ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. xx, pp. xxx–xxx, 2017

http://dx.doi.org/10.1016/j.worlddev.2017.01.019

Weather Shocks and Agricultural Commercialization in Colonial Tropical Africa: Did Cash Crops Alleviate Social Distress?

KOSTADIS J. PAPAIOANNOU [a] and MICHIEL DE HAAS [b,*]

[a] *London School of Economics and Political Science, UK*
[b] *Wageningen University, Netherlands*

Summary. — A rapidly growing body of research examines the ways in which climatic variability influences economic and societal outcomes. This study investigates how weather shocks triggered social distress in British colonial Africa. Further, it intervenes in a long-standing and unsettled debate concerning the effects of agricultural commercialization on the abilities of rural communities to cope with exogenous shocks. We collect qualitative evidence from annual administrative records to explore the mechanisms linking weather extremes to harvest failures and social distress. We also conduct econometric testing on a novel panel dataset of 143 administrative districts across west, south-central, and east Africa in the Interwar Era (1920–39). Our findings are twofold. First, we find robust evidence that rainfall anomalies (both drought and excessive precipitation) are associated with spikes in imprisonment (our proxy for social distress). We argue that the key causal pathway is the loss of agricultural income, which results in higher imprisonment for theft, unrest, debt, and tax default. Second, we find that the impact of weather shocks on distress is partially *mitigated* by the cultivation of export crops. Our findings suggest that, even in the British colonial context, smallholder export crop cultivation led to higher private incomes as well as greater public investment. Our findings speak to a topic of considerable urgency today as the process of global climate change accelerates, generating more severe and unpredictable climatic extremes. An increased understanding and identification of *adaptive* and *mitigating* factors would assist in targeting policy interventions and designing adaptive institutions to support vulnerable rural societies.

Key words — Africa, weather shocks, economic history, climate vulnerability, food crisis, agricultural commercialization

1. INTRODUCTION

For centuries, thinkers and scholars have sought to understand whether and how climatic conditions influence societies and the economy. A better understanding of this causal link promises insights into why some economies have thrived *historically* while others languished, how *contemporary* societies can design effective policies and institutions to shield against current climate extremes, and how climate change may impact the *future* of humanity. In recent years, a proliferation of rigorous studies has emerged, aiming to quantify and assess the effects of climate extremes on economic and social outcomes (Dell, Jones, & Olken, 2014; Hsiang, Burke, & Miguel, 2013). This surge can be explained partly by rising public concerns about climate change and its potentially ensuing distortive effects on human development; partly by greater popular awareness of the critical role that climate might play in affecting social and economic outcomes; and partly by methodological advances and data availability, aided by improvements in computing power.

The adverse impact of climatic variability on social outcomes has proven particularly pronounced in developing regions, with Sub-Saharan Africa (henceforth abbreviated to Africa) being the most vulnerable one. This does not come as a surprise, as a large share of the population depends on rain-fed subsistence agriculture, with less than 5% of the cultivated area being irrigated (FAO, 2015). In such a context, climate-induced harvest failures can easily spill over into food insecurity, economic distress, and social destabilization. Africa's rising population densities, pervasive climate change, and resurging socio-political instability make this continued vulnerability to the vagaries of climate a most pressing concern (Morton, 2007).

While climate extremes have an undoubted and significant impact on societies, human affairs are not *uniformly determined* by climate. Instead, the effects of climate are mediated by a wide variety of geographical, cultural, institutional, and commercial factors (Sen, 1981; Thompson, 1971; Watts &

* We are indebted to Erwin Bulte, James Fenske, Ewout Frankema, and Ted Miguel whose comments and suggestions substantially improved this study. For useful comments, we thank Gareth Austin, Felicitas Becker, Peter Bent, Cédric Chambru, William Collins, Daniel Curtis, Leigh Gardner, Jose Martinez-Gonzalez, Leander Heldring, Solomon Hsiang, Noel Johnson, Niek Koning, Paul Lane, Paolo Malanima, Maarten Voors, Pieter Woltjer, and the participants of the International Workshop in Historical Ecology at Uppsala University, Sweden (November 2014), the Thesis Workshop Series at the London School of Economics and Political Science (LSE), United Kingdom (February 2015), the seminar of Political Economy, Economic History, Growth and Development at Groningen University, Netherlands (February 2015), the Economic History Graduate seminar at Oxford University, United Kingdom (May 2015), the Datini-ESTER advanced seminar in Prato, Italy (May 2015), the ERSA Workshop at Stellenbosch University, South Africa (May 2015), the XIIth World Economic History Congress in Kyoto, Japan (August 2015), the Social Science History Association conference in Baltimore, USA (November 2015), the Development seminar at UC Berkeley, USA (February 2016), the European Social Science History Association Conference in Valencia, Spain (March 2016), and the African Studies seminar at the Graduate Institute, Geneva, Switzerland (March 2016). We are grateful for the financial support of the European Research Council under the European Community's Seventh Framework Programme (ERC Grant Agreement no. 313114) as part of the project *Is Poverty Destiny? A New Empirical Foundation for Long-Term African Welfare*. Any remaining mistakes are our own. Final revision accepted: January 22, 2017.

Please cite this article in press as: Papaioannou, K. J., & de Haas, M. Weather Shocks and Agricultural Commercialization in Colonial Tropical Africa: Did Cash Crops Alleviate Social Distress?, *World Development* (2017), http://dx.doi.org/10.1016/j.worlddev.2017.01.019

Bohle, 1993). The key question, then, is which factors enable the *mitigation* of adverse impacts of climate extremes, and how such factors can be propagated through targeted policy interventions (Adger, 2000; Folke, 2006; Gallopín, 2006).

Whether agricultural commercialization aggravates or mitigates the vulnerability of rural communities is the subject of a multifaceted, heated, and long-standing debate among historians, policy makers, and social scientists (Braun & Kennedy, 1994; Govereh & Jayne, 2003; Papaioannou, 2016). This study aims to use Africa's past experience with smallholder-based export production during the colonial era to generate new insights on the impact of agricultural commercialization on the abilities of rural communities to cope with weather shocks. We provide new district-level evidence on the link between weather shocks and social tension and distress in British colonial Africa during the interwar era (1920–39), as well as on the mediating role of smallholder-based export crop production.

The data for our analysis have been compiled from annual *Colonial Blue Books* and *Administration Reports*, stored in *The National Archives of the UK* in London. Data were collected for over 200 sub-national administrative units in Botswana, Gambia, Ghana, Kenya, Malawi, Nigeria, Sierra Leone, Tanzania, Uganda, and Zambia (see Figure 1).[1] Exploiting the extensive and consistent administrative records that remain from Britain's African empire, we are able to provide new material on a world region for which systematic data collection is notoriously difficult, and, as a consequence, also expand the historical time horizon.

Our research strategy has both a qualitative and econometric component. *First*, we critically examine the colonial administrative records to improve our understanding of the mechanisms that explain the impact of drought and excessive rainfall on harvest outcomes and distress. *Second*, we econometrically test the link between weather shocks and social distress, as well as the mediating impact of export crop cultivation. To that end, we obtain observations on annual rainfall and imprisonment, and construct a novel panel dataset at the sub-national level. We also construct two indicators to measure each district's involvement in export crop cultivation. To measure social distress, we use annual fluctuations in imprisonment at the district level. While colonial prisons locked people up for a wide range of distress-related behaviors, such as debt, tax, and fine default, petty thefts, and civil disobedience (Bernault, 2007; Hynd, 2011), imprisonment spikes in years of weather shocks provide us with a particularly valuable inroad to capture social distress.

We justify the setting of our analysis in interwar British colonial Africa on a number of grounds. First, Britain administered a vast African empire. The extensive bureaucratic legacy has allowed us to construct a consistent district-level dataset spanning approximately one-fifth of Africa's landmass and one-third of its population in this period. Second, the geographic and temporal scope provides data for over 200 subnational administrative units. In some of these units, crops were grown on a considerable scale for export, while in others agricultural production was primarily geared toward subsistence. Our temporal scope encompasses the interwar period, a period of relative calm between the violent early-colonial conquest and the highly politicized post-war road to independence (Killingray, 1986).

Our qualitative evidence suggests several different mechanisms through which both drought and excessive rainfall result in harvest failures, adversely affecting agricultural incomes and provoking distress. The econometric estimates for our full sample, using fixed-effects models, confirm this relationship and reveal a robust *U-shaped* impact of weather shocks on different measures of imprisonment. The effect is not symmetrical. A "negative rainfall shock" (drought), measured as a one-standard deviation decrease from the long-term rainfall mean, is associated with 16.0 standard deviation increase in total imprisonment, and a "positive rainfall shock" (excessive rainfall), measured as a one standard deviation increase from the long-term rainfall mean, is associated with an even stronger 24.8 standard deviation increase in total imprisonment. These effects are similar in magnitude to accumulated evidence from other studies reviewed by Hsiang *et al.* (2013). The results are robust to using two different indicators of annual rainfall anomaly, as well as range of alternative formulas for parameterizing rainfall shocks.

Having established a robust overall relationship between rainfall anomalies and annual spikes in imprisonment for our full dataset, we test if this relationship is mediated by smallholder-based export crop cultivation. Our results show that a one standard deviation change in rainfall (in either direction) is associated with 10.2 standard deviation change in total imprisonment in districts with substantial export crop

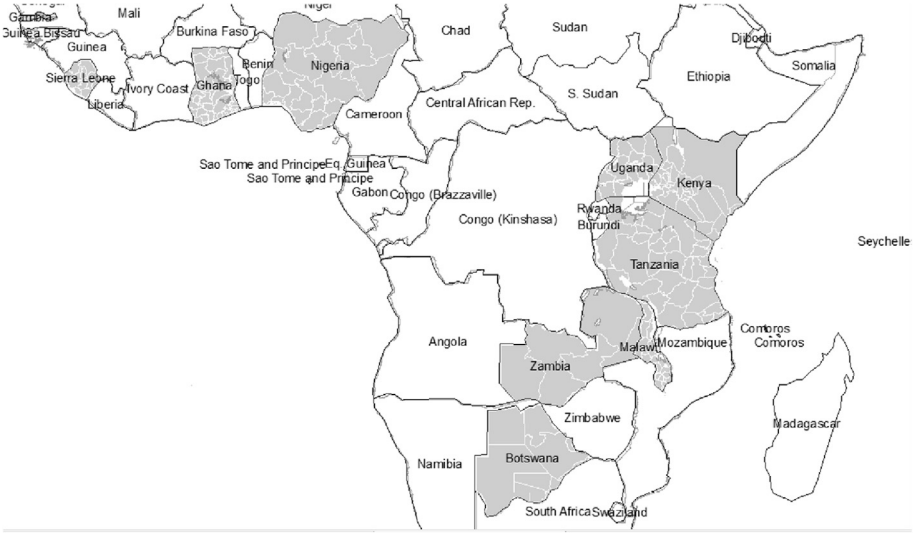

Figure 1. *Countries included in this study, with internal administrative borders, ca. 1930. Notes: See main text.*

Please cite this article in press as: Papaioannou, K. J., & de Haas, M. Weather Shocks and Agricultural Commercialization in Colonial Tropical Africa: Did Cash Crops Alleviate Social Distress?, *World Development* (2017), http://dx.doi.org/10.1016/j.worlddev.2017.01.019