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Shocks to military support and subsequent assassinations in Ancient Rome

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HIGHLIGHTS

- Rainfall predicts assassinations of Ancient Roman emperors, from 27 BC to 476 AD.
- When rainfall is low, Roman troops starve, and are more likely to mutiny.
- Lower rainfall predicts more troop mutinies.
- More mutinies predict more assassinations of Roman emperors.
- These results suggest that an emperor relied on his military for support.

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ABSTRACT

A dictator relies on his military's support; shocks to this support can threaten his rule. Motivated by this, we find that lower rainfall, along the north-eastern Roman Empire, predicts more assassinations of Roman emperors. Our proposed mechanism is as follows: lower precipitation increases the probability that Roman troops, who relied on local food supplies, starve. This pushes soldiers to mutiny, hence weakening the emperor's support, and increasing the probability he is assassinated.

An army marches on its stomach.

- Napoleon Bonaparte

1. Introduction

Dictators rely upon a military to retain power. Therefore, shocks to a dictator's military support can affect his tenure in office, yet little work has explored this from a quantitative and causal perspective (Derpanopoulos et al., 2016; Miller, 2012).

We therefore ask the question, what were the shocks that caused assassinations of Roman emperors. The Roman Empire, which lasted from 27 BC to 476 AD, had a total of eighty-two emperors.[1] It therefore provides a rich historical laboratory from which to draw inferences. Moreover, assassinations were not rare: roughly 20% of emperors were assassinated, and 5% of the years of the Roman Empire involved an emperor's murder. In our definitions, we do not consider speculated murders, or attempted killings.[2]

Our research adds to recent quantitative work on Ancient political economy (Manning et al., 2017; Harper, 2017; Cook, 2013). Also, no causal econometric work has examined Ancient Rome's' political and military intrigues, though some work has focused on Roman economics (Temin, 2012; Scheidel and Friesen, 2009). Our analysis uncovers how vital a dictator's military support is, in cementing his power.

The following historical facts are relevant:

(1) The Roman economy was largely agricultural, depending on rainfed agriculture (Harper, 2017).
(2) The bulk of the Roman army was stationed along the Western frontier, and relied heavily on local food sources (Roth, 1998; Elton, 1996).[3]

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[1] The Empire formally started with Augustus in 27 BC. While the entire Empire's end date is contestable, the Western Empire fell in 476 AD, when Emperor Romulus was deposed.

[2] We consider both Eastern and Western emperors. Over the period we consider, only one Eastern emperor, Numerian, was assassinated.

[3] Despite an Eastern military presence, Eastern climate data is not available for our period of study.

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(3) Food transport, in Ancient Rome, was very slow (Terpstra, 2013).

Using time series analysis, we find that lower rainfall in northern frontier provinces, like Germania (present-day Germany), increases the likelihood of Roman emperor assassination, in a given year. Such provinces had heavy troop concentrations. A standard deviation reduction in rainfall (mm) causes an 11% standard deviation rise in assassination probability. We hypothesize that when rainfall is low, Roman soldiers stationed along the frontier become agitated, due to lack of food, hence weakening the emperor's hold on power; we provide evidence for this mechanism.

A starving military is probably not the sole determinant of a Roman emperor's violent demise. However, we explain one potential forcing variable, which can heighten political instability within the Roman Empire. Other factors might also have played a role. Our study informs the literature on the economic causes and consequences of violence (Anderson et al., 2017; Chaney, 2013; Jones and Olken, 2009; Collier and Hoeffler, 2004; Miguel et al., 2004).

We proceed as follows. Section 2 discusses our data and empirical strategy. We show empirical results in Section 3. Section 4 concludes.

2. Data and empirical strategy

2.1. Empirical strategy

To test for the effects of rainfall and drought on Roman emperor assassinations in year t, we estimate the following time-series specification:

$$Assassination_t = \beta_0 + \beta_1 D_{t-1} + \boldsymbol{\gamma}'\mathbf{X} + \epsilon_t. \quad (1)$$

Here, $Assassination_t$ is either a dummy for whether or not an emperor was killed, or the total number of emperors killed in a given year.

D_{t-1} is $Precipitation_{t-1}$, a rainfall shock, lagged by one year. We use a lagged shock because Roman armies had sufficient grain storage capacity for one year, and were able to temporarily smooth negative shocks. However, we show that this is robust to a simultaneous shock.

We use Newey–West standard errors to account for serial correlation and heteroskedasticity (Newey and West, 1987). We assume that the error structure is autocorrelated up to 10 lags.

Our identification strategy is based on the fact that rainfall is exogenous. A negative coefficient on β_1 implies that the shock negatively predicts assassinations.

2.2. Data

We acquire data on Roman assassinations from Scarre's (2012) *Chronicle of the Roman Emperors*. Scarre indicates when a Roman emperor had been murdered. We exclude speculated murders, attempted killings, and suicides, since in these cases there is often historical ambiguity, and it is difficult to ascertain a counterfactual. For instance, the emperor Nero committed suicide, mistakenly thinking that armed men were on their way to kill him (Buckley and Dinter, 2013).

Precipitation data for this period are from Buengten et al. (2011). These authors collect data from 7284 precipitation-sensitive oak tree rings from France, southeastern Germany, and northeastern Germany, corresponding to the Ancient Roman frontier. They supplement this with 104 historical accounts to reconstruct AMJ (April–May–June) precipitation, for the region, from 398 BC to 2008 AD. Precipitation is measured in millimetres.

Roman Germania grew grain, which requires favourable rainfall (Roth, 1998). The AMJ precipitation reconstructions, spanning 91 days, coincide with the planting, initial, crop development, and mid-season stages of spring wheat's 120–150 day growth period (Brouwer and Heibloem, 1986). Moreover, the Roman army had grain storage technology, usually for up to a year (Roth, pp. 176).

Summary statistics are shown in Appendix Table A.1. We provide a time series graph of the total number of assassinations, against rainfall, over this period in Fig. 1.

3. Results

3.1. Main results

In Table 1, we report our main results for Roman assassinations from 27 BC to 476 AD. Negative rainfall shocks predict significantly more assassinations. In Column (1), for example, a standard deviation decline in rainfall causes an 11.6% standard deviation increase in assassination probability. In Column (5), a standard deviation drop in rainfall causes a 13.4% standard deviation increase in total assassinations.

Our identifying assumption is that rainfall is unrelated to unobservables that could bias our results. To test this, we perform a placebo test (in Appendix B), regressing assassinations on future rainfall, one year forward. We find no significant effects from this exercise, and the coefficients are smaller than those for our main results. This supports our identification strategy.

3.2. Mechanisms

In Table 2, we test for whether rainfall predicts mutinies, using data from Venning (2011). We find an effect; for instance, in column (1), a standard deviation drop in rainfall causes a 13.3% standard deviation rise in mutiny occurrence. In the appendix Table A2, we test whether mutinies predict assassinations. In appendix, section C, we offer a historical argument.

4. Conclusion

We suggest a mechanism that facilitated a Roman emperor's murder: troops along the Western frontier, incited by starvation, weakened the empire's political stability, in turn increasing the probability of assassinating an emperor. We show that rainfall in the northern empire predicts conditions that make assassinations more likely, and that low rainfall irks troops. Negative shocks to a dictator's military support, in the case of Ancient Rome, predict his demise.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2018.06.030.

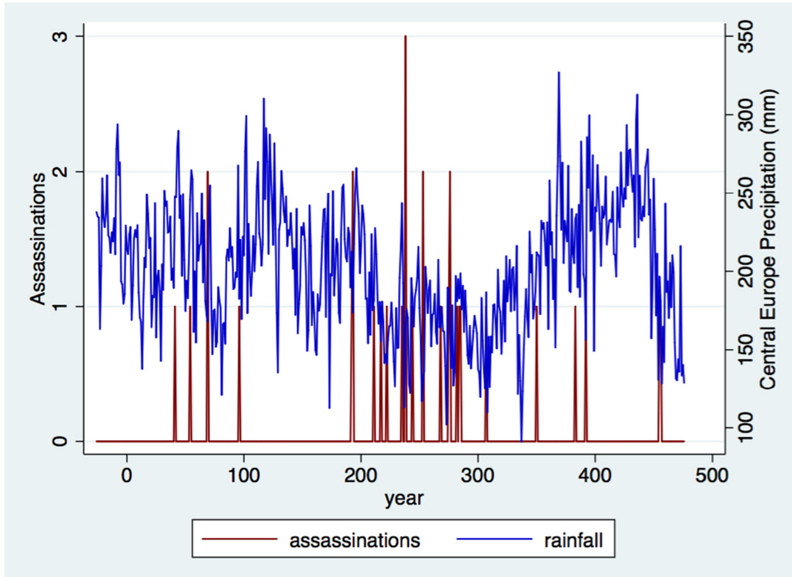

Fig. 1. Assassinations and Precipitation, 27 BC - 476 AD. The above figure shows the number of assassinations of Roman Emperors (red), against reconstructed April–May–June (AMJ) precipitation (blue), over time. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 1
Effect of rainfall on assassinations.

Dependent variable:	(1) Dummy	(2) Dummy	(3) Dummy	(4) Dummy	(5) Count	(6) Count
$\text{Precipitation}_{t-1}$	$-.061^{***}$	$-.013^{***}$			$-.095^{***}$	
	(.019)	(.005)			(.036)	
Precipitation_{t}			$-.044^{**}$	$-.010^{**}$		$-.074^{***}$
			(.020)	(.004)		(.027)
Estimation	OLS	Logit	OLS	Logit	OLS	OLS
AR(10)	.012		.012		.065	.012
No. of observations	503	503	503	503	503	503

Columns (1)–(4) report results using an assassinations dummy, while columns (5) and (6) report results using the total number of assassinations. Newey–West standard errors are reported in parentheses in columns (1), (3), (5), and (6). Robust standard errors are reported in columns (2) and (4). All columns, except for (2) and (4), report the coefficient multiplied by 100. The AR(10) row reports the p-value from the Breusch–Godfrey test, with null hypothesis of no autocorrelation up to 10 lags. Significance levels are $^{***}< .01$, $^{**}< .05$, and $^{*}< .1$.

Table 2
Mechanism: Effect of rainfall on frontier mutinies.

Dependent variable:	(1) Dummy	(2) Dummy	(3) Dummy	(4) Dummy	(5) Count	(6) Count
$\text{Precipitation}_{t-1}$	$-.054^{**}$	$-.020^{***}$			$-.055^{**}$	
	(.024)	(.006)			(.025)	
Precipitation_{t}			$-.051^{**}$	$-.019^{***}$		$-.059^{**}$
			(.025)	(.007)		(.029)
Estimation	OLS	Logit	OLS	Logit	OLS	OLS
AR(10)	.00004		.00003		.0001	.0001
No. of observations	503	503	503	503	503	503

Columns (1)–(4) report mutiny dummy results. Columns (5) and (6) report results using the total number of mutinies. Newey–West standard errors are in parentheses in columns (1), (3), (5), and (6). Robust standard errors are in columns (2) and (4). The coefficient is multiplied by 100, except in columns (2) and (4). The AR(10) row reports the p-value from the Breusch–Godfrey test, with null hypothesis of no autocorrelation up to 10 lags. Significance levels are $^{***}< .01$, $^{**}< .05$, and $^{*}< .1$.

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