State legitimacy and famines in Sub-Saharan Africa

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State Legitimacy and Famines in Sub-Saharan Africa

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Abstract

Political Economy of famines mainly focusses on political regimes to understand the role of institutions. In this paper, we investigate a broader concept, state legitimacy, and its role on one specific development outcome, famine management. State legitimacy refers to the political history of a country, meaning the embedding of state and society. Using a database of Sub-Saharan countries observed from 1980 to 2005, we use three empirical strategies: logit on famine occurrence, negative binomial regression and Arellano-Bond dynamic model on the number of years of famines. They all lead to the same results : there is room for a political economy of famine based on an analysis of state. State legitimacy prevents famines, controlling for shocks countries might go through, and controlling for the quality of government.

The main contributions of this paper are first to consider the role of state legitimacy in the political economy of famines and second to apply the concept in an empirical analysis, using for the first time a state legitimacy variable.

Keywords: Democracy, Famine, Institutions, State Legitimacy, Sub-Saharan Africa

JEL classification: I3, I18, H11, H12, O55, Q18

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1 Introduction

This paper tries to point out the weight of political factors in famines occurrence. Recent developments in the economic literature of famines focus on their political determinants, from the theory developed by Sen (1999) to its empirical investigation (Plümper and Neumayer (2009)[1], Burchi (2011)[2]). However, they only deal with one aspect of institutions of a country, that is political regimes. The aim of this paper is to provide a broader view of institutional determinants of famines, based on consideration for state. We use the concept of state legitimacy to understand its impact on famines occurrence, with a complementary view of the role of state and government. We focus on Sub-Saharan Africa for two reasons. First, as argued by Devereux (2000 [3]), famines are increasingly concentrated in Africa, more precisely in Sub-Saharan Africa. Since the early 1980s, 8 out of the 9 most dramatic famines occurred in Sub-Saharan Africa, accounting 470,000 deaths[1]. Second, even though the link between crop failures and famines has been relaxed (Devereux and Howe (2002) [4]), climate change and especially the rise of drought risks in this region of the world increases the risk of famine occurrence, and shed light on the importance of qualitative institutions to prevent and manage famine.

Famines are complex phenomena. A classical definition in economic literature can be found in Sen (1981) [5]: a famine is " a particularly virulent manifestation of starvation causing widespread death". Understanding famines has been an early concern of economists, first of all Malthus (1798)[6]. The early models of famines focus on the gap between food supply and food demand, considering a given technology and a fixed level of cultivable land available. Then, economic reflection on famines shifted to food availability. Sen's major work on poverty and famines (1981 [5]) impulsed a turning point. Sen first assesses that starvation is a matter of ownership, hence of economic institutions. Ownership is defined by entitlement, and famines are the outward sign of a market collapse. The political economy of famines is more recent. Sen (1999 [7]) shifted his focus from economic to political institutions, asserting that "democracy prevents famines" through two main channels: free media and multi-parties elections. Sen's work has been discussed, supported by Burchi (2011[2]) or criticized by Plümper and Neumayer (2009 [1]). However, these discussions mainly focus on the form of government - roughly: democracy or autocracy-. In this paper, we

[1]"*In deed, since the 1980s, famine appears to have taken-up permanent residence in the Horn [of Africa]*". Devereux (2000) [3]:8

investigate statehood as a relevant concept to model the connection between political institutions and famines.

We use two measurements of famines: its occurrence and the number of occurrences of famine during the period. Hence, we develop a cross-country analysis of the impact of institutional quality on these dependent variables. Two types of famine-prone shocks are controlled: climatological shocks, represented by the National Rainfall Index, and its standard deviation by country ; political shocks, represented by the occurrence of a civil war. Controlling for these shocks, we measure direct and indirect effect of institutional variables. Political regime quality is represented by an index of democracy. State quality is measured by a dataset developed by Englebert (2000 [8]) that is state legitimacy. State legitimacy has two dimensions: the horizontal legitimacy is the ethnic fragmentation of the country. Vertical legitimacy is the proximity of the state - as a structure of political power - to the society. To the best of our knowledge, this paper is the first to offer a political economy of famines based on statehood. Moreover, it is the first to use Englebert's dataset on state legitimacy.

On a sample of 36 countries over the period 1980-2005, three empirical strategies are developed. First, we focus on famine occurrence, using a logit. The outcomes are striking: when significant, the coefficients associated to political variables are strongly negative, meaning that an improvement of institutional quality decreases the likelihood of a famine. Moreover, even though there is a shock, a higher state legitimacy lead to a lower likelihood of famine occurence. Potential endogeneity of civil war is controlled and do not change the results. Second, we focus on the number of years of famine a country goes through. Using a negative binomial model designed for panel data, we obtain the same outcomes than previous: a protective effect of institutional quality, from political regime to state legitimacy. Third, expected temporal autocorrelation of this variable is controlled using an Arellano-Bond estimator. The signs and significance of our coefficients remain identical. Hence, our empirical work definitely support our assumption that a political economy of famines can also be based on statehood consideration. A higher state legitimacy protects individuals against famines, controlling for the quality of its government.

The remainder of the paper is structured as follows. Section 2 reviews existing modelling of famines and offers a political theory of famines based on statehood. Section 3 presents the empirical strategy and outcomes. Section 4 concludes.

2 Toward a political economy of famines

2.1 Famine as food deprivation

2.1.1 Defining famines

Defining famine is not that simple, and this impacts the empirical analysis of famines. Hence, a survey of the economic concept is necessary.

First of all, the outlines of the concept of famines are changing and that provides a first obstacle to the measurement of famines. Famine involves acute starvation - the lack of body mass for age and height - (Drèze and Sen (1989) [9]) that differs from chronic starvation - leading to low development of body and lack of height for age. Hence, famines may be defined as "health crisis" (de Waal (1989) [10]), differing from other malnutrition issues. However, as they are complex phenomena, involving multidisciplinary concepts, famines are more often measured by their consequences. De Waal (2000 [11]) identifies four outcomes, occurring with different intensity in each famine. (1) Hunger defining the undernutrition aspect, and relating to the etymological meaning of famines as "fames", hunger in latin. (2) Impoverishment, i.e. "loss of livelihood, income and assets" (De Waal (2000) [11]:6). (3) Social breakdown, that is the dislocation of social networks, for instance by the massive migration following from famines (4) Mortality, that is higher during famines.

Second, even agreeing on a definition of famine, available figures are controversial. As argued by Devereux (2000 [3]), "surprisingly little is known about the scale of excess mortality in most famines". First, even basic demographics are often unreliable or unavailable in the concerned countries. Therefore, data collected during a crisis are not reliable. Moreover, famine mortality is also due to epidemiological reasons, like epidemics in the relief camps or diseases due to weakness or change of nutritional regimes: malaria, measles and diarrhea are the main killers (Shears (1991) [12]). Relating disease mortality to the concept of famines is not automatic, and the figures of famine mortality might vary from single to double. Devereux (2000 [3]p.6) surveys the estimated mortality in major 20th century famines, and shows that even the mortality of famines accepted as such is still debated. For instance, the mortality of ethiopian famine from 1983 to 1985 is estimated from the lower bound of 590,000 (Africa Watch (1991) [13]) to the larger bound of 1,000,000 (Kumar 1991 [14]). Finally, as argued by Devereux and Howe (2004 [15]), famine definition is still ideologically biaised: "Any definition represents a choice and is therefore more political than technical: rather

than being 'found', a definition of famine must be 'agreed'".

A direct implication of this observation is that it is difficult to provide an empirical analysis of famines. In particular, an estimation of the number of deaths or people affected by a famine is unreliable. Therefore, running estimation on it may lead to inaccuracy and over- or under-estimation of the impact of parameters. Even though lower in information (as argued by Devereux and Howe (2004) [4]), a binary consideration famine/no famine is more reliable than an estimation based on famine mortality[2].

2.1.2 Explaining famines: groundings of the current theories.

The demographic explanation: The first economist modeling famines was Malthus(1798[6]), who delimitated the ground for a so-called neo-malthusianism [3]. Demographic explanations of famines define them as the result of food supply limits due to massive increase in the population.

The economic explanation:

Famines as entitlement failures Sen (1981 [5]) provides an other economic explanation of famines. His main purpose is to discuss the food availibility theory, inspired by Malthus'work. Sen goes from a commodity approach (food) to an entitlement approach, focusing on the legal right to possess food on the market. His work starts with a paradox: some of the 20th century famines occurred in countries with no food availibility decline. Sen provides a general framework to understand these famines, that is a decline of food access. Hence famines are not related to food availibility but to dispersion of entitlement that is "the set of alternative commodity bundles that a person can command in a society using the totality of right and opportunities that he or she faces" (Sen (1984) [17]).

According to Sen's analysis, there are four legal sources of food : production-based entitlement comes from what people produce, trade-based entitlement from the trade of physical assets, labor-based entitlement from the fact that agents are entitled with their wage and transfer-based entitlement from formal or informal transfers. Three exchanges conditions determines the entitlement: endowments: ownership over productive resources as well as market prices, production

[2]However, our estimation on the count of death has similar behavior that the models presented in this paper. Results available upon request.

[3]See Dupâquier (1980 [16]) for a discussion of the relevance of "malthusianism" qualification

possibilities and their use and exchange conditions. These conditions define an entitlement set, that can be represented as an endowment vector x on an exchange entitlement mapping $E_i(.)$ [4]. Two situations may lead to starvation: a shift in exchange conditions, or a shift in endowment.

Critiques to the entitlement approach The interest of this approach is its focus on market and institutions. Nevertheless, according to Edkins (2000) [18], it leaves out the social and political aspects. Devereux (2001[19]) establishes a more systematic survey of critiques and counter-critiques of Sen's theory. He distinguishes two strands of refutation: reinterpretation or counter-example of Sen's theory. Sen himself admits four limitation of his theory:

- "choosing to starve": food consumption choice might be considered at a household level: there are tradeoff inside the household, leading to starvation of some agents.
- "starvation or epidemics?": famine mortality is more due to migration and diseases than to lack of food entitlement approach focusses on starvation and leaves out the famine mortality issue.
- "fuzzy entitlements": according to Devereux (2001 [19]), "the notion of entitlement is conceptually and empirically inseparable from an economic system founded on private property and the legal rights associated with exclusive ownership by individuals of assets as commodities" - entitlement approach doesn't hold when considering a system of non-institutionalized rights.
- "extra-entitlement transfers": entitlement approach cannot address "war famines", since "entitlement theory has no place for violence" (de Waal (1990) [11]p. 473).

According to Devereux (2001 [19]), Sen's theory of entitlement doesn't pay attention to famines as political crisis.

Sen's theory on entitlement failure had a large impact on economic literature (Devereux (2001) [19]). However, in the beginning of the 1990s, famines are more and more considered as complex emergencies, with multiple factors. Hence, the political frame is defined as very important to understand the occurrence of a famine: even though different shocks can lead to famines, the political management of it is the main explanation of famine occurrence or prevention. As summarized by

[4]The purpose of this section is a brief epistemology of famines explanation. See Sen(1981 [5]) for broader explanation on the legal sources of food, the exchanges conditions, the mechanisms of entitlement failure and for a graphic presentation

Keen (1994 [20]:213): "the real root of famine may lie less in a lack of purchasing power within the market (although this will be one of the mechanisms of famine) than in a lack of lobbying power within national (and international) institutions" . Sen answers back the critiques (Drèze and Sen (1989)[9], then Sen (1999) [7]) with a theory of political regime determining famines occurrence.

2.2 A political theory of famines

2.2.1 Political regime and famines

Famines and Democracy In this section, we focus on the link between political variables and famines: this relation is the core of this paper's investigation. We want to test the assumption that political frame matters to manage shocks leading to famines. We first consider the classical political theory of famines, and then suggest a complementary view to Sen's theory. Sen ((2005) [21]:188) points out that "major famines do not occur in democracies, even when they are very poor". According to Sen (1999 [7]), two strands support the incentives for democracy to act against famines: the nature of regime and the freedom of press. First, democracy does not mean a greater benevolence than autocratic regimes. It creates an environment of political competition, with a cycle of elections leading politicians to struggle for reelection. Then the government will pay attention to the general interest. Second, free press guarantees information access to the public. On one hand, free press provides useful informations to politicians. On the other hand, it compels government to act: transparency of information prevents famines concealing.

Empirical Support and Critiques Empirical supports of these theories are often case studies. Drèze (in Drèze and Sen (1991) [22]) selects four examples of famines prevention in Africa to stress the efficiency and the relevance of early warning systems: Cape Verde, Kenya, Zimbabwe, Botswana support the demonstration. Sen only provides local evidence for his theories, through case studies, but he argues that "there has never been a famine in a functioning multiparty democracy" (Sen (1999) [7]). Following Sen, Burchi (2011 [2]) estimates the impact of democratic regimes on famine occurrence and mortality at an international scale, using a sample of low-income and emerging countries that are still likely to go through a famine. He uses the frame of public choice developed by Buchanan and Brennan (1980 [23]) to show that democracies have more incentives to avoid famines. Running separate regressions on democracies and autocracies, he shows that democ-

racies are by far more likely to avoid famines. Hence he confirms the validity of Sen's argument.

Table 1: List of Famines that occurred in democracies

Year	**Countries**
1982	Botswana
1983	Nigeria
1986	South Africa
1987	Sudan
1988	South Africa, Sudan
1991	Mali, Namibia, Zambia
1992	Botswana, Somalia
1995	Namibia, South Africa, Zambia
1998	Namibia
2000	Madagascar, Somalia
2001	Niger
2001	Lesotho, Madagascar, Namibia, Senegal
2004	Kenya, Somalia, South Africa
2005	Burundi, Kenya, Madagascar, Malawi, Mali, Niger, Somalia

Democracies are defined according to Polity IV Dataset

However, some critiques can be raised. As presented in table 1, there are counter-examples to Sen's theory : in our sample, 32 famines occurred in democracies, out of 126 during the period (1980-2005). For instance, Rubin studies the Malawian famine of 2002 (Rubin 2009 [24]) and explains it by the fragility of the state and the dependance to international food aid. Moreover, Plümper and Neumayer (2009 [1]) develop an alternative political theory of famines. Refuting Sen's theory by empirical counter-facts, they base their demonstration on the selectorate theory of Bueno de Mesquita et al. (2002 [25]): both democracies and autocracies face a trade-off between cost of action and cost of inaction. The government is assumed to maximize its political support to stay in power. Then "both democracies and autocracies can experience famine mortality if governments find that inaction is the support-maximizing strategy" (Bueno de Mesquita et al (2002) [25]:58): some government might gain, letting famines to occur. Plümper and Neumayer (2009 [1]) provide empirical support to their theory. There is still a difference between democracies and autocracies: the latter are more likely to target population that benefit from transfers, whereas democratic policies benefit a higher proportion of affected people.

Rubin (2009 [26]) is more skeptical about the possibility of a monocausal theory of famines. According to Rubin (2008 [27]), there is no robust evidence of the impact of political regimes on famine

occurrence, varying the regression models and the variables. Famines are complex phenomena that require a multicausal theory. Hence there is room for improvement of famines explanations.

Theoretical critiques. One main critique against the use of political regime as an indicator of institutional quality is particularly crucial concerning Sub-Saharan Africa. Some countries have good indicators of democratic parameters, like multiparty elections, but are not actual democracies. The critique is developed by Diamond (2002 [28]), through the concept of "hybrid regimes". Hybrid regimes are these "combining democratic and authoritarian elements" (Diamond 2002 [28]:23). Therefore, Diamond draws up a classification of regimes, distinguishing democratic and non-democratic regimes. He divides non-democratic regimes into electoral authoritarian regimes and politically closed. Electoral authoritarian regimes may be competitive or hegemonic (non-competitive). Ambiguous regimes are the residuals. Table 2 sums up the classification for Sub-Saharan Africa in 2002. Borders between democratic and autocratic regimes are particularly blurred in this region of the world. Hence, focusing on election to define democracies is not always sufficient, especially focusing on Africa.

Table 2: Hybrid Regimes in Africa

Democratic		**Ambiguous**	**Non Democratic**		
Liberal	Electoral	Ambiguous	Competitive	Hegemonic Electoral	Politically Closed
Cape Verde	Ghana	Mozambique	Lesotho	Burkina Faso	Swaziland
Mauritius	Mali	Tanzania	Central Af. Rep	Congo	Burundi
Sao Tome et Princ.	Nambibia	Nigeria	Guinea Bissau	Mauritania	Congo, DRC
South Africa	Benin	Djibouti	Cote d'Ivoire	Chad	Eritrea
Botswana	Madagascar	Sierra Leone	Gabon	Guinea	Rwanda
	Seychelles	Zambia	Gambia	Uganda	Somalia
	Senegal		Togo	Angola	Sudan
	Malawi		Ethiopia	Liberia	
	Niger		Kenya	Equat. Guinea	
			Cameroon		
			Zimbabwe		

Sources: Diamond (2002 [28])

A second argument might be stressed: economists study democracies to deal with institutional quality. As argued by Englebert (2000 [8]), this focus of economists on democracy reveals a confusion between government and state. The government is "the particular occupants of executive office at any given time" (B. Gilley, 2002 [29]). According to a classic definition, the state is "an organization

with a comparative advantage in violence, extending over a geographic area whose boundaries are determined by its power to tax constituents" - North (1981 [30]:21). A second aspect of what state means is developed by Gilley (2002 [29]), according to whom state is "the basic institutional and ideological structure of a political community". Importing the concept of state in a political economy of famines is particularly interesting focusing on Africa. African states generally have low state capacity. As Englebert writes: "in a nutshell, most African States fall short of the requirements for statehood. They may exist as juridical entities, but they lack "empirical statehood" "(Englebert 2000 [8]). This observation follows Jackson and Rosberg (1982 [31]) theory of African weak states. Therefore, statehood quality is an interesting prism of analysis for Sub-Saharan Africa. It is also a way to politically differentiate African countries with a concept differing from political regime, relating to political history and to social environment of a country.

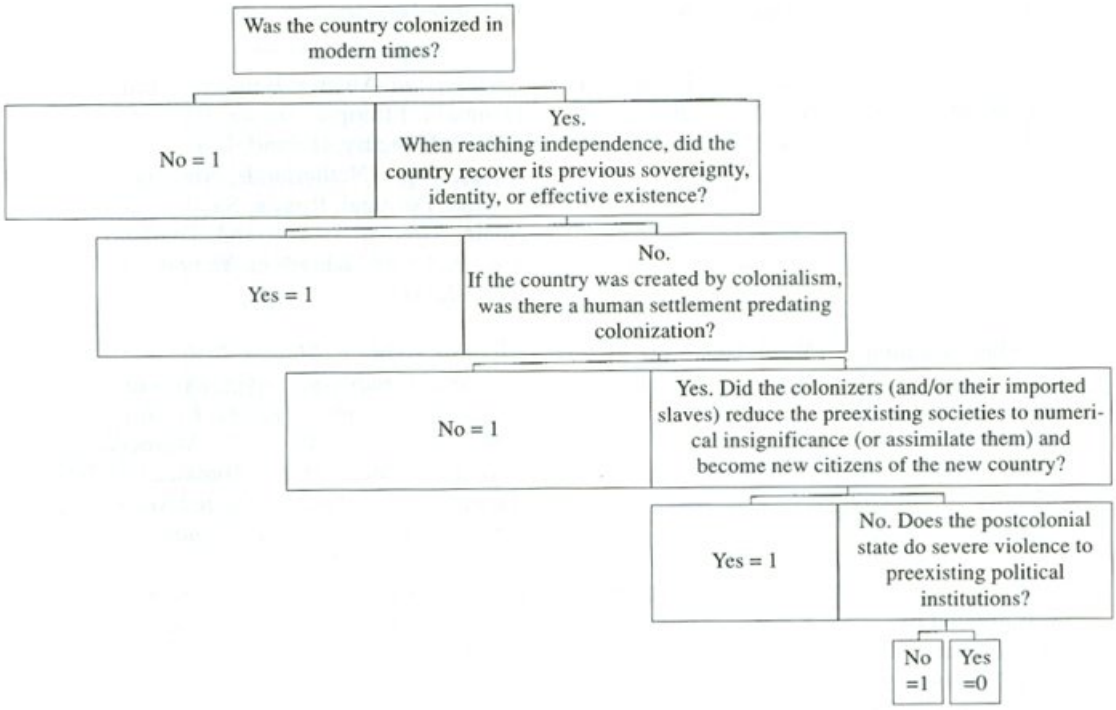
2.2.2 State legitimacy and famines

The theoretical grounding of state legitimacy and its impact on famines Following Englebert (2000 [8]), we focus on one particular dimension of states, that is the link between state as a structure and society as a whole of individuals. This idea is defined by the concept of state legitimacy. The concept has been used and developed for decades (see Bratton and Chang (2006 [32]) for a review). Here, we consider legitimacy as following: "a state is more legitimate the more that it is treated by its citizens as rightfully holding and exercising political power." (Gilley 2006 [29]:500). "Legitimacy is an endorsement of the state by citizens at a moral or normative level". The function of state legitimacy, as surveyed by Peter (2010 [33]), gives lead to a political economy of famines based on consideration for state. First, legitimacy brings political authority and trust in state. This trust is the basis of a better ability of institutions to protect citizens. In deed, state legitimacy increases its power to act. However, this is not independent of a second feature of state legitimacy that is the respect of social contract, reflecting how close the state is to society. Third, state legitimacy decreases the risk of shocks leading to famine, especially the likelihood of civil wars: trust in institutions build peace (Blattman and Miguel (2010) [34]). These channels might be considered as independent of political regime. However, according to Bratton and Chang (2006 [32]), we prefer an assumption of complementarity of state legitimacy and political regime, both variables building each other. The goal of this paper is to stress the interest of state legitimacy as

an institutional variable, but not against political regimes.

How to measure State Legitimacy There are three major ways to measure state legitimacy (see Gaus (2011) [35] for a detailed review). First, survey-based analysis focusses on the public opinion on state legitimacy. For instance Bratton and Chang (2006 [32]) use results of Afro-Barometer 2002 to analyze the link between state building and democratization. Second, there is a behavioral approach, stating that contestation behaviors mean a lower state legitimacy. Third, an approach focusses on the change of legitimation discourses of politicians as a way to define legitimacy. All these approaches refer to political legitimacy as "some benchmark of acceptability or justification of political power or authority and - possibly - obligation" (Peter (2010) [33]), but based on individual beliefs (Gaus (2011) [35]). Englebert (2000 [8]:72) provides an interesting alternative, using historical and ethnic background of a country to define its legitimacy. Two dimensions are stressed. Vertical legitimacy refers to the co-building of state and society, that shed light on state consistency. Figure 1 presents the construction such an index. The second dimension is horizontal legitimacy, that is the ethnic fragmentation inside the country, i.e. an index of the consistency of borders definition. Hence Englebert's database on state legitimacy is more likely to catch the political aspect of state capacity.

Figure 1: State Vertical Legitimacy - Decision Tree



Source: Englebert 2001 ([8])

To the best of our knowledge, Englebert (2000 [8]) is the only one testing the relevance of state legitimacy for economical issues. Empirically, Englebert (2000 [8]) provides evidences of the interest of state capacity to explain cross-country variations.

Concerning the introduction of state in a political economy of famines, an estimation is provided by Plumper and Neumayer (2009 [1]). However, they use gross national product of state as a proxy for state capacity: hence the data refers more to an economical power of states than to its effectiveness. Our study is the first to introduce statehood consideration in an economic analysis of famines, and the first to use Englebert's database in economic literature.

3 State legitimacy and famines: empirical investigation

3.1 Data

3.1.1 Data bases

We use a sample of 36 Sub-Saharan countries [5] from 1980 to 2005. Six databases are merged. The dataset is balanced.

Dependent variables are computed from the Emergency Disasters DataBase (EM-DAT) provided by the World Health Organization Collaborating Centre for Research on the Epidemiology of Disasters (CRED). The particular interest of this base is that even smaller famines are included. These data are computed from many different sources and are the most accurate and the largest available. We use both count of deaths and count of people affected[6] to generate a dummy variable: each time at least one people is affected by famine, we define the event as a famine. First, famine occurrence is a dummy variable by country and by year : 126 famines occurred during the period. The second dependent variable is the number of years of famine during the period.

Institutional variables on statehood and political regimes are computed from two bases. Englebert provides a dataset on state legitimacy. These variables do not vary during the period. Vertical legitimacy's computation is presented in figure 1. Horizontal legitimacy variable is equal to 1 minus the percentage of a country's population belonging to an ethnic group that was divided into, at least, two countries, after the decolonization. The types of regime is provided by Polity IV data base. Polity IV is a project on political regime characteristics, founded by Ted Gurr and directed by Monty G. Marshall. According to the Code book, the interest of this base is " that it examines concomitant qualities of democratic and autocratic authority in governing institutions, rather than discreet and mutually exclusive forms of governance". Interaction variables of shocks and institutions are computed from dummy for horizontal legitimacy - the dummy is equal to one if the variable is superior or equal to 75%[7]- and for democracy - the dummy equals 1 when the index

[5]Countries of the sample are: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo (former Congo Brazzaville), Democratic Republic of Congo (former Congo Kinchasa), Cote d'Ivoire, Eritrea, Ethiopia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Senegal, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

[6]People affected are "people requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people.", according to EM-DAT glossary.

[7]Following Englebert (2000)[8]

is superior or equal to 5 [8]. In deed, theses interaction variables describes the reactions to a shock differentiated by the fact that the government is democratic and by the fact that state is horizontal legitimate.

The other interest variables are variables of negative shocks : droughts and war, that are commonly considered as determinants of famines[9]. To define drought, we use the National Rainfall Index, that is the national average of the total annual precipitation weighted by its long-term average, computed by the United Nations Divisions for Sustainable Development. We check its robustness with an index that is richer but available for a smaller sample Palmer Drought Severity Index (PDSI)[10]. This index is an algorithm of soil moisture, and is computed using precipitation and temperature data, as well as the local Available Water Content (AWC) of the soil[11]. We derive two notions of drought. The "National Rainfall Drought" is computed from a standardized anomaly index for the country i at year j, and μ and σ the mean and the standard errors of the National Rainfall Index (NRI).

$$SAI_{i,j} = \frac{NRI_{i,j} - \mu_i}{\sigma_i}$$

There is a drought when $SAI_{i,j} < -1$. Similarly, a standardized anomaly index is computed for the Palmer index.

To measure international and civil wars, we use the Uppsala Conflict Data Program (UCDP) at the Department of Peace and Conflict Research, Uppsala University and Centre for the Study of Civil War at the International Peace Research Institute, Oslo (PRIO). According to the data presentation, "the dataset has been widely used since it was first made available, both by researchers and policy makers" (e.g. Collier (2003) [39]; Miguel (2004) [40]; and Wolfson (2004) [41])".

Per capita income is controlled using a database provided by World Bank, computing the purchasing power parity by country in current USD.

[8] This is the specification used by E. Miguel, S. Satyanath, E. Sergenti. (2004) [36]

[9] The 'war famines' are Angola 1974/6, 1993/4, 2001/2; Zaire 1977/8, 1997; Liberia 1992/3; Sierra Leone 1995/8, according to Devereux and Howe (2002) [15]

[10] As Dubresson et al. (1994) [37] argues, level of precipitation is not efficient to measure drought.

[11] This dataset has been computed by Couttenier and Soubeyran (2010) [38]

3.1.2 Summary statistics

Table 3 provides summary statistics. Approximately 13% of the countries of the sample go through a famine each year. In 2005, the mean number of years of famines is 3.5, with a standard deviation of 2.54. The mean horizontal legitimacy is 55.1% : in each country, 45% of the population belong in mean to ethnic groups that are divided into at least two countries. 30.5 % of the countries are hence horizontal legitimate. Only 14% of the sample is vertical legitimate. The index of democracy is very low in mean, but we have to take account of its improvement during the period. In 2005, 47% of the countries are democratic, this figure was only 19% in 1980. The mean drought is 24.3% considering NRI deviation, and 19.6 % considering (on a lower sample) Palmer drought.

Table 3: Summary Statistics

Variable	Mean	Std. Dev.	N
Country Characteristics			
Population	15071361.111	19951878.404	936
Per capita Income (Current USD, PPP)	648.502	787.093	741
Dependent Variables: Famine			
Famine Occurrence	0.135	0.341	936
Famine (People Affected)	255048.628	1348492.993	936
Famine Mortality (Absolute Value)	22246.759	25450.513	936
Political Institutions: State Legitimacy			
Horizontal Legitimacy	0.551	0.291	884
Dummy for Horizontal Legitimacy in 2005	0.306	0.467	36
Vertical Legitimacy	0.143	0.35	910
Political Institutions: Political Regime			
Democracy	2.042	2.885	828
Dummy for Democracy in 2005	0.472	0.506	36
Autocracy	4.501	3.119	828
Other Control Variable: War			
Civil War	0.226	0.419	936
Other Control Variable: Drought			
National Rainfall Index	978.899	478.914	936
Drought (National Rainfall Index)	0.243	0.429	936
Palmer Index	17.565	2.458	910
Drought (Palmer Index)	0.196	0.397	910

Table 4 provides more accurate descriptive statistics on institutional variables, comparing statehood variables to political regime and its evolution during the period[12]. A first observation is the large dispersion of the political variables in the sample, both concerning government quality and

[12]Except for Niger and Nigeria, these evolutions are linear.

statehood. It means that differentiating the countries by these institutional variables makes sense. Moreover, it is interesting to compare political regime and statehood quality. For instance, amongst the 12 countries that are horizontal legitimate (score $> 75\%$), only 4 are democracies : Botswana, Lesotho, Madagascar and South Africa. On the contrary, democratic countries of 2005 that do not have high horizontal legitimacy are Congo (former Congo-Brazzaville), Malawi, Mali, Namibia, Niger, Nigeria, Senegal, Sudan, Zambia.

Table 4: Summary Statistics for Political Variables from 1980 to 2005

Countries	**Democracy**	**Evolution**	**Autocracy**	**Evolution**	**Horiz. Legit.**	**Vertic. Legit.**
Angola	.83	2	5.43	-3	.53	0
Benin	3.96	6	2.5	-7	.67	0
Botswana	7.17	2	0	0	.90	1
Burkina Faso	.55	2	4.76	-5	.57	0
Burundi	1.48	7	4.95	-6	.98	1
Cameroon	.59	1	6.21	-3	.87	0
Central Afr. Rep.	1.93	**1**	3.48	-5	.19	0
Chad	.56	1	4.22	-4	.48	0
Congo	1.07	**0**	5.36	**-4**	.25	0
Congo, DRC	1.2	0	7.27	**-1**	.37	0
Cote d'Ivoire	.48	5	7.14	-8	.76	0
Eritrea	0	0	6.5	1	.	.
Ethiopia	1.68	3	4.48	-5	.95	1
Ghana	3.07	8	3.07	-7	.66	0
Guinea	.48	1	4.58	-7	.09	0
Kenya	2.21	8	4.31	-6	.64	0
Lesotho	3.84	8	3.64	-7	.99	1
Liberia	2.05	3	4.47	-4	.56	0
Madagascar	4.65	7	-6	1	0	
Malawi	3.07	6	4.45	-9	.34	0
Mali	4.07	7	2.75	-7	.13	0
Mauritania	.14	0	6	-2	.03	0
Mozambique	2.59	5	3.48	-8	.80	0
Namibia	6	0	0	0	.38	0
Niger	3.46	**7**	3.75	**-6**	.29	0
Nigeria	2.57	**4**	3.25	**-1**	.49	0
Senegal	3.79	6	2.10	-4	.20	0
Somalia	0	0	7	0	.03	0
South Africa	8.11	2	1.26	-3	.	0
Sudan	.86	0	5.82	-3	.42	0
Swaziland	0	0	9.45	-1	1	1
Tanzania	.96	2	4.45	-3	.74	0
Togo	.59	1	4.93	-4	.59	0
Uganda	.86	-3	3.93	**3**	.63	0
Zambia	3	**5**	3.76	-9	.44	0
Zimbabwe	1.28	-4	4.51	4	.75	0

Table 5 provides correlation between the political concepts. Obviously, the variables are close by subgroups refering to the same political concept, political regime on one hand, statehood on the other hand, but they are not highly correlated with the other type of institutional variable. Hence, this is a first evidence of a room for a political economy of famines taking account of statehood

quality.

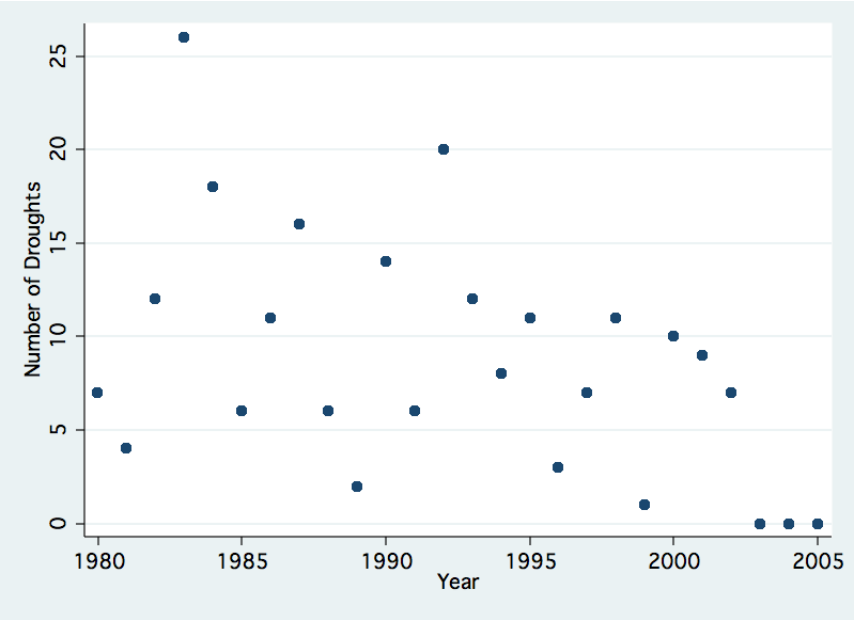
Table 5: Correlation between Political Variables

	Democracy	**Autocracy**	**Horizontal Legitimacy**	**Vertical Legitimacy**
Democracy	1			
Autocracy	-.8639***	1		
Horizontal Legitimacy	.0738**	.0202	1	
Vertical Legitimacy	.0834**	.0417	.5905***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

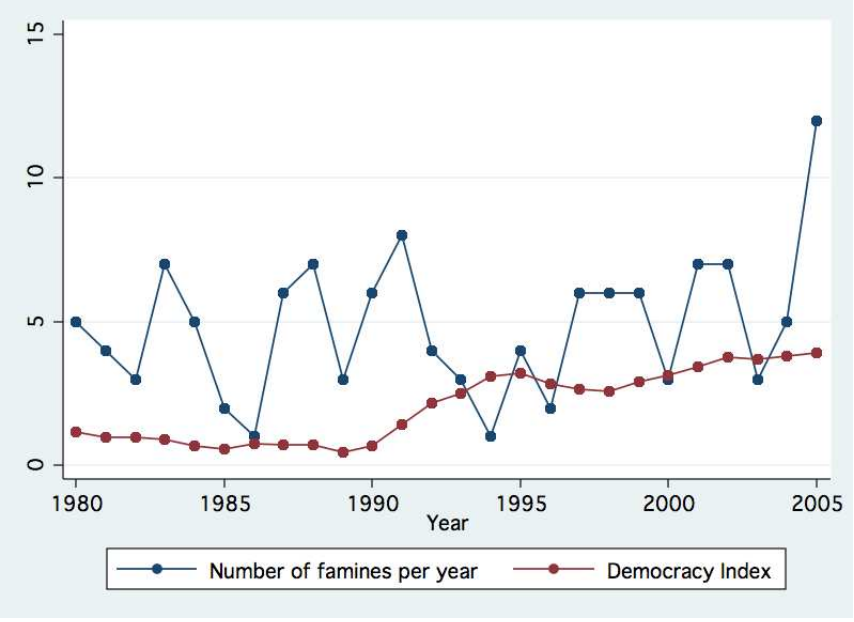
One main issue concerning this sample is the choice of Sub-Saharan countries, that are both famine-prone countries and more likely to be politically vulnerable. This choice of countries is first related to their vulnerability to famines than countries from other regions : following Sarracino (2010 [42]), we remind that the research on famines explanation have to have an applied goal, that is preventing famines. Second, these countries are chosen because they are still democracies under construction, and because state legitimacy is highly dispersed. Third, their vulnerability to famines might increase, sharpening the emergency to understand famines in this region of the world. Even though the number of droughts per year is decreasing in our sample of Sub-Saharan countries (figure 2), the trend is upward (Paeth et al. (2009)[43]). This apparent paradox can be explain by the fact that from 1980 to 1984, Africa knew sharp droughts, followed by a period of increasing rainfall amount (FAO (1996) [44]) This drying trend have two consequences: a change in land use and the increase in migrations, both stressing vulnerability of population. These three arguments, however, might lead to a selection bias within the sample, famines increasing the likelihood to become an autocratic regime or an unlegitimate state. However, data on statehood are only computed with social history of states, featuring parameters that are not influenced by health crisis - such as reaction to decolonization. Moreover, we observe on the period both an improvment of political regimes and an increase in the number of famines. Therefore, reverse causality with famines decreasing this index has no empirical background.

Figure 2: The shift of climatological environment



Source : National Rainfall Index

Figure 3: Comparison of the number of famines and the improvment of political regimes.



3.2 An estimation of famine occurrence

3.2.1 Empirical design: logit with panel data

Our first goal is to measure the impact of political variable on the likelihood of famines occurrence. Controlling for shocks increasing the likelihood of famines and for income increasing entitlement, we focus on the political variables, and their interaction with shocks variables.

3.2.2 Results

The results of a logit regression on famine occurrence is presented table 3. Two types of robustness controls are used: robust standard errors for each regression, and country fixed effects (columns (2), (4) and (6)). The significant coefficients of the regression have the expected signs and interesting magnitudes. Per capita income has no impact on famine occurrence. The level of precipitation has a negative impact on famine occurrence: the coefficient is significant at 99 percent confidence and doesn't vary with the addition of new variables. A famine is more likely to occur when there is a civil war the same year at 90 percent confidence (columns (1) and (5)). Vertical legitimacy has a highly negative impact on famine occurrence, taking acount of country fixed effects. Even though non significant, we observe a negative impact of the quality of political regime on famine occurrence. The impact of political variables on famines when a civil war occurs has the expected negative sign, although non significant.

However, we suspect endogeneity of the civil war variable. Although omitted variable might lead to a correlation between error term and civil war, the main factor of endogeneity here is simultaneity of famines and civil wars. Some authors argue that there are "civil war famines" (Devereux and Howe (2002) [15]), but the contrary is also likely: famines might lead to famines riots, that can degenerate into civil wars. Hence, we use an instrumental variable, the lagged civil war. Lagged civil war is a good instrument, because of a hight correlation with present civil war, and no correlation with famines [13]. We estimate the model with this lagged variable (Table 7) and we run Hausman tests on each regression to compare the instrumental regression to the previous. Except for the first equation (column (1)) run without country fixed effect, we find that civil war is exogenous : the

[13]To check the interest of this standard instrument in panel regression, we run two regressions. First, civil war is higly correlated with lagged civil war: the logit coefficient is 3.510 with a high Z-score 17.79. Second, lagged civil war doesn't explain famines: the logit run on lagged civil wars is not globally significant. However, further tests are run after the regressions.

model with an instrument is also consistent, and the H_0 assumption of non systematic difference between IV and regular model is satisfied.

This first empirical investigation provides evidences for the analysis, but the global significance of the model is disappointing. Some trends, due to the nature of the sample (panel data) may be hidden with a linear model.

The same model is estimated with a logit on panel data, on Table 8. Signs and magnitude of estimated coefficients are similar to previous estimation. The level of precipitation is still significant and negative with the same magnitude than previously. Signs and magnitude of coefficients are similar using palmer index instead of National Rainfall Index, however non globally significant (see table 16). A famine is still more likely to occur during a civil war. The coefficients associated to state legitimacy are significantly negative taking account of country fixed effects. Even though non significant, the coefficient associated to political regime is also negative : increasing by one the index of good quality of regime decreases the likelihood of famine. Interaction variable are non significant, but have the expected sign, except for the interaction of civil war and horizontal legitimacy. However, the z-scores associated are so low that we can't conclude.

Like in previous estimation, we suspect endogeneity of the civil war variable. We estimate the model with lagged civil war (table 9) and we observe the same negative effect of National Rainfall Index and civil wars on famine occurrence. Political variables are less certain. When asymptotic assumption is filled out, Hausman test have low chi2 scores, except for the last specification (column 7). Therefore, the regular model is consistent as well : civil war is considered as exogenous.

3.3 Adding a dynamic dimension: accumulating famines

3.3.1 Empirical design and interest

As each of the state went throught at least one famine during the 1980-2005 period, the role of political variable might be lowered considering the unique event of a famine occurring. Hence, we use a second variable of interest, more likely to represent the intensity of famine risk. This section focusses on the repetition and cumulation of events, with an other way to measure famines. A count variable is created: the accumulation of famines during the selected period (1980-2005). The interpretation is as follows: controlling for shocks, political variables might impact this count. A more legitimate state is less likely to go through a large number of famine across years.

Table 6: Logit on Famine Occurrence

	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Income	0.0000378	-0.000158	0.0000455	-0.000193	0.0000598	-0.000208
	(0.23)	(-0.27)	(0.28)	(-0.32)	(0.36)	(-0.35)
NRI	-0.00103***	-0.00391**	-0.00103***	-0.00399**	-0.000972***	-0.00321
	(-3.73)	(-2.79)	(-3.69)	(-2.84)	(-3.50)	(-1.93)
Civil War	0.651*	0.162	0.810*	0.179	0.813*	0.238
	(2.28)	(0.33)	(2.11)	(0.22)	(2.09)	(0.29)
Horizontal Legitimacy	0.222	0.609	0.314	1.319	0.0661	0.149
	(0.61)	(0.47)	(0.69)	(0.85)	(0.11)	(0.08)
Vertical Legitimacy	-0.0240	-4.823*	-0.0274	-5.736**	0.0703	-3.991
	(-0.05)	(-2.46)	(-0.05)	(-2.93)	(0.12)	(-1.56)
Democracy	-0.0835	-0.0323	-0.0803	-0.0109	-0.105	-0.0368
	(-1.69)	(-0.47)	(-1.49)	(-0.14)	(-1.81)	(-0.42)
Civil War * Horizontal Legitimacy			-0.247	0.753	-0.0252	0.802
			(-0.33)	(0.63)	(-0.03)	(0.66)
Civil War * Vertical Legitimacy			-0.259	-1.543	-0.419	-1.615
			(-0.24)	(-1.06)	(-0.37)	(-1.09)
Civil War * Democracy			-0.0243	-0.0226	-0.0354	-0.0379
			(-0.21)	(-0.17)	(-0.30)	(-0.26)
Drought * Horizontal Legitimacy					0.525	0.217
					(1.03)	(0.36)
Drought * Democracy					0.0893	0.0703
					(0.96)	(0.62)
Constant	-0.987**	3.571	-1.034**	3.665*	-1.100**	2.755
	(-2.75)	(1.94)	(-2.77)	(1.97)	(-2.92)	(1.32)
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Wald Test	20.25***	54.64 ***	21.16**	57.67***	23.33**	61.06***
Log-Likelihood	-209.652	-186.792	-209.426	-186.120	-207.613	-185.699
Observations	554	554	554	554	554	554

Z statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Logit on Famine Occurrence - Instrument: Lagged civil war

	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Income	0.0000227	-0.000220	0.00000948	-0.000121	0.0000280	-0.000132
	(0.13)	(-0.36)	(0.05)	(-0.20)	(0.16)	(-0.22)
NRI	-0.000860**	-0.00416**	-0.000929**	-0.00404**	-0.000870**	-0.00370*
	(-3.03)	(-2.86)	(-3.21)	(-2.80)	(-3.04)	(-2.09)
Lagged Civil War	0.929**	0.662	0.855*	0.0842	0.849*	0.123
	(3.21)	(1.30)	(2.32)	(0.09)	(2.28)	(0.13)
Horizontal Legitimacy	0.221	1.254	0.461	0.612	0.245	0.489
	(0.59)	(0.94)	(1.01)	(0.38)	(0.43)	(0.26)
Vertical Legitimacy	0.147	-5.250**	-0.172	-3.495*	-0.0765	-4.368
	(0.33)	(-2.61)	(-0.32)	(-2.32)	(-0.13)	(-1.64)
Democracy	-0.0725	-0.0156	-0.0959	-0.0548	-0.125	-0.0795
	(-1.45)	(-0.21)	(-1.71)	(-0.62)	(-1.93)	(-0.80)
Lagged Civil War * Horiz. Legit			-0.610	0.145	-0.417	0.134
			(-0.78)	(0.11)	(-0.52)	(0.10)
Lagged Civil War * Vertical Legitimacy			1.169	0.786	0.983	0.780
			(1.15)	(0.54)	(0.95)	(0.53)
Lagged Civil War * Democracy			0.586	0.976	0.573	0.922
			(0.80)	(0.92)	(0.78)	(0.84)
Drought * Horizontal Legitimacy					0.469	-0.0430
					(0.95)	(-0.07)
Drought * Democracy					0.0922	0.0639
					(1.02)	(0.51)
Constant	-1.278***	3.383	-1.182**	3.797	-1.254**	3.388
	(-3.33)	(1.81)	(-3.05)	(1.91)	(-3.20)	(1.44)
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Wald-Test	21.28***	56.25***	23.11***	57.76***	24.88***	60.17***
Log-Likelihood	-198.684	-174.402	-197.907	-173.771	-196.271	-173.586
Hausman test	21.14***	3.69	-17.75	3.36	7.17	9.29
Observations	554	554	554	554	554	554

Z statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Logit on Panel Data - Famine Occurrence

Equal correlation model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Per Capita Income	-0.000119	0.0000211	-0.000183	0.0000312	-0.000219	0.0000435	-0.000231
	(-0.24)	(0.13)	(-0.31)	(0.19)	(-0.37)	(0.26)	(-0.40)
NRI	-0.00372***	-0.00108***	-0.00393***	-0.00106***	-0.00401***	-0.000994**	-0.00322
	(-3.66)	(-3.64)	(-3.66)	(-3.32)	(-3.79)	(-2.85)	(-1.95)
Democracy	-0.0331	-0.0750	-0.0322	-0.0709	-0.0106	-0.0935	-0.0387
	(-0.63)	(-1.74)	(-0.57)	(-1.44)	(-0.17)	(-1.65)	(-0.58)
Horizontal Legitimacy	.261	0.213	-2.880***	0.263	-3.417**	-0.0147	-2.904*
	(0.70)	(0.61)	(-3.35)	(0.57)	(-2.97)	(-0.03)	(-2.28)
Vertical Legitimacy	-.170	-0.0373	-1.553***	0.0191	-1.206***	0.155	0.849
	(-0.31)	(-0.08)	(-5.96)	(0.03)	(-3.94)	(0.21)	(0.90)
Civil War		0.584	0.166	0.746*	0.195	0.747*	0.250
		(1.87)	(0.32)	(2.14)	(0.26)	(2.14)	(0.33)
Civil War * Horizontal Legitimacy				-0.143	0.724	0.0963	0.773
				(-0.22)	(0.84)	(0.14)	(0.85)
Civil War * Vertical Legitimacy				-0.441	-1.521	-0.650	-1.588
				(-0.56)	(-1.32)	(-0.71)	(-1.28)
Civil War * Democracy				-0.0260	-0.0227	-0.0386	-0.0373
				(-0.27)	(-0.20)	(-0.40)	(-0.30)
Drought * Horizontal Legitimacy						0.524	0.202
						(0.91)	(0.26)
Drought * Democracy						0.0896	0.0753
						(1.00)	(0.56)
Constant		-0.923*	3.615**	-0.991*	3.695**	-1.071*	2.772
		(-2.52)	(2.82)	(-2.46)	(2.91)	(-2.53)	(1.46)
Convergence	Yes	Yes	No	Yes	No	Yes	No
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	Yes	No	Yes	No	Yes
Wald-Test	21.55***	25.89***	4809.83***	49.28***	5346.33***	34.87***	4195.43***
Observations	488	554	554	554	554	554	554

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Logit on panel data, equal correlation specification.

Table 9: Logit on Panel Data - Famine Occurrence - Lagged Civil War

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Per Capita Income	0.00000299	0.00000933	-0.000254	-0.00000219	-0.000156	0.0000125	-0.000165
	(0.02)	(0.06)	(-0.32)	(-0.01)	(-0.20)	(0.08)	(-0.22)
NRI	-0.00114***	-0.000918**	-0.00418***	-0.000974**	-0.00406***	-0.000910**	-0.00372*
	(-3.46)	(-2.97)	(-3.70)	(-3.08)	(-3.64)	(-2.71)	(-2.10)
Horizontal Legitimacy	0.261	0.213	-8.912***	0.438	-3.422*	0.210	-3.117
	(0.70)	(0.61)	(-8.38)	(0.95)	(-2.49)	(0.36)	(-1.76)
Vertical Legitimacy	-0.170	0.144	6.538***	-0.164	-1.007**	-0.0468	-1.060**
	(-0.31)	(0.28)	(6.03)	(-0.28)	(-3.09)	(-0.08)	(-3.05)
Democracy	-0.0718	-0.0655	-0.0150	-0.0912	-0.0546	-0.118*	-0.0811
	(-1.64)	(-1.53)	(-0.26)	(-1.94)	(-0.93)	(-2.06)	(-1.13)
Lagged Civil War		0.882**	0.664	0.798*	0.0922	0.784*	0.132
		(3.27)	(1.89)	(2.09)	(0.12)	(2.05)	(0.17)
Lagged Civil War * Horiz. Legit				-0.570	0.126	-0.368	0.121
				(-0.92)	(0.15)	(-0.61)	(0.14)
Lagged Civil War * Vertical Legitimacy				1.134*	0.805	0.922	0.797
				(1.99)	(1.04)	(1.74)	(1.00)
Lagged Civil War * Democracy				0.607	0.979	0.584	0.931
				(0.90)	(1.14)	(0.97)	(1.07)
Drought * Horizontal Legitimacy						0.452	-0.0590
						(0.77)	(-0.07)
Drought * Democracy						0.0929	0.0686
						(1.03)	(0.46)
Constant	-0.709	-1.219**	3.432*	-1.128*	3.842*	-1.204**	3.428
	(-1.53)	(-2.86)	(2.33)	(-2.54)	(2.25)	(-2.63)	(1.39)
Convergence	Yes	Yes	No	Yes	No	Yes	No
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	Yes	No	Yes	No	Yes
Wald-Test	21.55***	34.71***	4637.07***	76.04***	5231.99***	104.06***	4742.72***
Hausman test		6.54	-412.51	7.75	-927.83	11.57	27312.82***
Observations	488	554	554	554	554	554	554

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Logit on panel data, equal correlation specification.

Because it is a count variable, we use count models to estimate the impact of political variables.

3.3.2 Results

The distribution of the count variable helps choosing the best model. Poisson regression has one strong assumption, the equality of mean and variance λ. Statistically, the count varies from 0 to 10, with a 1.88 mean and a 3.93 variance: there is an overdispersion of data. The distribution of the cumulative sum of famines across year is very likely to follow a negative binomial process (see figures 4 and 5).

Figure 4: Frequency of the number of cumulated famines

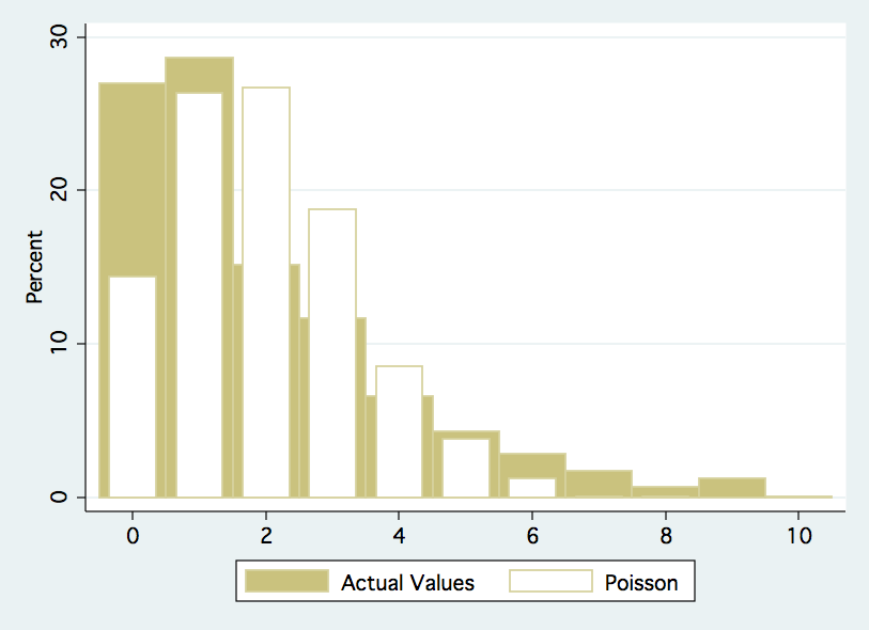
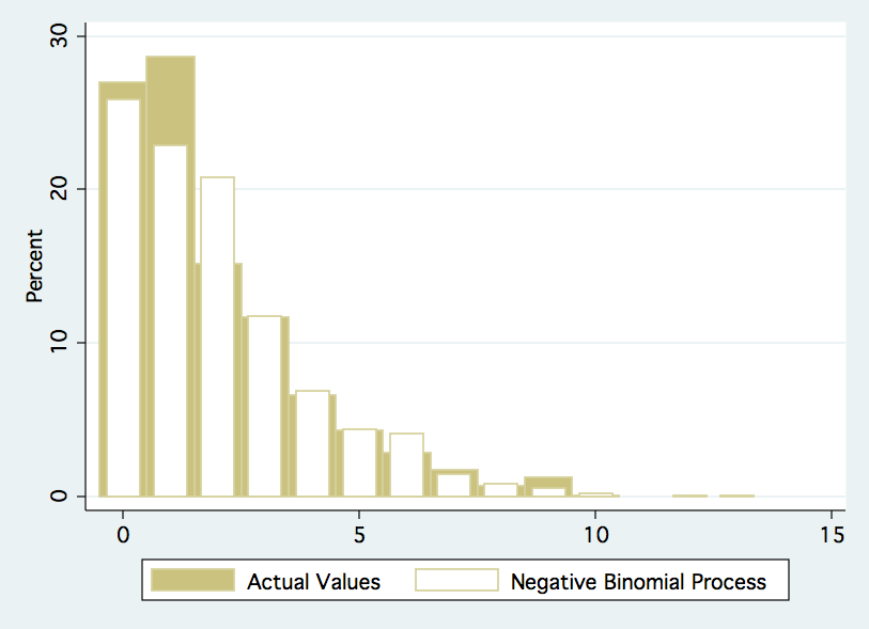


Figure 5: Frequency of the number of cumulated famines (Negative binomial Projection)



Because of this overdispersion of data we run a negative binomial regression[14], presented table 10. It is more likely to fit the data. Two types of robustness controls are used: robust standard errors for each regression and country fixed effects ((2), (4) and (6)). As expected, shocks variables have a negative impact on famines: lower precipitations or a civil war during one year increases the number of years of famines. The direct effect of state legitimacy is significantly negative and have a higher magnitude than the shocks variables. Surprisingly, political regime quality has a positive coefficient, but its interaction with shocks remains negative and of higher magnitude than the direct effect: hence, we can say that a political regime is not in itself a good factor of prevention of famine, but acts positively when there is a shock. We check civil war endogeneity running a model with lagged civil wars (table 11). Hausman tests have different behaviors. Some are weakly positive (column 1 and 3), some are strongly positive but related to a non convergent estimation (column 2), or strongly negative (columns 4 and 6), meaning that the model fitted fails to meet asymptotic assumption. These outcomes invite us to stay cautious with the results. Moreover, the panel dimension is not taken into account.

Therefore we run a negative binomial regression for panel data (table 12). Results hold with this

[14]Results of a Poisson regression are available upon request and present the same results.

specification: horizontal legitimacy and democracy have a significant and negative impact on the number of years of famines during the period, controling for shocks and with country fixed effects. A country is less likely to accumulate famines in the long run when its state effectiveness is higher and when its political regime quality increases. The coefficients do not help to determine a higher effect of state legitimacy or of political regime. They help showing the interest of a political concept that is broader than political regime: state effectiveness matters significantly. Interestingly, civil war coefficient is lowered taking account of the longitudinal dimension. Hence, in the long run, political variables matter more. Like in previous regressions, we control for endogeneity of civil war, running a regression with lagged civil war (table 13). The Hausman tests are balanced. Some are weakly positive or negative (columns 1, 3 and 6), but adding country fixed effect leads to a clear conclusion of endogeneity of civil war. Hence, we prefer to interpret the instrumental model. We focus on the columns 3 and 5, that are convergent estimations with interaction variables. The impact of a drought is still the same, significantly negative. Per capita income still have no significant impact on famine. Lagged civil war increases the number of year of famines at current year. Interestingly, the coefficient associated to the interaction between horizontal legitimacy and lagged civil war has the same magnitude with opposite sign : the effect of a civil war is cancelled when the state is horizontal legitimate. Surprisingly, the coefficient associated to democracy is positive. Nevertheless, this effect is ten times lower than its association with civil war. We explain the positive coefficient of vertical legitimacy by the fact that Ethiopia, that is vertical legitimate, is also the country that went through the greater number of years of famines -9- during the period.

Table 10: Negative Binomial Regression - Dependent Variable: Accumulation of Famines

	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Income	-0.00000279	-0.0000334	0.0000161	-0.000135	0.0000111	-0.000133
	(-0.07)	(-0.28)	(0.41)	(-1.25)	(0.28)	(-1.23)
NRI	-0.000725***	0.0000676	-0.000784***	0.000106	-0.000790***	0.0000924
	(-7.79)	(0.29)	(-8.86)	(0.48)	(-9.01)	(0.31)
Civil War	0.450***	-0.173	0.894***	0.407	0.889***	0.391
	(4.03)	(-1.57)	(7.04)	(1.89)	(7.02)	(1.82)
Horizontal Legitimacy	-0.0389	-1.382***	0.229*	-0.943***	0.222	-0.997***
	(-0.36)	(-5.55)	(2.02)	(-3.58)	(1.68)	(-3.37)
Vertical Legitimacy	-0.0130	-2.112**	-0.317	-2.332***	-0.316	-2.292***
	(-0.08)	(-3.00)	(-1.91)	(-3.56)	(-1.95)	(-3.45)
Democracy	0.0322**	0.0782***	0.0545***	0.119***	0.0625***	0.124***
	(2.77)	(4.73)	(4.57)	(10.16)	(4.40)	(9.78)
Civil War * Horizontal Legitimacy			-1.098***	-0.700**	-1.109***	-0.681**
			(-4.98)	(-2.73)	(-4.96)	(-2.66)
Civil War * Vertical Legitimacy			1.287**	0.811**	1.297**	0.791**
			(3.00)	(2.65)	(3.03)	(2.58)
Civil War * Democracy			-0.166***	-0.150***	-0.161***	-0.146***
			(-4.89)	(-5.76)	(-4.80)	(-5.87)
Drought * Horizontal Legitimacy					-0.00774	0.0965
					(-0.05)	(0.81)
Drought * Democracy					-0.0342	-0.0184
					(-1.74)	(-1.22)
Constant	0.992***	1.340***	0.939***	0.852*	0.952***	0.875*
	(8.33)	(4.52)	(8.24)	(2.52)	(8.43)	(2.14)
Convergence	Yes	Yes	Yes	Yes	Yes	Yes
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Wald	116.71***	.	198.71***	.	202.65***	.
Log Likelihood	-893.271	-673.213	-869.326	-655.220	-868.246	-654.892
Observations	554	554	554	554	554	554

Z statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Negative Binomial Regression - Dependent Variable: Accumulation of Famines

Lagged Civil War

	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Income	-0.00000968	-0.0000589	0.00000281	-0.000139	-0.00000272	-0.000134
	(-0.24)	(-0.51)	(0.07)	(-1.27)	(-0.07)	(-1.21)
NRI	-0.000702***	0.0000535	-0.000799***	0.0000101	-0.000808***	-0.0000970
	(-7.64)	(0.24)	(-8.90)	(0.05)	(-9.11)	(-0.35)
Lagged Civil War	0.511***	-0.101	0.834***	0.466*	0.830***	0.450*
	(4.88)	(-1.06)	(6.92)	(2.38)	(6.92)	(2.31)
Horizontal Legitimacy	-0.0512	-1.287***	0.230*	-0.798***	0.237	-0.905***
	(-0.48)	(-5.34)	(2.01)	(-3.36)	(1.81)	(-3.44)
Vertical Legitimacy	0.0291	-2.116**	-0.302	-0.440***	-0.305	-0.441***
	(0.19)	(-3.03)	(-1.82)	(-4.34)	(-1.89)	(-4.17)
Democracy	0.0296**	0.0759***	0.0481***	0.121***	0.0568***	0.127***
	(2.61)	(4.68)	(3.94)	(10.76)	(3.96)	(10.48)
Lagged Civil War * Horiz. Legit			-0.890***	-0.467*	-0.907***	-0.463*
			(-4.46)	(-1.97)	(-4.47)	(-1.97)
Lagged Civil War * Vertical Legitimacy			0.954**	0.197	0.980**	0.198
			(2.74)	(0.83)	(2.80)	(0.84)
Lagged Civil War * Democracy			-1.078***	-1.247***	-1.052***	-1.211***
			(-5.46)	(-6.50)	(-5.42)	(-6.78)
Drought * Horizontal Legitimacy					-0.0593	0.0345
					(-0.38)	(0.34)
Drought * Democracy					-0.0374	-0.0213
					(-1.90)	(-1.50)
Constant	0.994***	1.300***	0.991***	0.793**	1.008***	0.924**
	(8.50)	(4.73)	(8.61)	(2.73)	(8.85)	(2.59)
Convergence	Yes	No	Yes	No	Yes	Yes
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Wald Test	119.29***	.	187.63***	.	195.35***	.
Log-Likelihood	-864.393	-648.088	-843.097	-629.679	-841.401	-629.326
Hausman Test	14.87**	643939.68***	9.37*	-12161.20	6.97	-15243.53
Observations	534	534	534	534	534	534

Z statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: Estimation of Famines Accumulation - Negative Binomial Regression with Panel Data

	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Income	-0.0000136	-0.0000613	-0.0000441	-0.000123	-0.0000473	-0.000124
	(-0.09)	(-0.29)	(-0.30)	(-0.63)	(-0.33)	(-0.63)
NRI	-0.000265	-0.0000230	-0.000267	0.0000576	-0.000388*	0.0000869
	(-1.60)	(-0.09)	(-1.57)	(0.23)	(-2.06)	(0.27)
Civil War	-0.0816	-0.140	0.507*	0.520*	0.479*	0.514*
	(-0.53)	(-0.59)	(2.49)	(2.22)	(2.40)	(2.20)
Horizontal Legitimacy	-0.197	-1.648***	-0.219	-0.850**	-0.216	-0.871**
	(-0.55)	(-7.08)	(-0.56)	(-2.91)	(-0.54)	(-2.65)
Vertical Legitimacy	0.288	-1.820***	0.272	-2.595***	0.248	-2.577***
	(0.53)	(-8.90)	(0.51)	(-9.00)	(0.46)	(-7.96)
Democracy	0.0829*	0.103***	0.113***	0.115***	0.122***	0.119***
	(2.41)	(4.33)	(5.62)	(4.72)	(5.48)	(4.61)
Civil War * Horizontal Legitimacy			-0.885***	-0.925***	-0.868***	-0.905***
			(-3.66)	(-3.58)	(-3.51)	(-3.34)
Civil War * Vertical Legitimacy			0.958***	1.169**	0.952***	1.153**
			(4.31)	(3.08)	(4.19)	(3.00)
Civil War * Democracy			-0.152**	-0.145***	-0.144**	-0.144***
			(-2.86)	(-4.36)	(-2.93)	(-4.51)
Drought * Horizontal Legitimacy					0.0311	0.0892
					(0.25)	(0.61)
Drought * Democracy					-0.0377**	-0.0116
					(-2.88)	(-0.86)
Constant	0.582*	1.396***	0.454*	0.787*	0.577**	0.756
	(2.46)	(4.80)	(2.27)	(2.43)	(2.79)	(1.94)
Convergence	Yes	No	Yes	No	Yes	No
Robust Standard Errors	Yes	No	Yes	No	Yes	No
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Wald Test	12.37*	2087.57***	857.73***	5504.59***	927.73***	7871.01***
Observations	554	554	554	554	554	554

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13: Negative Binomial Regression on Panel Data - Lagged Variable

	(1)	(2)	(3)	(4)	(5)	(6)
Per Capita Income	-0.0000297	-0.0000867	-0.0000488	-0.000128	-0.0000543	-0.000124
	(-0.20)	(-0.42)	(-0.30)	(-0.63)	(-0.35)	(-0.61)
NRI	-0.000246	-0.0000132	-0.000302	-0.0000389	-0.000469*	-0.000127
	(-1.59)	(-0.05)	(-1.79)	(-0.16)	(-2.48)	(-0.40)
Lagged Civil War	-0.0144	-0.0445	0.514**	0.498*	0.487**	0.490*
	(-0.11)	(-0.22)	(3.08)	(2.16)	(2.98)	(2.13)
Horizontal Legitimacy	-0.217	-1.512***	-0.266	-0.755*	-0.231	-0.837*
	(-0.62)	(-6.80)	(-0.67)	(-2.47)	(-0.57)	(-2.53)
Vertical Legitimacy	0.331	-1.869***	0.391	-0.450***	0.343	-0.448***
	(0.62)	(-9.23)	(0.70)	(-6.33)	(0.61)	(-5.83)
Democracy	0.0817*	0.101***	0.114***	0.115***	0.123***	0.120***
	(2.47)	(4.71)	(5.73)	(5.21)	(5.58)	(5.10)
Lagged Civil War * Horiz. Legit			-0.586**	-0.626**	-0.585**	-0.625*
			(-2.71)	(-2.62)	(-2.72)	(-2.55)
Lagged Civil War * Vertical Legitimacy			0.323	0.596	0.359	0.599
			(1.36)	(1.28)	(1.50)	(1.28)
Lagged Civil War * Democracy			-1.207***	-1.041***	-1.151***	-1.027***
			(-3.58)	(-4.02)	(-3.86)	(-4.10)
Drought * Horizontal Legitimacy					-0.0266	0.0132
					(-0.20)	(0.09)
Drought * Democracy					-0.0381**	-0.0167
					(-2.66)	(-1.18)
Constant	0.581**	1.305***	0.488*	0.802**	0.655**	0.905**
	(2.64)	(5.06)	(2.40)	(2.67)	(3.18)	(2.59)
Convergence	Yes	No	Yes	No	Yes	No
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Wald Test	11.06*	2131.68***	260.87***	3989.77***	1033.87***	7581.82***
Hausman Test	0.04	111.92***	-0.58	61.55***	-8.00	276689.60***
Observations	554	554	554	554	554	554

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14: Test of predicted probabilities for Poisson

Count	Actual	Poisson	Diff. Poisson	Negative Binomial	Diff. Negative Binomial
0	.2701	.2677	-.0024	.2961	.0260***
1	.2864	.2982	.0118***	.2873	.0009
2	.1513	.2059	.0546***	.1880	.0367***
3	.1169	.1162	-.0007	.1068	-.0101***
4	.0661	.0596	-.0065***	.0576	-.0085***
5	.0431	.0289	-.0142***	.0305	-.0126***
6	.0287	.0134	-.0153***	.0161	-.0126***
7	.0172	.0059	-.0113***	.0084	-.0088***
8	.0067	.0025	-.0042***	.0044	-.0023***
9	.0125	.0010	-.0115***	.0023	-.0102***
10	.0010	0	-	0	-
Sum	1.1334	1.5993	.4259***	1.6042	.4708***

Z statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A dispersed probabilities test doesn't help to choose the model. However, as the results are similar in sign, magnitude and significance, the interpretation helds.

3.3.3 Temporal autocorrelation

One last issue is the existence of temporal autocorrelation: health crisis increases the vulnerability of a country. We run an Arellano-Bond estimation on the number of years of famines, with different lags. Table 15 shows the results. A striking fact is the correlation between dependent variable and its lagged values, from the first to the third - more lags doesn't improve the quality of the results. Despite this result, the interpretation of the results is quite the same than that of previous estimations. National Rainfall Index still has a negative effect on the number of years of famines. Per capita income, even with this dynamic consideration, have no impact on the number of years of famines. The positive effect of civil war on the number of years of famine is more uncertain, however non significant. When significant, institutional quality variable decreases the number of years of famine: when there is a civil war, taking account of the country history, vertical legitimacy of the state decreases the likelihood of a new famine occurrence. This effect is the same, however non significant, for democracy index.

Hence, whatever the empirical strategy, institutional variables matter and have a significant impact on the occurrence and the intensity of famines.

Table 15: Results of an Arellano-Bond Estimation with Robust Standard Errors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lag 1	0.798***	0.915***	0.916***	0.705***	0.699***	0.698***	0.668***	0.661***	0.660***
	(19.78)	(44.09)	(44.89)	(17.53)	(18.36)	(18.59)	(14.44)	(14.52)	(14.43)
Lag 2				0.227***	0.237***	0.238***	0.164***	0.176***	0.179***
				(6.45)	(6.50)	(6.59)	(3.44)	(3.44)	(3.52)
Lag 3							0.104	0.107	0.104
							(1.82)	(1.72)	(1.67)
Per Capita Income	-0.0000558	0.0000849	0.0000871	0.0000820	0.0000864	0.0000878	0.000107	0.000115	0.000112
	(-0.71)	(1.04)	(1.06)	(0.93)	(0.89)	(0.90)	(1.11)	(1.08)	(1.06)
NRI	-0.000391***	-0.000432***	-0.000390*	-0.000345***	-0.000371***	-0.000332*	-0.000305**	-0.000331***	-0.000324
	(-4.05)	(-4.74)	(-2.44)	(-3.35)	(-3.74)	(-2.00)	(-3.14)	(-3.59)	(-1.96)
Civil War	-0.0182	0.102	0.105	-0.0122	0.0667	0.0680	-0.0486	-0.00288	-0.00472
	(-0.24)	(1.10)	(1.14)	(-0.16)	(0.63)	(0.64)	(-0.56)	(-0.03)	(-0.05)
Democracy	0.00525	0.00968	0.00922	-0.0134	-0.0000364	-0.00140	-0.0170	-0.00794	-0.00841
	(0.33)	(0.44)	(0.48)	(-0.77)	(-0.00)	(-0.07)	(-0.99)	(-0.36)	(-0.41)
Civ. War * H. Legit.		0.163	0.171		0.236	0.24 1		0.271	0.269
		(0.89)	(0.86)		(1.36)	(1.28)		(1.69)	(1.56)
Civ. War * V. Legit.		-0.555**	-0.565**		-0.602***	-0.607**		-0.710***	-0.704***
		(-3.19)	(-2.87)		(-3.66)	(-3.23)		(-4.24)	(-3.77)
Civ. War * Democ.		-0.0335	-0.0343		-0.0211	-0.0219		-0.00640	-0.00662
		(-1.70)	(-1.77)		(-0.99)	(-1.03)		(-0.31)	(-0.32)
Drought * H. Legit.			0.0249			0.0104			-0.00160
			(0.26)			(0.11)			(-0.02)
Drought * Democ.			0.00284			0.00488			0.00157
			(0.18)			(0.32)			(0.11)
Constant	0.867***	0.622***	0.573**	0.596***	0.584***	0.542*	0.578***	0.566***	0.561*
	(7.02)	(5.07)	(2.72)	(4.59)	(4.20)	(2.46)	(4.26)	(3.97)	(2.48)
Wald Test	530.80 ***	3155.04 ***	3592.09***	1862.82***	2800.04***	3140.06***	1596.32***	2593.42***	2808.42***
Observations	487	487	487	476	467	467	454	445	445

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4 Conclusive remarks

This paper points out a striking fact: there is room for a political economy of famines based on considerations for statehood, different from political regime. Hence, especially focusing on Sub-Saharan Africa, the structure of power, i.e. the state, is as important as the rules, i.e. the government, to understand crisis management.

However, we would like to conclude by two issues that need further investigations. First, an empirical issue follows from our estimation. As pointed out, data quality could be improved. A better dataset on other statehood features would allow us to support our assumption with stronger arguments. For instance, state capacity as defined by Besley and Persson (2009[45]) would be an other track to evaluate the weight of state structure on famines. In particular, features of legal capacity - the law accountability - and features of fiscal capacity - the capacity of state to rise income - could lead to a better understanding of the link between statehood and famines. However, existing data for Sub-Saharan countries are available for a short period, starting in 1996[15].

A second issue concerns the channels through which statehood actq against famines. In a further research, we would like to understand the modes of enforcement of the social contract between state and society, and therefore the main outcomes of a qualitative statehood. Policy implications could follow.

[15]These variables are computed by World Bank and by the Political Risk Services group (PRS), throught the International Country Risk Guide (ICRG)

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Table 16: Logit on Panel Data with Palmer Index

	(1)	(2)	(3)
Per Capita Income	0.000132	0.000146	0.000145
	(0.65)	(0.75)	(0.75)
Palmer Index	-0.0425	-0.0410	-.0447
	(-0.79)	(-0.76)	(-0.80)
Horizontal Legitimacy	0.201	0.204	0.222
	(0.41)	(0.45)	(0.44)
Vertical Legitimacy	0.196	0.225	0.157
	(0.33)	(0.41)	(0.27)
Democracy	0.0135	0.0142	0.0148
	(0.29)	(0.31)	(0.29)
Civil War		0.574	0.562
		(1.83)	(1.22)
Civil War * Horizontal Legitimacy			-0.0780
			(-0.10)
Civil War * Vertical Legitimacy			0.327
			(0.33)
Civil War * Democracy			-0.00741
			(-0.07)
Constant	-1.436	-1.583	-1.509
	(-1.48)	(-1.66)	(-1.49)
Observations	630	630	630
Wald Test	1.59	4.95	5.12
Log-Likelihood	-254.662	-253.107	-253.041

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$