



Exogenous volatility and the size of government in developing countries ☆☆☆



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ABSTRACT

This paper presents instrumental variables estimates of the effects of GDP per capita volatility on the size of government. We show that for a panel of 157 countries spanning more than half a century, rainfall volatility has a significant positive effect on GDP per capita volatility in countries with above median temperatures. In these countries rainfall volatility has also a significant positive reduced-form effect on the GDP share of government. There is no significant reduced-form effect in the sample of countries with below median temperatures where rainfall volatility has no significant effect on GDP per capita volatility. Using rainfall volatility as an instrumental variable in the sample of countries with above median temperatures yields that greater GDP per capita volatility leads to a significantly higher GDP share of government.

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1. Introduction

Controversy seems to exist in the literature in regards to the relationship between government size and economic volatility. In a seminal paper, [Rodrik \(1998\)](#) suggests that in order to provide social insurance against random shocks government size increases in response to increases in economic volatility. Important subsequent papers by [Fatas and Mihov \(2001a,b\)](#) employing also instrumental variables for the size of government to address causality, interpreted available empirical evidence, indicating that larger government size causes smaller volatility.² Hence, the still lingering issue is whether the original causal interpretation in [Rodrik \(1998\)](#) is correct. In particular, if terms of trade volatility interacted with trade openness cause an increase in the size of government because larger government size is a buffer against

economic shocks, then the argument should apply more generally to other, more plausibly exogenous shocks as well.³

To address causal effects of volatility on government size, one needs to utilize an exogenous source of variation in volatility. This is particularly important in light of the findings in [Fatas and Mihov \(2001a,b\)](#) indicating that output volatility is endogenous to the size of government. In this paper, to focus on causal effects of volatility on government size, we employ a country-specific standard deviation of rainfall as a source of exogenous volatility. For a panel of 157 countries spanning the period 1950–2009, we document that rainfall volatility has a significant positive effect on GDP per capita volatility in the sample of countries with above median temperatures. In this sample of high-temperature countries, median PPP GDP per capita is below 1500 with an interquartile range of [838; 4089]; the median GDP share of agriculture is above 0.28 with an interquartile range of [0.16; 0.38]. The significant positive effect of rainfall volatility on GDP per capita volatility in the sample of countries with

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² See also [Andres et al. \(2008\)](#) and [Fatas and Mihov \(2012\)](#) for more recent studies; and [Galí \(1994\)](#) for an earlier study that compares based on a sample of 22 OECD countries' correlations between economic volatility and government size with theoretical predictions from a RBC model.

³ One important issue with terms of trade shocks is that for economically large countries, changes in the size of government can have a direct effect on the terms of trade. This, in turn, raises the question of whether, from a global welfare point of view, a larger government size is optimal in response to terms of trade volatility. See [Epifani and Gancia \(2009\)](#) where the point of terms-of-trade endogeneity to government size is laid out in detail.

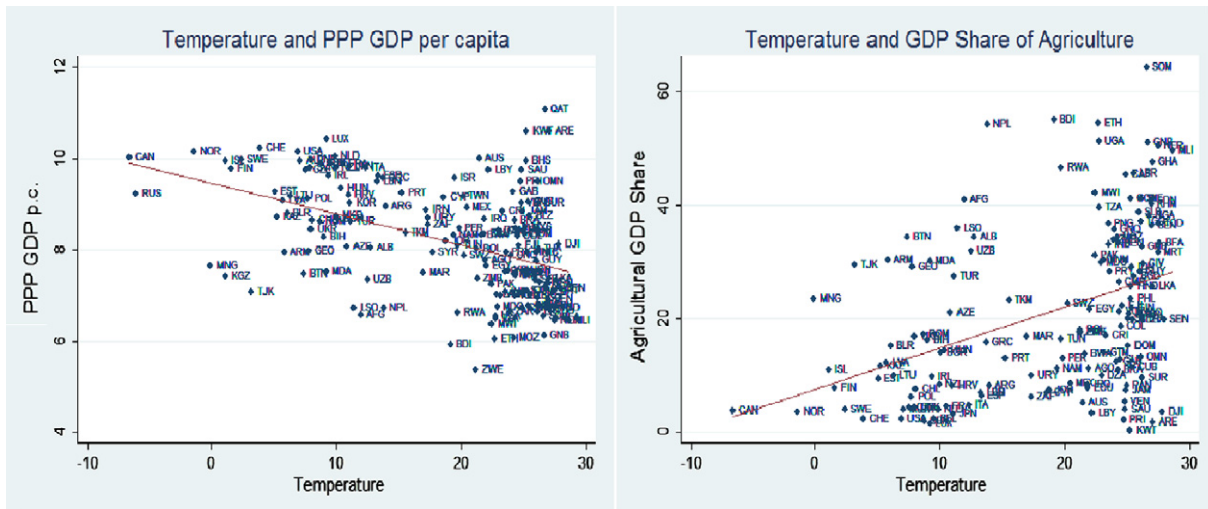


Fig. 1. Cross-country differences in temperature and economic development. Note: The left-hand figure shows a cross-country scatter plot of the relationship between temperature and the log of PPP GDP per capita. The right-hand figure shows a cross-country scatter plot of the relationship between temperature and the agricultural GDP share. All variables are calculated as an average over the 1950–2009 period.

relatively high temperatures should therefore be interpreted in light of the fact that these countries are relatively less developed due to (exogenous) climatic conditions. Fig. 1 illustrates graphically this negative link between cross-country differences in temperature and economic development.⁴

The reduced-form analysis shows that: (i) rainfall volatility has a significant positive effect on the GDP share of government in the group of countries with relatively high temperatures; (ii) there are no significant reduced-form effects in the group of countries with relatively low temperatures (where rainfall volatility has no significant effects on GDP per capita volatility). If rainfall volatility has systematic effects on the size of government beyond GDP per capita volatility, then there should be a significant effect of rainfall volatility on government size in the sample where rainfall volatility has no significant effect on GDP per capita volatility. The fact that this is not the case suggests that rainfall volatility has no significant independent effects on government size beyond GDP per capita volatility. Under this exclusion restriction, we can exploit the significant effect of rainfall volatility on GDP per capita volatility in the sample of countries with relatively high temperatures to construct instrumental variables estimates of the causal effects that GDP per capita volatility has on the size of government.

Our instrumental variables regressions yield a significant positive effect of GDP per capita volatility on the GDP share of government consumption expenditures. In a pooled panel estimation the second-stage coefficient on GDP per capita volatility is around 2.4 with a standard error of 1.1. The pooled panel estimations are based on multi-clustered standard errors at the country and time level with control variables including continent dummies, continent-specific time fixed effects, the level of rainfall, as well as other geographic characteristics related to countries' latitude and longitude, their size in square kilometers, and whether the country has access to the sea. We document that the IV estimates are robust to controlling in the panel regressions for country fixed effects or using only cross-sectional data.

It is noteworthy that IV estimates are larger than OLS estimates. In the sample of 157 countries during the 1950–2009 period OLS estimation yields a significant positive coefficient on GDP per capita volatility of around 0.2 with a standard error of around 0.1. In the sample of high-temperature countries the OLS coefficient is also positive but

only in some specifications significantly different from zero. The Hausman test rejects the hypothesis that the OLS coefficient is equal to the IV coefficient at the conventional significance levels. One reason for IV estimates being larger than OLS estimates is that the latter suffer from a negative reverse causality bias: according to the literature discussed above larger government size reduces GDP per capita volatility. Hence there is a negative correlation between the right-hand-side regressor (GDP per capita volatility) and the error term that downward biases the OLS estimate. In contrast, because rainfall volatility is exogenous to the size of government, the IV estimates do not suffer from this reverse causality bias, hence, our results are well consistent with those of existing literature suggesting a stabilizing role of government size.⁵

Methodologically, our paper belongs to a growing body of literature that explores the effects of exogenous climate shocks on economic and political outcomes.⁶ While this literature focuses on first moments, we are interested in rainfall volatility, captured by a second moment of rainfall within a time period, as our indicator for exogenous volatility. To the best of our knowledge, this is the first paper to utilize such an approach for explaining the size of government.

Beyond the literature that focuses on the determinants of government size, our results are relevant for studies that explore the stabilizing role of government size. In particular, our finding of a significant positive effect of exogenous volatility on government size implies that benchmark least squares estimates of the (negative) effects of government size on volatility are upward biased. Thus, due to causality running from more economic volatility to larger government size, partial correlations between the size of government and economic volatility will understate the true stabilizing effects of government size.

The rest of the paper proceeds as follows. In the next section, we provide some theoretical background. Section 3 describes the data. This is followed, in Section 4, by a discussion of our estimation approach. Section 5 then contains the empirical analysis, and Section 6 concludes.

2. Theoretical background

In this section we discuss possible reasons why economic volatility could lead to larger government size. The first reason is related to

⁴ We are certainly not the first to point to this negative link between temperature and economic development. See, for example, Gallup and Sachs (2000) or Dell et al. (2012) for a recent study that demonstrates a negative within-country effect of temperature on measures of economic development in poor countries.

⁵ Another reason why OLS estimates are smaller than IV estimates could be measurement error. Classical measurement error in GDP per capita volatility will attenuate the least squares estimates towards zero but not the IV estimates.

⁶ See, for example, Barrios et al. (2010), Brückner and Ciccone (2011), Dell et al. (2012), or Miguel et al. (2004).

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