

HUNGER AND ANGER IN AUTOCRACIES AND DEMOCRACIES

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How do democracies and autocracies respond to rising food prices? Authoritarian regimes, we argue, must match the redistribution that the poor would obtain in a democracy to prevent an uprising. Interpreting authoritarian regimes as the rule of a faction of the rich, we develop a model that suggests that (1) food price inflation is both a threat to democracies and autocracies, (2) food price inflation is more of a threat to autocracies than to democracies, and (3) food price inflation is more of a threat to autocracies that are more factionalized. We provide empirical evidence for these hypotheses.

Keywords: Food Price Inflation, Food Price Riots, Comparative Economics

JEL Classification: H12, O12, O15, P51

1. Introduction

The 2007/2008 Food Price Crisis was a grim reminder of the importance of food security for political stability. While the relationship between food security and political stability has been known since biblical times, the exact transmission mechanism from food insecurity to political instability in different political regimes is still an underdeveloped research question.

The starting point for this paper is the theory of the rational choice of government size (Meltzer and Richards, 1981; Persson and Tabellini, 2000). Within this framework, Boix (2003) developed a theory of the rise and fall of democratic and autocratic regimes. Inequality, among other factors, plays an important role in these political dynamics. According to our knowledge, the addition of the impact of food price inflation to such political dynamics has not yet been systematically examined.

Our model allows for three hypotheses: (1) Food price inflation is a threat to political stability of all regimes. (2) Authoritarian regimes are more vulnerable to food price inflation shocks than democratic regimes. (3) Among authoritarian regimes, more factionalized regimes are more vulnerable to political instability than less factionalized authoritarian regimes.

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We also test these hypotheses empirically. For this purpose we built an unbalanced dataset with all available observations since 1960, where each observation is a three year average. Our dependent variable is a dummy for the occurrence of a revolution. Our main focus independent variable is food price inflation, the level of democracy, and the presence of factionalized elites. We also add several controls. We estimate our hypotheses using a logit model.

The remainder of this paper is organized as follows: We discuss the literature as relevant to our question in section two. In section three we present our theoretical framework. Section four introduces our data and methodology. In section five we report our empirical results. We conclude with a summary of our main findings and outlook in section six.

2. Literature Review

The conflict-ridden relationship between food prices and political stability is known since ancient historical records. The reason for this is the fact that food is a unique commodity. Like no other commodity, food is essential to a person's physical and often religious life.

In international law, access to food is a basic human right. Eventually, without solid food and liquids people would die within four to six weeks and two to four days, respectively. In the United Nations' 1948 Universal Declaration of Human Rights, the right to food is implicitly mentioned. Article three states: "Everyone has the right to life, liberty and security of person." More explicitly, in Article 25(1), it says: "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control." (Assembly, U. G., 1948)

With regards to the right to food, the United Nations have expressed various goals for the world community. For example, the 1966 International Covenant of Economic, Social and Cultural Rights states in Article 11 that the parties recognize "the right of everyone to an adequate standard of living for himself and his family, including adequate food [...]." They also recognize, closely related, "the fundamental right of everyone to be free from hunger [...]." (Assembly, U. G., 1966)

Jean Ziegler, the United Nations' Special Rapporteur on the 'Right to Food', defined the right to adequate food in 2002 as follows: "Right to adequate food is a human right, inherent in all people, to have regular, permanent and unrestricted access, either directly or by means of financial purchases, to quantitatively and qualitatively adequate and sufficient food corresponding to the cultural traditions of people to which the consumer belongs, and which ensures a physical and mental, individual and collective fulfilling and dignified life free of fear." (Ziegler, 2008)

The emphasis on access either directly or by means of financial purchases emphasizes capabilities, which is influenced by Amartya Sen's capabilities approach. In Sen's terminology, capabilities depend on resources. Capabilities, in turn, become a prerequisite for functionings, and functionings a prerequisite for the generation of utility.

The importance of thinking in terms of capabilities for development is best illustrated using the example of a land reform. A peasant under feudalism has very little resources (access to capital) and capabilities (freedom to produce), leading to inferior functionings (bad nutritional and health status), and low utility (joy of life). A land reform, on the other hand, would increase the farmer's resources, capabilities, functionings and utility. In short: the right to food is not an entitlement per se, but an approach to empower individuals with freedoms and opportunities to take care of themselves (Sen, 1985).

Spitz (1985) provides an interesting historical reflection on the right to food, arguing that the right to food was first naturally ingrained in pre-historic societies. The right to food was largely threatened by outsiders, but barely by inner-group dynamics. As opposed to barter-based hunter-gatherer economies that were organized around kinship and tribalism, modern states developed fiscal structures, monetary systems, political borders, and military units. In early modern states, the predominant tax base was the agricultural sector. The first fiscal revenues were in the form of grain, and granaries were the first public budgets. With the development of pre-capitalist welfare states, the state increasingly denied the right to food to many of its own subjects, especially farmers, while food was guaranteed to soldiers, clerics, and public employees.

Early rulers of agricultural societies were aware of the dangers of food crises for their political survival, which is why food markets were subject to substantial regulations. The emphasis on food security was common to all major civilizations. Confucius, for example, listed eight items that are essential for the well-being of societies, among which the first is food, followed by clothing, shelter, enriching the state, increasing the population, ending conflict among people, preventing war, and getting blessings from the gods (Lee, 2010). Political advisors of the time also knew that high food prices hurt consumers, low prices producers, and either high or low prices the government.

In order to avoid massive food price fluctuations, recommendations for anti-cyclical stabilization can already be found in China around 400 BC (Spitz, 1985). The idea of anti-cyclical policy for the purpose of food security can also be found in Genesis 41:1-40, where Joseph advises Egypt's Pharaoh to "[...] collect all the food of these good years that are coming and store up the grain under the authority of Pharaoh, to be kept in the cities for food. This food should be held in reserve for the country, to be used during the seven years of famine that will come upon Egypt, so that the country may not be ruined by the famine."

In order to prevent political instability arising from food price fluctuations, trade with food was often strictly regulated. Spitz, for example, quotes a speech by Lysias, in which he refers to unregulated food trade as a destabilizing factor for society in ancient Greece as follows: "When do they make the biggest profits? When the news of a disaster enables them to sell at high prices. Your misfortunes are so welcome to them that sometimes they hear of them before anyone else, sometimes they invent them" (Spitz, 1985, p. 309).

Yet, not all political philosophers held that food merchants are evil. In his famous introduction to his universal history, the so-called *Al-Muqaddimah*, Ibn Khaldun, the prominent Arab political thinker and politician of the 14th century, regularly emphasizes the importance of food security. While Ibn Khaldun agrees with the Greek that speculative hoarding of grain is harmful to society's well-being, Khaldun argued that "[i]ntelligent and

experienced people in the cities know that it is inauspicious to hoard grain and to wait for high prices [...]. The reason may perhaps lie in the facts that people need food, and that the money they spend on it, they are forced to spend. Therefore, their souls continue to cling to (their money). The fact that souls cling to what is theirs may be an important factor in bringing bad luck to the person who takes (someone's money) giving nothing in return" (Khalidun, 1958, p. 499). Despite the fact that Khalidun hoped for the good in merchants' spirits, he also advocated for the supervision of markets to assure that economic activity serves the public interest.

In the history of economic thought, Thomas Malthus developed the most famous hypothesis for the impact of food insecurity on political stability. Malthus projected that England's population, which increased exponentially, would eventually outgrow the means of food production, which is subject to diminishing returns. This pessimistic congestion hypothesis stands in contrast to Adam Smith's optimistic innovation hypothesis. Smith saw in fast population growth a source of modernization through the realization of economies of scale from bigger markets and specialization gains from a deeper division of labor (Spengler, 1976).

Thus, the interaction of food insecurity and political stability has a long tradition in political philosophy and the history of economic thought. Surprisingly, however, the literature that examines exclusively the transmission mechanism from food insecurity to political instability is rather limited. Instead, the literature generally highlights partial aspects of political instability rather than comprehensive theoretical frameworks. For example, research shows that food price inflation hinders economic growth (Carolan, 2012; Cruz, Sanchez and Amann, 2011; Dia Kamgnia, 2011), contributes to general inflation (Jalil and Zea, 2011; Sand and Støholen, 2008), increases real income inequality (Chaudhry and Chaudhry, 2008; Vu and Glewwe, 2011), undermines public health and welfare (Anriquez, Daidone and Mane, 2013; Hadley et al, 2012), and widens the depth of poverty (Azzam and Rettab, 2012).

While the more specific literature on differences between democracies and authoritarian regimes' response capacities to exogenous shocks does not necessarily address food price inflation explicitly, there is a general consensus that both authoritarian and democratic regimes can experience political instability from adverse macroeconomic developments. Regarding authoritarian regimes, Desai, Olofsgard, and Yousef argue that "...recessions or financial crises that provoke fiscal crises can potentially deprive autocrats of needed resources to sustain generous welfare programs" (Desai, Olofsgard, and Yousef, 2009, pp. 117-118). As for democracies, Levin-Waldman, 2012 and Solt, 2008 argue that rising inequality, which is closely related to food price inflation, often leads to decreased participation and democratic engagement, but not necessarily violent government overthrows. In a similar vein, Wagle (2009) finds that, referring to South Asia, democracy and inequality are compatible with each other. In other words, democracies may not prevent inequality, but more likely humanitarian catastrophes. As for democracies' ability to better prevent humanitarian catastrophes than authoritarian regimes, Amartya Sen (1981), most famously, showed that democracies have never witnessed famines. This, of course,

does not mean that democracies are immune to political protests and anti-government demonstrations from an increase of inequality in general and food insecurity in particular (Arezki and Brückner, 2011; Brinkman and Hendrix, 2011; Muller and Seligson, 1987; Persson and Tabellini, 1994), but they are typically more tampered in democracies than in autocracies.

As autocracies are generally more vulnerable to overthrows, there are also differences in vulnerability among autocracies. These differences depend on the degrees of factionalization that prevail within the authoritarian leadership. Tullock (1971) argues that elites who are part of the authoritarian regime, but not in the top echelon of power, will have an increased incentive to join the rebellion if they believe a new government might offer them a higher position. “Thus, from the private goods theory of revolution, we would anticipate senior officials who have a particularly good chance of success in overthrowing the government and a fair certainty of being at high rank in the new government, if they are successful, to be the most common type of revolutionaries” (Tullock, 1971, p. 98). These ‘middle elites’ thus have mounting pressure to abdicate their support of the authoritarian regime and support the revolution, both from mounting costs and rising rewards (Tullock, 1971).

Therefore, in order to understand and possibly predict uprisings in countries confronted by food price inflation, it is important to distinguish not only between democracies and autocracies, but also different kinds of autocracies.

3. Theoretical Model

In order to illustrate the relationship between food price inflation and political regime stability, we build a model that is essentially a combination of the rational theory of government size and Engel’s law. The society in our model is characterized by income inequality. We assume that the society consists of only two segments, poor (P) and rich (R). We normalize the population size to one so that

$$P + R = 1 \quad P + R = 1 \text{ with } P > 0.5 \quad (1)$$

The income shares of the poor and rich, Y_P and Y_R , are also normalized to one, and we assume that in aggregate terms the rich have more income than the poor. This is,

$$Y_P + Y_R = 1 \text{ with } Y_R > R \quad (2)$$

From (1) and (2) it follows that the per capita income levels (y) can be written as follows:

$$y_P = \frac{Y_P}{P} < 1 \quad (3)$$

$$y_R = \frac{Y_R}{R} > 1 \quad (4)$$

This setup assures that the average per capita income is also normalized to one:

$$y = P \frac{Y_P}{P} + R \frac{Y_R}{R} = 1 \quad (5)$$

Moreover, we hold that the poor spend all their income on food while the rich spend zero on food. This means that food price inflation only affects the real incomes of the poor, it does not affect the real incomes of the rich. Thus, nominal income is deflated for the two population groups by the following two food price deflators, d :

$$d_P = 1 + FPI \quad (6)$$

and

$$d_R = 1 \quad (7)$$

In a democratic setting (D) with simple majority rule, the poor maximize a utility function with respect to an optimum tax rate (τ) used for the redistribution of income. This utility function is given by:

$$U_P^D = (1 - \tau) \frac{y_P}{d_P} + \frac{\tau}{d_P} - \frac{\left(\frac{\tau}{d_P}\right)^2}{2} \quad (8)$$

The first term on the right hand side captures the poor's post-tax real income, the second term the real income transfer, and the third the welfare loss from taxation.

Maximizing this utility function with respect to the nominal tax rate yields the following optimum solution, τ^* :

$$\tau^* = d_P (1 - y_P) \quad (9)$$

This result shows that the optimum nominal tax rate increases with food price inflation and with the level of income inequality as measured by the difference between the average income, which is equal to one, and the poor's income y_P . (The Gini coefficient could be written as $\text{Gini} = \frac{1 - y_P}{2/p}$).

Substituting (9) in (8) yields the poor's utility in a democracy.

$$U_P^D = \frac{y_P}{d_P} + \frac{(1 - y_P)^2}{2} \quad (10)$$

In a democracy, the aggregate poor always receives the nominal net transfer of

$$T = P(\tau^* - \tau^* y_P) = P\tau^* (1 - y_P) = Pd_P (1 - y_P)(1 - y_P) = d_P \underbrace{P(1 - y_P)^2}_{const.} = d_P c \quad (11)$$

As opposed to democracy, where all poor citizens have practically access to the incomes of the rich through redistributive taxation, there is no redistributive taxation in an authoritarian system. Instead, we argue, that the authoritarian regime applies a consumption subsidy system to match the utility that an individual poor would receive under democratic redistribution in order to prevent an uprising for democratic reforms. This means that as long as the hypothetical utility from democratic redistribution is equal or less to the utility

from a consumption subsidy systems, the authoritarian regime enjoys political stability. This is, an authoritarian regime is politically stable as long as

$$U_P^D (\text{Democratic Redistribution}) \leq U_P^A (\text{Consumption Subsidy}) \quad (12)$$

A final assumption of our model is that the authoritarian bargain is characterized by elitism in the sense that a faction e of the rich monopolize political decision making. This captures the fact that authoritarian regimes are often made up of smaller subgroups originating within certain tribes or being protected by outside forces. Accordingly, whereas in a democracy the redistributive conflict is between P poor and R rich, the redistributive conflict in an authoritarian regime is between P poor and eR rich.

Within the model, the financial resources needed by the authoritarian elite to match the poor's utility from democratic redistributive taxation have to be at least as much as the value of the nominal net transfer under democracy for the authoritarian regime not to collapse. Moreover, we posit that while the rich experience disutility from the deadweight loss associated with taxation, the authoritarian elite member faces a deadweight loss from subsidizing food prices. We argue, for simplicity, that the deadweight loss for an authoritarian elite member from financing price subsidies is as high as the deadweight loss from redistributive taxation for an individual rich in a democracy. Plausibility suggests, however, that the deadweight loss is likely higher for the authoritarian elite member, because each authoritarian elite member must shoulder a higher de facto net transfer to the poor.

The above setup assures that, holding everything else constant, the overall disposable income to appease the poor is smaller under an authoritarian bargain than the available redistributive resources to a poor in a democracy. In addition, each individual authoritarian elite member must contribute a higher transfer to appease the poor than the individual rich in a democracy. This then raises the question why there is a benefit to authoritarian rule. The most plausible answer is that an authoritarian ruler has an additional source of utility from authoritarian rule, which goes beyond the authoritarian elites' incomes. These factors must be non-monetary and non-monetizable perks, p , such as social prestige and power.

In summary, we propose that the only differences between an authoritarian elite member and a rich in a democracy are first the presence of non-monetary perks that come with authoritarian rule and, secondly, a higher financial transfer burden by the authoritarian elite member. This can be written as:

$$U_E^A = y_R - \frac{T}{\epsilon R} + \pi = y_R - \frac{d_{PC}}{\epsilon R} + \pi \quad (13)$$

$$U_R^D = y_R - \frac{T}{R} = y_R - \frac{d_{PC}}{R} \quad (14)$$

From equations (13) and (14) it follows that an authoritarian elite member gives way to democratization whenever

$$d_p > \frac{\varepsilon\pi R}{(1-\varepsilon)P(1-y_p)^2} \tag{15}$$

which shows that food price inflation has the power to undermine the authoritarian bargain. According to equation (15), food price inflation increases the authoritarian bargain if (1) authoritarian perks are low, (2) the population share of poor is high, (3) the size of the elite is small, and (4) income inequality as measured by $(1-y_p)$ is high.

The emergence of “trouble” under the authoritarian bargain can be alternatively expressed in aggregate terms, which is when the authoritarian elite is running out of money to meet the redistributive demands of the poor. This is the case when:

$$\varepsilon Y_R - d_p c < d_p c \tag{16}$$

Likewise, a democracy would run out of money to meet the poor’s redistributive demands when

$$Y_R - d_p c < d_p c \tag{17}$$

This is illustrated in Figure 1, which shows how much the poor can gain in access to redistributive capacity after a successful uprising towards a democracy. This gain from a democratic transition, G_{DT} , is equal to

$$G_{DT} = \frac{Y_R(1-\varepsilon)}{2} \tag{18}$$

Thus, the gain in access to redistributive capacity from a democratic transition is greater when the authoritarian elite is smaller.

Figure 1 summarizes the basic idea of how food price inflation challenges the authoritarian bargain. In addition to suggesting that an increase in redistributive demands

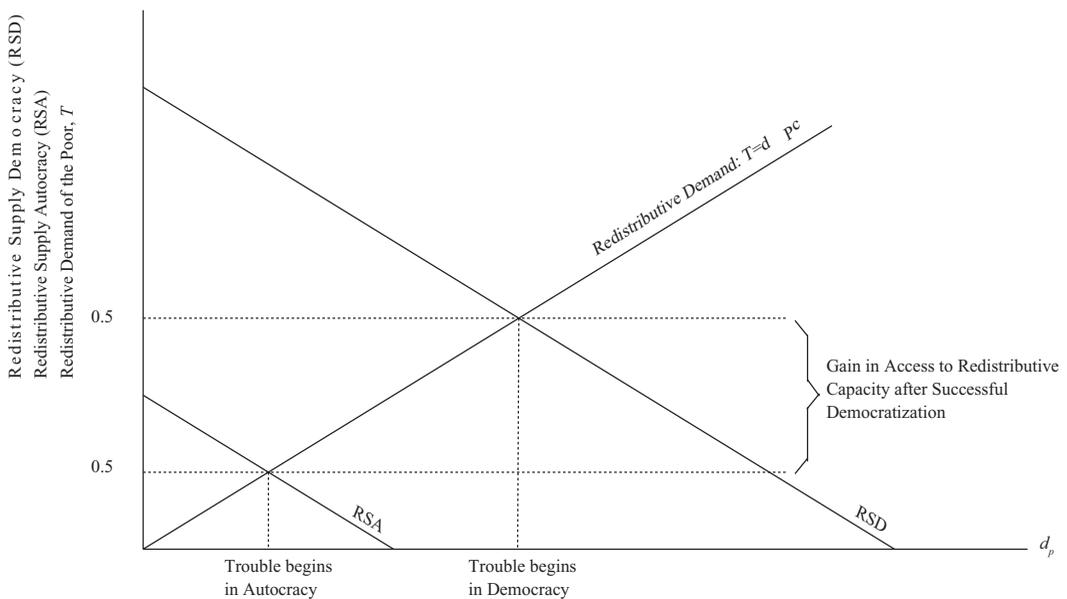


Figure 1: Food Price Inflation and Political Instability

can lead to trouble in the form of uprisings, food riots and the like in both authoritarian and democratic regimes, the model's predictions are limited to predicting the emergence of trouble, not the success of an uprising. This success depends on many other factors, which are not incorporated into the model.

What is obvious, however, is the fact that the non-elite rich play a crucial role in the uprising. In this model, the non-elite rich is like a silent supporter of the ruling authoritarian elite. The non-elite rich can be thought of as a group that agreed not to challenge the authoritarian elite's endowment with perks in exchange for being released from any financial burden to appease the poor. It seems now plausible to assume that the non-elite rich have always an incentive to support the ruling authoritarian elite. Because the non-elite rich knows that it will be taxed after a successful democratic transition, it has incentive to support in an uprising the authoritarian elite up to this expected taxation. It seems moreover likely that if the ruling authoritarian elite's perks are high that the authoritarian elite will co-opt the non-elite rich. The ruling authoritarian elite will then ask for financial contributions to appease the poor in exchange for access to the authoritarian elite's perks. Thus, unless there are any exogenous group animosities between the non-elite rich and the ruling authoritarian elite, it seems most plausible that the non-elite rich will support the authoritarian elite in an uprising. Whatever the group dynamics will be, the focus of our model is not on predicting success or failure of regime transitions, but to predict that higher food prices are a plausible source of political instability.

4. Data and Methodology

In order to provide empirical evidence for our model and three hypotheses, we collected data from various sources. Table 1 summarizes our variables, describes their meaning, lists their sources, and shows data transformations that we introduced to improve the distributional characteristics of the variables.

Table 1: Data and Sources

Variable	Abbreviation	Source	Description	Transformation
Revolution	Revs	Cross Country Time Series Archive	Any illegal or forced change in the top government elite, any attempt at such a change, or any successful or unsuccessful armed rebellion whose aim is independence from the central government (Domestic7)	1, if at least one occurrence of revolutionary event, 0 otherwise
Food Price Inflation	FPInflation	ILOStat (online)	ILOStat provides unbalanced panel data on consumer price indices (CPI) Food and non-alcoholic beverages	$\ln(\text{FP Inflation} + 9.405)$
GDP per capita	y	WDI (online)	GDP (constant 2010 US\$)	$\ln(y)$

Variable	Abbreviation	Source	Description	Transformation
Polity2 Score	Polity2	Marshall et al (2016)	Index between -10 and +10 with negative scores indicating autocracies, scores between 1 and 6 describing anocracies, and scores of 7 and greater identifying democracies	None
Food Imports	FoodImp	WDI (online)	Food imports (% of merchandise imports)	None
Gini Coefficient	GiniEst	WDI (online)	GINI index (World Bank estimate)	Missing country observations replaced by average of available country observations
Ethno-linguistic Fractionalization Index	EFI	Alesina et al (2003)	A measure of the degree of ethnic, linguistic and religious heterogeneity in various countries	Missing country observations replaced by average of available country observations
Total Resource Rents	NRR	WDI (online)	Total natural resources rents (% of GDP)	$\ln(\text{NRR}+1)$
Factionalized Elites	FacElite	The Fund For Peace (online)	Indicator of fragmentation of state institutions along ethnic, class, clan, racial or religious lines, as well as and brinkmanship and gridlock between ruling elites.	None
Regional Dummies	EAP, EECA, LAC, MENA, NAM, SA, SSA, WE	Author's Definition WDI Classification except for WE and EECA	EAP= East Asia and the Pacific EECA= Eastern Europe and Central Asia (former socialist countries) LAC= Latin America and the Caribbean MENA= Middle East and North Africa NAM= North America SA= South Asia SSA= Sub-Saharan Africa WE= Western Europe	1, if country part of region, 0 otherwise

Revolution is our dependent variable. Our main focus variables are Food Price Inflation, the Polity 2 score, and Factionalized Elites. All other variables are control variables. Real GDP per capita controls for the general level of development in a country. We hypothesize that higher per capita incomes reduce the probability of revolutions. Another right hand side variable is Food Imports and we expect it to carry a negative sign. Income inequality (Gini) is also part of our theoretical model where it is captured by the term $(1 - y_p)$. In

line with our model, higher levels of income inequality predict a higher probability of revolutionary uprisings. Ethnolinguistic Fractionalization is a proxy for potential inner-societal conflict and we predict that the variable carries a positive sign in the regression. Natural Resource Rents capture the idea of the rentier state and we argue that rentier states are more vulnerable to revolutionary confrontations than non-rentier states. Lastly, we control for regional fixed effects and time.

Our units of observations are all countries listed in the World Bank Development Indicators Database. Theoretically, these would be 217 countries, but due to missing observations the actual number of country observations is less than 217 in each of our empirical analyses. Our final dataset is an unbalanced panel that consists of all available observations since 1961. All our observations are three year averages, including the nineteen periods 1961 to 1963, 1964 to 1966, ..., 2014 to 2016.

Table 2 provides descriptive summary statistics of our dataset and Table 3 the number of country observations per region. As for Table 3, for example, the number 27 under EAP indicates that 27 countries have at least one observation for revolutions.

Table 2: Descriptive Summary Statistics

Variable	Mean	Median	Min.	Max.	Std. Dev.	IQR	n
Revolution	0.22	0.00	0.00	0.00	0.41	0.00	3,028
Food Price Inflation	25.43	5.80	-18.97	5,622.30	233.18	9.56	1,824
GDP per capita	10,963	3,542	121	144,250	16,562	12,599	2,996
Polity2 Score	1.11	2.00	-10	10	7.29	15.0	2,702
Food Imports	15.29	14.17	1.08	50.76	7.77	10.01	2,520
Gini Coefficient	40.21	39.50	17.20	65.80	9.47	14.40	799
Ethnolinguistic Fractionalization Index	0.45	0.46	0.00	0.98	0.28	0.47	3,173
Total Resource Rents	6.81	2.08	0.00	89.17	10.81	8.32	2,804
Factionalized Elites	6.11	6.80	0.80	9.98	2.45	3.80	512

Table 3: Number of Observations per Variable and Region

Variable	EAP	EECA	LAC	MENA	NAM	SA	SSA	WE
Revolution	27	26	34	20	2	8	47	23
Food Price Inflation	21	16	26	14	1	6	37	20
GDP per capita	34	29	36	20	3	8	47	27
Polity2 Score	19	27	24	19	2	7	45	19
Food Imports	30	26	37	21	3	8	47	23
Gini Coefficient	22	29	25	13	2	7	45	20
Ethnolinguistic Fractionalization Index	22	25	26	20	2	8	44	20
Total Resource Rents	35	29	37	21	3	8	48	28
Factionalized Elites	22	27	29	20	2	8	47	20

We run our regressions using the open source software gretl. In order to test our hypotheses we employ a logit model of the following kind

$$\ln\left(\frac{P(\text{Revs} = I)}{1 - P(\text{Revs} = I)}\right)_{jt} = b_0 + \sum_{i=1}^n b_i \times IV_{jt} + u_{jt} \quad (19)$$

where

i = Independent variable i

j = Country j

t = Time period t

Empirical Results

In running our regressions, we expect a multicollinearity problem among our three focus variables Food Price Inflation, Polity 2, and Factionalized Elites. Therefore, before running the regressions we first present a correlation matrix in Table 4.

Table 4: Pearson Correlation Matrix

	Revs	ln ILO FP Infl New	Polity 2	Fac Elite Est
Revs	1.000			
ln IL OFP Infl New	0.126	1.000		
Polity 2	-0.174	-0.141	1.000	
Frac Elite Est	0.311	0.244	-0.515	1.000
lny	-0.317	-0.237	0.465	-0.662
Food Imp	0.073	-0.035	-0.249	0.298
Gini Est	0.098	0.202	-0.148	0.186
EFI	0.147	-0.019	-0.131	0.311
ln NRR	0.162	0.187	-0.470	0.445

	lny	FoodImp	GiniEst	EFI	lnNRR
lny	1.000				
FoodImp	-0.378	1.000			
GiniEst	-0.319	0.074	1.000		
EFI	-0.380	0.066	0.343	1.000	
lnNRR	-0.396	0.026	0.278	0.407	1.000

As Table 4 shows, there is high collinearity between the two variables Polity2 and Factionalized Elites ($r = -0.515$). The Spearman rank correlation coefficient (not reported) is even $r = -0.71$. The three variables together also show a high internal consistency as measured by a Cronbach Alpha score of $\alpha = -0.985$. We therefore expect that when running the three variables Food Price Inflation, Polity2, and Factionalized Elites together, we will encounter typical multicollinearity problems such as non-significant or flipping signs.

These concerns are confirmed when we run the logit regression first for our three focus variables individually and then jointly together (Table 5). Models I to III show that when running our focus variables individually, all coefficients carry the expected signs and are significant at the 1% level. In Model IV, when we run all focus variables together, the signs still carry the expected signs, but the only significant variable is Factionalized Elites.

Table 5: Regression Results – the Problem of Multicollinearity

	Model I	Model II	Model III	Model IV	Model V
constant	-4.011*** (0.686)	-3.787*** (0.186)	-1.106*** (0.046)	-4.380*** (0.881)	0.296*** (0.399)
Food Price Inflation (ln)	0.704*** (0.004)			0.283 (0.277)	
Factionalized Elites (Est)		0.390*** (0.025)		0.299*** (0.069)	
Polity2 Score (ln)			-0.055*** (0.006)	-0.027 (0.029)	
Food Price Inflation Vulnerability					0.296*** (0.055)
N	563	2,845	2,635	494	494
Percent correctly classified	89.0%	77.4%	75.6%	88.3%	88.3%

Standard errors in parentheses.

***=significant at 1 %, **=significant at 5 %, *=significant at 10 %

In order to address this apparent multicollinearity problem, we decided to combine our three focus variables into an interaction term, which we call Food Price Inflation Vulnerability (FPIV) and which we define as follows

$$FPIV = \ln FPIInflNew + \text{FracEliteEst} - \ln(\text{Polity2} + 11) \tag{20}$$

Whenever interaction terms are introduced into a regression, it is necessary to include the individual components as separated regressors, too. This, however, can create new problems as well, namely multicollinearity between the interaction term and its individual components. This is shown in Table 6.

Table 6: Correlation Matrix of FPIV and its Subcomponents

	Food Price Inflation Vulnerability	Food Price Inflation	Factionalized Elites	Polity2
Food Price Inflation Vulnerability	1.000			
Food Price Inflation	0.215	1.000		
Factionalized Elites	0.975	0.112	1.000	
Polity2 Score	-0.613	-0.048	-0.512	1.000

In order to minimize this multicollinearity problem, we regress the FPIV interaction term against each of its subcomponents in a separate regression, store the residuals, and only add these residuals on the right hand side. In Table 7, these variables are labelled by “resid” in parentheses. Table 7 also shows an F-Test for the joint significance of the FPIV interaction term and its subcomponents by reporting the p-value for rejecting the null.

Table 7: Regression Results with Food Price Inflation Vulnerability Index

IV	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII
constant	-3.72*** (0.401)	-2.875** (1.389)	-1.381 (1.684)	-1.959 (2.077)	-1.354 (2.115)	-0.51 (2.444)	203.247*** (47.94)
Food Price Inflation Vulnerability	0.288*** (0.056)	0.263*** (0.069)	0.252*** (0.073)	0.250*** (0.082)	0.264*** (0.084)	0.176* (0.092)	0.334*** (0.116)
Food Price Inflation (resid)	1.813 (1.185)	1.598 (1.211)	0.772 (1.112)	-0.117 (2.039)	0.130 (2.057)	11.108** (4.482)	15.7*** (4.996)
Factionalized Elites (resid)	1.816 (1.145)	1.58 (1.181)	0.803 (1.079)	0.001 (1.987)	0.377 (2.012)	11.303** (4.458)	17.08*** (5.045)
Polity2 Score (resid)	-0.184 (0.116)	-0.162 (0.12)	-0.091 (0.112)	-0.013 (0.178)	-0.038 (0.179)	-0.884** (0.35)	-1.253*** (0.393)
GDP per capita (ln)		-0.081 (0.127)	-0.208 (0.146)	-0.216 (0.158)	-0.263 (0.162)	-0.359* (0.198)	-0.517* (0.303)
Food Imports			-0.018 (0.03)	-0.02 (0.029)	-0.018 (0.029)	-0.016 (0.029)	-0.026 (0.035)
GINI (Est)				0.018 (0.021)	0.021 (0.021)	0.025 (0.021)	0 (0.038)
Ethnolinguistic Fractionalization Index					-1.112* (0.669)	-1.043 (0.694)	-1.354* (0.815)
Natural Resource Rents (ln)						-0.299 (0.244)	-0.237 (0.28)
EAP							-1.81** (0.911)
EECA							-2.886*** (0.976)
LAC							-0.851 (0.971)
MENA							-2.299*** (0.851)
SA							-2.008 (1.536)
SSA							-1.309 (1.184)
Time							-0.1*** (0.024)
N	494	494	457	437	437	430	430
Percent correctly classified	88.3%	88.3%	88.2%	88.1%	88.3%	87.9%	87.9%
F-Test of joint significance of FPIV and Subcomponents (resid), H0: jointly not significant	$p < 1\%$	$p < 1\%$	$p < 5\%$	$p < 5\%$	$p < 5\%$	$p < 1\%$	$p < 1\%$

Standard errors in parentheses.

***=significant at 1 %, **=significant at 5 %, *=significant at 10 %

The results show that the FPIV interaction term is regularly significant at 1 % except for Model VI, in which it is significant at 5 %. The FPIV interaction term also regularly carries

the expected sign. Moreover, the FPIV interaction term and its individual subcomponents are always jointly significant at a = 5 %.

As for the control variables, GPD per capita always carries the expected negative sign and is also significant in Model VI and VII, at least at a 10% significance level. The coefficient for the variable Food Imports is also always negative but never significant. The same holds for the variable Gini, whose coefficient is always, as expected, positive but never significant. The two variables Ethnolinguistic Fractionalization and Natural Resource Rents show somewhat surprising results. The coefficient for Ethnolinguistic Fractionalization is regularly negative and even significant in two specifications, suggesting that more factionalized societies are less likely to witness revolutionary uprisings. As for the rentier state argument, countries with higher natural resource rents seem to be more resistant to political unrest, possibly because of greater financial resources to ameliorate exogenous shocks. While the results for the control variables are partially interesting and may call for future research, they are not a major concern for the purpose of this study. They only serve the objective of robustness checks.

Lastly, we also show in Figure 2 the FPIV variable’s predicted marginal probability, and the 95% confidence interval for the outbreak of a revolution using the results from our preferred Model V. We chose Model V for convenience reasons because the individual subcomponents are statistically not different from zero which allows for a relatively simple illustration of the FPIV’s effect on revolutions. Because the intercept is also not statistically significantly different from zero, however, the probability of a revolution at an FPIV of zero will be 0.5 and all calculated probabilities will be between 0.5 and 1.0. In order to correct for this effect we subtract from all predicted revolution probabilities 0.5. Figure 2 illustrates this effect. It suggests that a maximum food price inflation vulnerability score can increase the probability of a revolution by more than 40%.

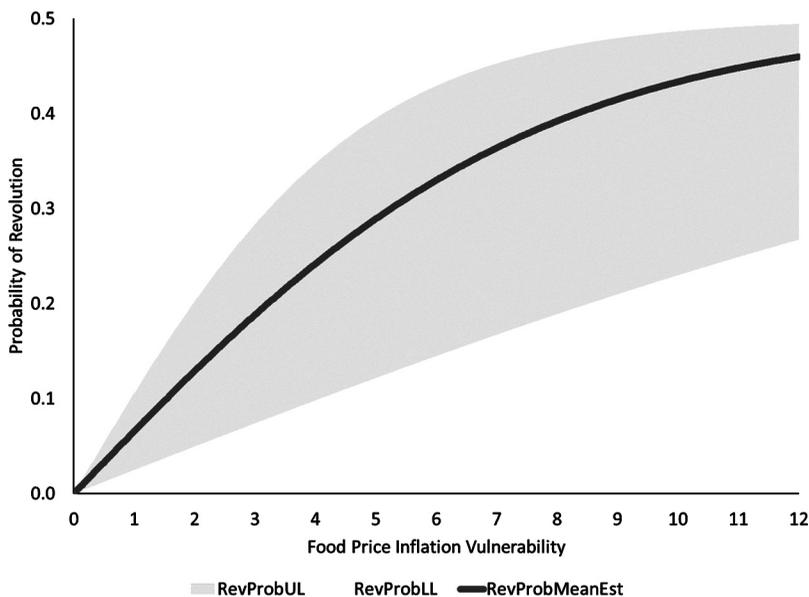


Figure 2: Marginal Effect of Food Price Inflation Vulnerability on Revolutions

6. Conclusions

Inflation in general is a threat to political stability irrespective of whether the regime is a democracy or authoritarian rule. Food price inflation, however, is a particular threat to political stability, because it directly affects people's life and health.

While the general relationship between inflation and political stability is well documented in empirically oriented papers, the exact transmission mechanism from food price inflation to political instability is not immediately clear from a theoretical perspective. In this paper we try to shed more light on this relationship and we present a formal model that incorporates food price inflation into a simple model of the rational size of government.

These models assume democratic decision-making and it is unclear how authoritarian regimes differ from democracies. Eventually, there is no theory of the rational size of government under the assumption of authoritarianism. In this paper we do not present such a theory either, other than arguing that authoritarian rulers know that they need to match the well-being of the poor under democratic rule in order to prevent revolutionary uprising.

After going through the rational logic of the model, we arrive at a rather simple explanation for two questions. Why is food price inflation a threat to political regimes in general? And why are authoritarian regimes more vulnerable to food price inflation than democracies? Our model suggests that food price inflation increases the redistributive demands of the poor towards the rich. Therefore, food price inflation is a threat to all political regimes. Our model also implies that the nature of authoritarian regimes differs from democratic ones with regards to the poor's access to redistributive capacity of all the rich in a democracy. For authoritarian rule to differ from democracy, the authoritarian elite must only be a faction of all the rich and therefore provide less redistributive capacity than the rich in a democracy.

Our model allows for several hypotheses, some of which can be tested empirically: These are: Food price inflation is a threat to all political regimes, democracies are less vulnerable than autocracies, and the more factionalized authoritarian regimes are, the more vulnerable they are to revolutionary uprisings.

In testing these hypotheses empirically, our biggest challenge was multicollinearity. Our indicators for food price inflation, level of democracy, and factionalization are highly correlated. We therefore constructed from these three indicators a Food Price Inflation Vulnerability interaction term and found that this interaction term is highly significant and robust across various model specifications.

Generally speaking, we hope that our model can help to predict political regime vulnerability in light of rising food prices. The basic idea of our model may also be transferred to other models dealing with the interaction of exogenous shocks and political regime stability.

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