academic freedom is positively correlated with better governance and more equitable policies.

5. Conclusions

Traditionally, economists have understood R&D as a process that provides value to society by creating new products with large commercial value. A significant proportion of this R&D takes place in universities' hard sciences departments. In this paper, we consider whether R&D primarily taking place in universities' humanities departments is also important. We posit that humanities scholars create a type of social R&D, which in the right settings can influence social policy. We test our hypothesis by investigating the relationship between academic freedom and inequality. We focus on inequality because it has preoccupied thinking in the humanities for over a century and has influenced classical thinking in most well-established disciplines.

Our econometric analysis uses cross-country inequality data from the World Bank and the World Inequality Database matched to a new academic freedom index developed by Kinzelbach et al. (2021) and Spannagel et al. (2020). Altogether, we show evidence of a negative relationship between academic freedom and inequality. Our regressions using Gini coefficients from the World Bank and wealth inequality from the World Inequality Database show evidence of a negative and statistically significant relationship between academic freedom and inequality. Income inequality data from the World Inequality Database exhibits negative, albeit imprecisely estimated, relationships.

We argue that the negative relationship between academic freedom and inequality stems from the potential influence that academics may have on their societies. To corroborate this intuition, we show evidence to suggest that academic freedom is associated with improvements in governance and social policy indicators. We show positive associations between the academic freedom index and (i) control of corruption, (ii) rule of law, (iii) regulatory quality, and (iv) voice and accountability, as well as policies associated with (v) gender equality, (vi) social protection, and (vii) sustainability.

[18] In another robustness exercise, we also examine the relationship between academic freedom and two composite indexes constructed with the CPIA and WGI indicators, respectively. We obtain similar findings.

Altogether, our findings have significant policy implications. Both universities and governments need to work together to strengthen existing ties. While government and academics are bonded by grant funding bodies, in the social sciences there is often very little follow-up by either party on the broader policy implications and applicability of research findings. In most cases, funding bodies keep a record of the final reports, but mostly there are no general or required built-in follow-up mechanisms that focus on applicability. As a first step, funding organization's should begin to require information on the applicability of the findings of funded social research. Then, governments and researchers should workshop and pilot ideas to gauge their applicability and viability in the field – in turn, this can spawn further research.

However, this process needs to recognise that not all research is funded. Universities and governments need to find regular and systemic ways of maintaining open channels of communication based on research needs (from the government side) and research outputs (from the academy). For example, policymakers should take a more active role in academic conferences, sending representatives to canvas relevant research output. Government can also begin to utilise existing and emerging machine learning methods to troll through working papers and recent publications to swiftly (albeit imperfectly) identify relevant pieces.

In turn, universities need to become more active in communicating their findings to government and broader society. A few existing online outlets aiming at translating academic research to wider audiences have emerged in some countries. Building on these models, governments could promote new avenues of dissemination of relevant work emerging in the social sciences. Universities must then provide academics with the resources and incentives to utilise these outlets. This may, perhaps, require formally recognising the value of these outlets for academic promotion or tenure.

An important limitation of this study is that we are unable to directly study the channels through which academia influences social policy. In Section 2 we propose that collaboration between the government and universities leads to the creation of new knowledge, which influences policy. We then provide potential examples of collaboration, including cross-government-academia (i) membership of research societies, (ii) presentations at university seminars and government meetings, and (iii) the creation of strategic alliances. Unfortunately, cross-country evidence of these types of integration does not exist. Its availability would not only allow researchers to obtain a better understanding of the channels through which academic freedom impacts social policy, but, more generally, provide a better idea of government policy transparency in action. We leave this important avenue of research to future studies.

Other avenues of future research in this field could build on our version of the Triple-Helix model by highlighting broader societal implications of university-government collaborations. This paper finds evidence that suggests that academic freedom is positively associated with democratic characteristics. Arguably, academic freedom can reinforce democratic institutions, which in turn, reinforce the academe. Better understanding the nexus between democracy and academic freedom is important. Future research could look at different types of democracies and government structures and expand on different aspects of academic freedom. Similarly, an emerging literature argues that entrepreneurship and democracy are intrinsically linked and driven by coinciding societal characteristics, such as freedom of thought (Audretsch and Moog, 2022). Academic freedom can clearly play a role here in helping scholars understand one of the bridges between entrepreneurial activities and democracy. In turn, this may help us to obtain a better grasp of the full array of mechanisms through which academic freedom can influence economic growth, thus providing greater insights into endogenous growth theories.

CRediT authorship contribution statement

Alberto Posso: Conceptualization, Methodology, Visualization, Investigation, Writing – original draft, Writing – review & editing. **Quanda Zhang:** Data curation, Methodology, Visualization, Investigation, Writing – original draft, Writing – review & editing.

Data availability

Data will be made available on request.

Appendix

Fig. A1, Table A1, Table A2, Table A3, Table A4, Table A5, Table A6, Table A7.

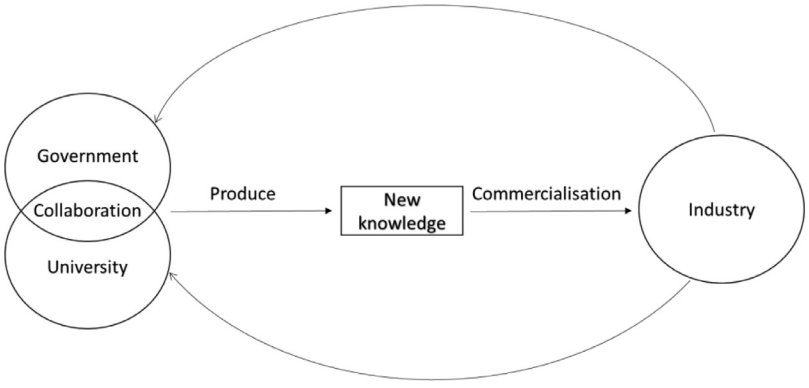

Fig. A1. Triple Helix-III Model.
Source: Adapted from Abbas et al. (2019) and Etzkowitz and Leydesdorff (2000).

Table A1
Summary statistics.

Variable	Description	Obs.	Mean	SD
Main data set				
Inequality	Gini coefficient (0 to 100)	1497	38.41	9.32
Academic freedom	Academic Freedom Index (0=low to 100=high)	1497	78.18	23.58
GDP per capita	GDP per capita (in 2010$), in log	1497	9.00	1.39
Population	Population, in log	1497	16.35	1.60
Trade	Trade (% of GDP)	1497	85.27	51.71
Government expenditure	Government expenditure (% of GDP)	1497	16.17	6.42
Savings	Gross domestic savings (% of GDP)	1497	20.52	13.51
Patents	Patent applications (in '000s)	1200	12.10	67.79
Publications	Scientific and technical journal articles (in '000s)	1183	19.63	59.30
Democracy	Democracy score (−10=low to 10=high)	1442	6.59	5.06
Control of corruption	Control of corruption	1207	0.30	1.06
Rule of law	Rule of law	1207	0.31	1.02
Regulatory quality	Regulatory quality	1204	0.45	0.89
Voice and accountability	Voice and accountability	1207	0.40	0.88
Government effectiveness	Government effectiveness	1205	0.41	0.95
Gender equality	Gender equality (1=low to 6=high)	168	3.70	0.69
Social protection and labor	Policies for social protection and labor (1=low to 6=high)	165	3.55	0.44
Sustainability	Policy and institutions for environmental sustainability (1=low to 6=high)	168	3.30	0.46
Longer term data set				
Wealth inequality indicator top 10% share	Net personal wealth share held by the top 10% group	278	63.87	13.38
Wealth inequality indicator top 1% share	Net personal wealth share held by the top 1% group	278	31.02	12.70
Income inequality indicator top 10% share	Income share held by the top 10% group	5830	44.94	10.57
Income inequality indicator top 1% share	Income share held by the top 1% group	5829	16.33	7.26

Table A2
List of countries in the sample.

Albania	Finland	Montenegro	Turkmenistan
Algeria	France	Morocco	Uganda
Angola	Gabon	Mozambique	Ukraine
Argentina	Georgia	Namibia	United Arab Emirates
Armenia	Germany	Nepal	United Kingdom
Australia	Ghana	Netherlands	United States
Austria	Greece	Nicaragua	Uruguay
Azerbaijan	Guatemala	Niger	Uzbekistan
Bangladesh	Guinea	Nigeria	Vanuatu
Belarus	Guinea-Bissau	North Macedonia	Vietnam
Belgium	Guyana	Norway	Zambia
Benin	Haiti	Pakistan	Zimbabwe
Bhutan	Honduras	Panama	
Bolivia	Hungary	Papua New Guinea	
Bosnia and Herzegovina	Iceland	Paraguay	
Botswana	India	Peru	
Brazil	Indonesia	Philippines	
Bulgaria	Ireland	Poland	
Burkina Faso	Israel	Portugal	
Burundi	Italy	Romania	
Cameroon	Jamaica	Rwanda	
Canada	Japan	Senegal	
Central African Republic	Jordan	Serbia	
Chad	Kazakhstan	Seychelles	
Chile	Kenya	Sierra Leone	
China	Kosovo	Slovenia	
Colombia	Latvia	Solomon Islands	
Comoros	Lebanon	South Africa	
Costa Rica	Lesotho	Spain	
Croatia	Liberia	Sri Lanka	
Cyprus	Lithuania	Sudan	
Czech Republic	Luxembourg	Sweden	
Denmark	Madagascar	Switzerland	
Dominican Republic	Malaysia	Tajikistan	
Ecuador	Maldives	Tanzania	
El Salvador	Malta	Thailand	
Estonia	Mauritius	Timor-Leste	
Eswatini	Mexico	Togo	
Ethiopia	Moldova	Tunisia	
Fiji	Mongolia	Turkey	

Table A3
Alternative IV estimation and first stage IV 2SLS estimation.

Panel A: Alternative IV estimation

	Dependant variable: gini coefficient	
	(1)	(2)
Instrument	Patents	Publications & Patents
Academic Freedom	−0.397**	−0.210*
	[−1.063]	[−0.577]
	(0.177)	(0.122)
Other controls	Yes	Yes
First-stage F	10.605	11.177
Hansen J p value	–	0.122
Time FE	Yes	Yes
Country FE	Yes	Yes
Observations	1189	961

Panel B: First stage IV 2SLS estimation

	Dependant variable: academic freedom		
	(1)	(2)	(3)
Publications	−0.059***		−0.035
	[−0.158]		[−0.0323]
	(0.019)		(0.038)
Patents		−0.019***	−0.010
		[−0.052]	[−0.099]
		(0.006)	(0.011)
Other controls	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	1122	1189	961

Notes: Other controls include GDP per capita and its quadratic term, population, trade, government expenditure and savings. Patents, publications refer to patent applications, scientific and technical journal articles, respectively. Both are sourced from the World Development Indicators (WDI) from the World Bank. Data on patents is available for the period 1980–2018, while data on publications is available for the period 2000–2018. Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. ***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.
Abbreviations: IV 2SLS – Instrument Variable Two Stage Least Squares, FE – Fixed Effects.

Table A4
Alternative IV and IFE estimation controlling for democracy.

dependant variable: gini efficient		
	(1)	(2)
Estimation method	IV 2SLS	IFE
Academic freedom	−0.409*	0.020
	[−1.062]	[0.054]
	(0.243)	(0.036)
Democracy	Yes	Yes
Other controls	Yes	Yes
First-stage F	7.543	–
Time FE	Yes	Yes
Country FE	Yes	Yes
Observations	1122	1122

Notes: Other controls include GDP per capita and its quadratic term, population, trade, government expenditure and savings. Data on democracy is obtained from the Centre for Systemic Peace (CSP). Publications, defined as scientific and technical journal articles, is sourced from the World Development Indicators (WDI) from the World Bank and is available for the period 2000–2018. Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. ***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.
Abbreviations: FE – Fixed Effects; IV 2SLS – Instrument Variable Two Stage Least Squares; IFE – Interactive Fixed Effects.

Table A5
Additional estimations based on the components of AFI.

	Dependant variable: gini efficient				
	(1)	(2)	(3)	(4)	(5)
	Freedom of academic and cultural expression	Freedom to research and teach	Freedom of academic exchange and dissemination	Institutional autonomy	Campus integrity
Academic freedom	−0.003	−0.010***	−0.010***	−0.011***	−0.007
	[0.044]	[0.123]	[0.126]	[0.146]	[0.106]
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
Other controls	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	1497	1497	1497	1467	1456

Notes: Other controls include GDP per capita and its quadratic term, population, trade, government expenditure and savings. Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. *** and **indicate statistical significance at the 1 per cent and 5 per cent levels, respectively.
Abbreviations: FE – Fixed Effects, AFI – Academic Freedom Index.

Table A6
Results using longer-term data.

Panel A: Income inequality indicators		
Dependant variable:	top 10% share (1)	top 1% share (2)
Academic freedom	−0.0002	−0.010
	[−0.001]	[−0.044]
	(0.016)	(0.015)
Other controls	Yes	Yes
Time FE	Yes	Yes
Country FE	Yes	Yes
Observations	5830	5829
Panel B: Wealth inequality indicators		
Academic freedom	−0.090*	−0.124**
	[−0.152]	[−0.221]
	(0.038)	(0.038)
Other controls	Yes	Yes
Time FE	Yes	Yes
Country FE	Yes	Yes
Observations	278	278

Notes: Other controls include GDP per capita and its quadratic term and population. Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. *** and **indicate statistical significance at the 1 per cent and 5 per cent levels, respectively. Data on Income Inequality Indicators and Wealth Inequality Indicator is obtained from the World Inequality Database (https://wid.world/wid-world). Data on GDP per capita and population are sourced from the Maddison Historical Statistics 2020 Release (https://www.rug.nl/ggdc/historicaldevelopment/maddison).
Abbreviations: FE – Fixed Effects.

Table A7
Academic freedom versus governance and social policy measures, IV results.

Panel A

	Dependant variable: wgi indicators				
	(1) Control of corruption	(2) Rule of law	(3) Regulatory quality	(4) Voice and accountability	(5) Government effectiveness
Academic freedom	0.027**	0.011	0.029***	0.019***	0.016***
	[0.584]	[0.242]	[0.730]	[0.490]	[0.389]
	(0.013)	(0.011)	(0.009)	(0.007)	(0.006)
First-stage F	14.360	14.360	14.118	14.118	14.118
Other controls	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	1141	1141	1138	1138	1138

Panel B

	Dependant variable: cpia indicators		
	(1) Gender equality	(2) Social protection	(3) Sustainability
Academic freedom	0.003	0.013	0.059
	[0.096]	[0.644]	[2.718]
	(0.055)	(0.009)	(0.042)
First-stage	8.530	9.217	9.217
Other controls	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	156	153	153

Notes: Academic freedom is instrumented with publications. Other controls include GDP per capita and its quadratic term, population, trade, government expenditure and savings. WGI (World Governance Indicators), which is available for the period 1996–2018, is obtained from the World Bank (http://info.worldbank.org/governance/wgi, accessed on October 26, 2021). CPIA (Country Policy and Institutional Assessment), which is available from the period 2005–2018, is also obtained from the World Bank (https://datacatalog.worldbank.org/search/dataset/0038988, accessed on October 26, 2021). Standard errors clustered at the country level are reported in parentheses. Standardized coefficients are displayed in square brackets. *** and **indicate statistical significance at the 1 per cent and 5 per cent levels, respectively.
Abbreviations: FE – Fixed Effects, WGI – World Governance Indicators; CPIA - Country Policy and Institutional Assessment.

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