Business Cycles with Revolutions

Lance Kent*& Toan Phan† ‡

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Abstract

This paper develops an empirical macroeconomic framework to analyze the relationship between major political disruptions and business cycles of a country. We combine a new dataset of political revolutions (mass domestic political campaigns to remove dictators and juntas) across the world since 1960, with coup data and traditional macro data (of output, investment, trade, inflation and exchange rate). We then build a panel vector-autoregression model with two novel ingredients: (1) political disruptions and (2) an estimated probability of such disruptions. We find that both terms have statistically and economically significant impacts on business cycles. Interestingly, the impacts of the second term dominate those of the first, both statistically and economically. This suggests that our measure of political risk captures an important source of time-varying uncertainty and volatility in many countries.

Keywords: business cycles, political risk, time-varying uncertainty, panel VAR.

1 Introduction

In the past 50 years, many countries have experienced episodes of major political disruptions, including mass insurrections to overthrow ruling dictators/military juntas and coups d'etat. Many other countries, while so far having not experienced such disruptions, may still face significant risks of instability to the existing political institutions. Do observable macroeconomic factors, such as the 2008 recession that preceded the Arab Spring revolutions,

*Lance Kent, College of William and Mary, `lckent@wm.edu` and `http://lancekent.org`

†Toan Phan, UNC Chapel Hill, `phan@unc.edu` and `http://toanphan.org`

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increase the risks of political instability? Do revolutions and coups have significant impacts on the macroeconomy? And most interestingly, how can we estimate the impacts of political instability risks on the macroeconomy, even for countries that have not yet experienced episodes of instability?

Our paper develops a flexible macroeconomic time-series framework that can address these questions. First, we employ a new dataset, the Nonviolent and Violent Campaigns and Outcomes database ((Chenoweth 2011)), which documents known political campaigns with the objective of removing existing dictators or military juntas (which we conveniently call "revolutions") from 1960 to 2006 around the world. We combine this with well-known time-series databases of coups ((Marshall and Marshall 2011)), the quality of political institutions ((Marshall and Jaggers 2002)'s Polity IV score) and important macroeconomic variables (output, investment, trade, inflation and exchange rate from 1960 to 2012, from the World Bank's World Development Index). This gives us time-series data of 157 countries, 135 revolutions and 161 coups.

Second, we augment the standard panel vector-autoregression (VAR) approach in macroeconomics with a two-step regression method, often used in the empirical microeconomic literature. In the first step, we estimate a probit to predict the incidence of regime change campaigns for each country. In the second step, we include this time-varying predicted probability into our panel VAR. This term allows us to consider the endogeneity between business cycles and political disruptions. The term is also an endogenous measure of time-varying political risks.

We find in the probit that, not surprisingly, economic downturns have significant correlations with revolutions and coups. The polity score has a non-linear relationship with political risks. Regimes that are either very democratic or very autocratic face small probabilities of revolutions or coups. But regimes that are in the middle are vulnerable, to both revolutions and coups. However, the overall pseudo-R^2 of the probit regression is very small. This implies that it is difficult to predict political instability given our observable covariates. This is consistent with findings in the political science literature that revolutions are hard to predict ((Goldstone, Bates, Epstein, Gurr, Lustik, Marshall, Ulfelder and Woodward 2010)), as they usually require unexpected "sparks" ((Kuran 1989)), such as the self-immolation of the young merchant Mohamed Bouazizi that sparked the 2010 popular uprising in Tunisia.

We find that revolutions and coups have statistically and economically significantly impacts on output growth and especially real investment growth. An average episode of revolution or coup, while not nearly as damaging as the large world wars of the twentieth century, lead to declines of output and investment growth large enough to qualify as moderate "rare disasters."

Finally, we find that the risk of revolutions exerts a powerful influence on an economy. Our predicted probability of revolutions is economically and significantly correlated to all six macroeconomic variables. This result is an example of the macroeconomic effects of time-varying uncertainty about large rare negative shocks. It is also the means by which wide-scale political disruptions, despite being rare, can exert considerable influence over a country's business cycles even in normal times.

Since the feedback between economic downturns and political uncertainty can amplify otherwise mundane economic shocks, political risk can sizably increase the volatility[1] of business cycles even if the revolution is never actually observed. We illustrate this point by showing the impulse responses to a small 1 percentage point shock to output growth in two countries: one with a high polity score of 10, and one with a low polity score of 0 (and thus being in the "middle zone" of high political risk). In the low polity country, a negative shock to output growth increases the probability of revolution, which in turns dampen output and investment (and other variables) in the following period. Thus, through the political risk, output shocks become more persistent. This suggests that our measure of political risk captures an important source of time-varying uncertainty and volatility many countries, especially those with polity scores that are neither too high nor too low.

Literature. Our paper provides estimates of the size, triggers and consequences of a certain type of the extreme events recently studied in the macroeconomic rare event literature ((Barro 2006, Barro 2009), (Gabaix 2012)), and identified by the "narrative approach" used in other studies to identify fiscal policy shocks ((Ramey and Shapiro 1998) and (Ramey 2011)).

Our paper is also related to the macro literature on uncertainty shocks (Bloom 2009), (Christiano, Motto and Rostagno 2013) and citations therein). Our main contribution here is a constructed index of time-varying uncertainty that is derived from well-identified events in political science.

Our paper also relates to an empirical literature in political economy and growth that documents the relationship between democratizations and growth (see (Acemoglu and Robinson 2000b, Acemoglu and Robinson 2000a, Acemoglu and Robinson 2005, Acemoglu and Robinson 2012), (Rodrik and Wacziarg 2005), (Papaioannou and Siourounis 2008) and references therein). This literature usually focuses on the impacts of democratic transitions, but does not considered the episodes of political turmoils that precede them. Furthermore, we believe our paper is the first to provide a panel VAR analysis of revolutions. The VAR allows us to disentangle how different political (risk) shocks impact and propagate through the economy.

[1] And possibly skewness. However, we have not yet explored skewness in this draft.

Our paper borrows insight from the political science literature, including (Goldstone 2002)'s extensive survey of theories on political revolutions, and empirical work on predicting political violence such as (Goldstone et al. 2010), (Collier et al. 2005) and (Fearon and Laitin 2003).

Finally, this paper builds on our own work on the Arab Spring. In (Kent and Phan 2013b), we take a careful look into why the Arab Spring revolutions happened, and how short- and long-run macroeconomic conditions might have influenced the different outcomes: relatively peaceful abdications in Tunisia and Egypt, but civil wars in Syria and Libya. Then in (Kent and Phan 2013a), we build a neoclassical growth model with endogenous revolutions.

The plan of the paper is the following. In section 2, we describe our data sources. Section 3 documents our empirical work predicting unrest and estimating its impact both when realized and when merely anticipated. Section 4 uses impulse responses to study the dynamics of revolutions (and coups) and the risk of revolutions. Section 5 concludes.

2 Data

Revolutions. We draw data on timing of known political campaigns around the world from 1960 to 2011 from the NAVCO (Nonviolent and Violent Campaigns and Outcomes) dataset, version 2.0. Each campaign is defined as a series of observable, continuous mass mobilizations of citizens that are non-state actors,[2] in pursuit of a political objective (more on this below), and has discernable leadership (in order to rule out random or spontaneous riots). To qualify as a campaign, a political event must be followed by another event with at least 1000 observed participants, for the same goals, and with evidence of coordination across events.

Each campaign has an onset year and an end year. The onset year is defined to be the first year with a series of coordinated, contentious collective actions, with at least 1,000 observed participants. The campaign is recorded as over if peak participation drops below 1,000.[3]

The NAVCO dataset also gives (among other information) the country, the main participating groups, the documented objective of the movement, the presence of violence, and the degree to which the movement was successful. We focus only on NAVCO campaigns where the documented objective is "regime change", i.e., to remove ruling dictators or military junta.[4] For convenience, we usually refer to these regime change campaigns as "revolutions"

[2]Such as the military, and hence this rules out coups.

[3]The cut-off threshold of 1,000 is taken from the Correlates of War (COW)'s standard of reporting conflicts.

[4]Other types of campaign objectives listed in NAVCO but we do not consider: significant institutional

or "unrests", interchangeably.

Overall, the NAVCO dataset gives us 135 revolutions over 95 countries, with an average duration of 5.86 years[5]. NAVCO documents that 70 of these campaigns are primarily nonviolent (i.e., the documented main tactic is not to directly exert physical harm on the target), and the remaining are primarily violent.

Polity and Coups. In some of campaigns, the movement deposes the targeted regime. In others, the movement does not change the status quo. The long-run consequences of these events extend beyond the period of unrest, namely through the institutional change that potentially follows the event. We capture the notion of institutional change by considering not whether the regime is deposed but how characteristics of the polity change over time. After all, even regimes placed in power by pro-democratic movements can fail to live up to their promises, and the resulting institutions can be no more conducive to economic growth than the autocratic institutions they sought to replace. We use the Polity IV index ((Marshall and Jaggers 2002)) to measure polity characteristics. This index runs from -10 (fully autocratic) to +10 (fully democratic). We also incorporate (Marshall and Marshall 2011)'s dataset of all known coups from 1946 to 2012. This gives us 161 coups from 1960 to 2012.

Macroeconomics. Finally, we use annual panel macroeconomic data of 154 countries listed in the World Bank's World Development Indicators database, over the interval 1960-2011. This includes six time-series: real output, real investment, inflation, the nominal exchange rate against the US dollar, real imports and real exports.

3 Evidence

In this section we document several new stylized facts: one, mass unrest is difficult to predict; two, mass unrest is very disruptive economically when it happens; three, even small changes in the probability of mass unrest can have significant economic impacts.

3.1 Econometric Specification

The vector of endogenous variables Y are real output, real investment, inflation, the nominal exchange rate against the US dollar, real imports and real exports. All variables, except inflation, are in logs.

reform, policy change, territorial secession, greater autonomy, anti-occupation, and unknown.

[5]Episodes can begin or end at any day in the year. As a simplification, we code a year as belonging to the crisis if at any point in that year a country is in crisis.

3.1.1 Predicting Revolutions

Our empirical goal to measure the causes and effects of revolutions. To estimate the causes, we model unrest as an *endogenous* threshold process. Revolution is a state of unrest that countries enter into and exit from stochastically. In our empirical specification, a country is in a state of unrest during NAVCO episodes. The probability of entering into a unrest is endogenous: we posit that there is a stochastic index of discontent Z_{it} that, when positive, is necessary and sufficient for a country to transition into a state of unrest. The index of discontent is a linear function of a set of lagged political covariates Q_{it-1}, a vector ΔY_{t-1} of lagged growth rates of our endogenous economic measures such as real output and real investment, and an exogenous shock η_{it}. The vector Q_{it-1} of political variates includes the Polity4 score ($Polity_{t-1}$) and the square of the Polity4 score. Under this specification, periods of unrest are endogenous rare events.

$$Z_{it} = Q_{it-1}\beta_z + \Delta Y_{it-1}\gamma_z - \eta_{it} \tag{3.1}$$

$$\eta_{it} \sim N(0,1), \text{ i.i.d.} \tag{3.2}$$

$$\Pr(Unrest_{it} | \sim Unrest_{it-1}) = \Pr(Z_{it} > 0) = \Phi(Q_{it-1}\beta_z + \Delta Y_{it-1}\gamma_z) \tag{3.3}$$

Large rare shocks can exert influence over economic decisions even in periods when the shocks do not occur. The mere potential for these large rare shocks can drive investment, savings, asset prices, and other business cycle phenomena. In estimating the observable covariates that predict the states of unrest in our sample, we go beyond being able to predict rare events: we are able to construct a time-varying probability of entering into a state of unrest. If the rare disaster literature is correct, then even small movements in the probability of entering into unrest should have economically significant effects on business cycles. So, armed with estimates $\hat{\beta}_z$ and $\hat{\gamma}_z$, we construct our time-varying probability of entering unrest:

$$\hat{P}_{it} = \hat{\Pr}(Unrest_{it} | \sim Unrest_{it-1}) = \Phi(Q_{it-1}\hat{\beta}_z + \Delta Y_{it-1}\hat{\gamma}_z) \tag{3.4}$$

The term η_{it} captures sparks, or factors leading to unrest that are unobservable to the econometrician. One example could be the presence of a charismatic leader such as Ayatollah Khomeini during the 1979 Iranian Revolution. Our measure $\hat{P}_{it}$ will not include these unobservable sparks.

3.1.2 Consequences of Revolutions and Coups

To estimate the effects of unrest, we assume that each variable in Y (for example, real output) is the sum of a country- and series-specific time trend and deviations from that trend.

Since most of the variables in Y are in logs, these time trends are constant-growth trends. The deviations of each variable from trend are linear functions of a vector X_{it-1} of political covariates, lagged growth rates of economic covariates Y, and a nonlinear function δ_y of the fitted probability of unrest $\hat{P}_{it}$. The vector X_{it-1} of political variates includes an indicator for being in a coup ($Coup_{t-1}$), an indicator for being a failed state ($StateFailure_{t-1}$), an indicator for being in a NAVCO event ($Unrest_{t-1}$), an indicator for all years five years or later following conclusion of a NAVCO event ($MoreThanFiveYearsAfterUnrest_{t-1}$), and the Polity4 score ($Polity_{t-1}$).

$$\Delta Y_{it} = \alpha_i + X_{it}\beta_y + \Delta Y_{it-1}\gamma_y + \delta_y(\hat{P}_{it}) + \epsilon_{it} \tag{3.5}$$

$$\epsilon_{it}|X_{it} \sim N(0,1), \text{ i.i.d.} \tag{3.6}$$

$$\epsilon_{it} \perp \eta_{it} \tag{3.7}$$

The last assumption is for identification: it is the assumption that the unobserved sparks to unrest do not themselves boost or hinder the growth in economic outcomes ΔY_{t-1}.

The country fixed effects on growth rates allow us to identify variation within countries over time as they enter and exit NAVCO events and experience changes in political conditions. The coefficients on NAVCO events ($Unrest$) and afterwards ($MoreThanFiveYearsAfterUnrest$) capture the disruption due to the event itself and the contribution of potential institution-building on the following recovery. We include coups and state failures to distinguish them from the potentially different and sometimes concurrent effects of unrest. We include the probability of *entering* unrest, but we do not include an estimate for *remaining* in unrest. Implicitly the average effect of the probability remaining in unrest is included by the coefficient on $Unrest$.

The interpretation of the estimate of $\delta_y(\hat{P}_{it})$ demands some care. The "true" probability of unrest is potentially a function of many variables not included in our specification. This means that the constructed series $\hat{P}_{it}$ depends on which variables we include in the estimation of the probit. When estimating δ_y, one shouldn't interpret it as the impact of the "true" probability, but rather the impact of the predictors Q_{it-1} and ΔY_{it-1} within the probit, to the extent that they are correlated with the onset of unrest. We include a nonlinear transformation of $\hat{P}_{it}$ (in addition to the nonlinearity of the probit itself) to further help us distinguish the *direct* effects of polity and ΔY from the effect that these covariates have *via the onset of unrest.*

3.2 Results

We estimate the model in two parts: First, we estimate a probit to predict the incipience of revolution via maximum likelihood. Second, taking from the probit the fitted probabilities of entering a state of unrest, we estimate the panel regression to find the country-specific trends and effects of unrest and polity change.

3.2.1 Predicting Revolutions

Table 1 reports probit estimates predicting the incidence of NAVCO event in period t conditional on there being no NAVCO event in period $t-1$.

$Unrest_t \| \sim Unrest_{t-1}$	Coefficient (standard error)	Marginal effect (standard error)
$Polity_{t-1}$	-0.031***	-0.0019*
	(0.01)	(0.00)
$Polity^2_{t-1}$	-0.006***	-0.0003***
	(0.00)	(0.00)
$\Delta Output_{t-1}$	-2.852***	-0.174***
	(1.00)	(0.06)
$\Delta Investment_{t-1}$	-0.131	-0.007
	(0.24)	(0.01)
$\Delta Exports_{t-1}$	0.294	0.017
	(0.29)	(0.02)
$\Delta Imports_{t-1}$	-0.294	-0.017
	(0.38)	(0.02)
$\Delta ExchangeRate_{t-1}$	-0.158	-0.010
	(0.14)	(0.01)
$\Delta Inflation_{t-1}$	0.478	0.029
	(0.28)	(0.02)
constant	-1.727***	
	(0.09)	
Pseudo-R^2	0.0818	
N	4222	

Table 1: Probit to predict incipience of unrest. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

There are no country fixed effects in this specification. Since we estimate this probit via maximum likelihood, including a country fixed effect would effectively remove from the sample any country that never experienced unrest in our sample time span[6]. We want our probit to exploit the fact that some countries never experience unrest in estimating the coefficients β_z and γ_z. Additionally, the fitted probabilities $\hat{P}_{it}$ for any country that never experienced unrest in our sample would be 0 and constant in a specification with country fixed effects, and we want to allow for the possibility that the probability of unrest for these countries was actually non-zero and time-varying. As a robustness exercise in the Appendix, we consider a specification for the probit regression that includes country fixed effects. The coefficients are not substantially changed by their inclusion. In the Appendix we also consider a specification that includes time fixed effects. These could capture potential contagion or spillover effects between countries in a given year. It turns out that the inclusion of these fixed effects doesn't substantially change the coefficients either. Therefore, when constructing $\hat{P}_{it}$ in our VAR, we use the coefficients obtained from the specification without any country or time fixed effects.

As seen in Table 1, falls in output growth today make unrest more likely tomorrow. For a country at the mean of the sample, when output growth declines by 1%, the probability of unrest in the following period increases by 0.257%. Changes in growth rates of the other endogenous economic variables to not give rise to any significant changes in the probability of unrest. This is not surprising, since the growth rates of the other endogenous economic variables are generally correlated with the growth of output.

The coefficients on polity highlight a "middle polity instability effect" documented in (Goldstone et al. 2010). The negative coefficient on the linear term $Polity_{t-1}$ means that more democratic countries have lower probability of unrest. The negative coefficient on $Polity^2_{t-1}$ means that the more extreme a country's polity is, in either the democratic or autocratic direction, the lower the probability of unrest. The coefficients on $Polity_{t-1}$ and $Polity^2_{t-1}$ may seem small, but an increase from a neutral polity to a strongly democratic one is an increase in $Polity_{t-1}$ of 10 points, and an increase in $Polity^2_{t-1}$ of 100 points. Summing up the marginal effects, this would mean a reduction in the probability of unrest by 6.6%, which is quantitatively significant.

The final noteworthy result is that the pseudo-R^2 is only 0.08. This tells us that there are other factors not in the regression that explain the incidence of unrest. This isn't surprising, given that mass unrest is a rare event. While there are many countries with middlingly undemocratic regimes and low levels of output growth, when taken over all countries and over all years, unrest is a phenomenon that not many countries experience. In other words, the significant factors in our probit are strongly associated with but not sufficient for unrest. Thus our probit is evidence that another factor is at play: an shock, unseen to the

[6]Maximum likelihood would send the fixed effects of these countries to $-\infty$.

econometrician, that enables the mass of protestors to overcome the coordination problem and effectively mount a movement. Revolutions, as argued by (Kuran 1989) and others in the political economy literature, need sparks.

3.2.2 Consequences of Revolutions: Direct and Anticipation Effects

Tables 2 through 7 display the estimates for each element of equation (3.5) individually. The regressions were run with Stata's *xtreg* command and with standard errors clustered at the country level. In each table, the first two columns show estimation results without the constructed probabilities $\hat{P}_{it}$, and the last two show results with them. Also, the first and third columns do not include the vector of lagged economic covariates ΔY_{it-1} while the second and fourth columns do. In effect, the second and fourth columns are estimates of a VAR for ΔY_{it}, where the constant term is shifted by political covariates X_{it} and possibly fitted probabilities $\hat{P}_{it}$.

$\Delta Output_t$	(1)	(2)	(3)	(4)
$Coup_t$	-0.019***	-0.016***	-0.014***	-0.012***
	(0.00)	(0.00)	(0.00)	(0.00)
$Interregnum_t$	-0.057***	-0.056***	-0.039*	-0.040**
	(0.01)	(0.02)	(0.02)	(0.01)
$Unrest_t$	-0.021**	-0.019**	-0.053***	-0.049***
	(0.01)	(0.01)	(0.01)	(0.01)
$MoreThanFiveYearsAfterUnrest_t$	0.001	-0.000	0.004	0.003
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t$	-0.000	0.000	-0.002***	-0.002***
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t^2$	-0.000	-0.000	-0.000***	-0.000***
	(0.00)	(0.00)	(0.00)	(0.00)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})$			-2.389***	-2.222***
			(0.18)	(0.18)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})^2$			3.649***	3.067**
			(0.92)	(0.96)
Constant	0.046***	0.036***	0.109***	0.098***
	(0.00)	(0.00)	(0.01)	(0.01)
ΔY_{t-1}	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.033	0.088	0.287	0.321
N	4816.000	4558.000	4717.000	4532.000

Table 2: Output: coefficient estimates. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

Table 2 shows the regression results for the growth rate of output (that is, the first difference in the logarithm of output).

Coefficients on ΔY_{it-1} are not shown, even for the specifications where they are included, since the statistical and economic significance of an estimated VAR are usually better conveyed in impulse response functions rather than in individual coefficients. One thing, however, that can be observed in the above table is that including the ΔY_{it-1} tends to dampen the effects of X_{it} and $\hat{P}_{it}$. This is because there is some degree of internal propagation arising from the inclusion of the autoregressive coefficients. To the extent that shocks to X_{it} last for multiple periods, and to the extent that the autoregressive coefficients of a VAR give rise to internal propagation of shocks, the average predicted deviation from trend attributable to a shock to X_{it} or $\hat{P}_{it}$ will be larger than the coefficient displayed in the table. Another way to see this is to note one could calculate the difference in ergodic means between a country that is permanently in a state of tranquility versus one that is permanently in a state of unrest, and note that the average deviation of a country in unrest from trend will depend both on how far the ergodic means are from each other and how long it takes to transition between ergodic means relative to the average duration of unrest. However, the fact that there's not much difference between including and excluding ΔY_{it-1} (that is, between columns 1 and 2 or between columns 3 and 4) indicates that there's not much internal propagation arising from the autoregressive coefficients. This is to be expected since the endogenous variables the VAR are growth rates, not levels.

Political covariates have significant impacts on output growth, both economically and statistically. Every year in which a coup takes place is associated with a decline in output growth of between 1.2 and 1.9 percentage points, significant in all four specifications on the 1% level. State failure has a negative impact in all four specifications. When the effect is significant, it is large: a drop in output growth of between four and five percentage points for each year in which the state has failed. The effect of polity is close to zero and insignificant when $\hat{P}_{it}$ is not included, but surprisingly large and negative when it is. The presence of country fixed effects means the regression is exploiting within-country variation; each additional point in the democratic direction (on a scale from -10 to 10) is associated with a 0.2% decline in output growth.

The interpretation of the effect of an increase in the fitted probability of unrest merits more care. The very large coefficients in the table both reflect the effect of a 100% increase in $\hat{P}_{it}$. The implied net marginal effects of a smaller increase in $\hat{P}_{it}$ are much more reasonable. For example, the marginal effect of increasing $\hat{P}_{it}$ from 2% to 3%[7] is $0.03 * (-2.079) + 0.03^2 * (2.089) - (0.02 * (-2.079) + 0.02^2 * (2.089)) \approx -0.0207$, or a fall in output growth of 2.07%. This is still quite large. In addition, the R^2 of the two regressions with the fitted probabilities $\hat{P}_{it}$ are much larger than in the two regressions without. We conclude from this result that the effects of our probit covariates, as they come through the channel of being associated with more likely incipience of unrest, are both statistically and economically significant.

Why does the coefficient on unrest increase once we include the fitted probabilities $\hat{P}_{it}$? It is because there are two effects from being in unrest in this specification. The first is the direct loss from entering unrest. The second is that, after the first period of unrest, there are no longer any influence of $\hat{P}_{it}$. This is because $\hat{P}_{it}$ is only present in periods that were preceded by no unrest. The regression accords a larger direct effect to unrest in the specifications with $\hat{P}_{it}$ because this direct effect has to "overcome" the average estimated effect of relief from $\hat{P}_{it}$.

[7]This is a plausible scenario, since the mean of $\hat{P}_{it}$ is 0.0177 and its standard deviation is 0.0214.

The existing literature on democratization and growth finds a significant increase in the growth rate of output following a sharp increase in a country's polity score. Given that there is considerable overlap between the episodes considered in that literature and out NAVCO incidents of unrest, out estimate of the effect of $MoreThanFiveYearsAfterUnrest$ might capture the same phenomenon. However, we estimate the effect of $MoreThanFiveYearsAfterUnrest$ to be small and not generally statistically significant. But this is not inconsistent with the literature. The coefficient on $MoreThanFiveYearsAfterUnrest$ is the difference in growth relative *not* to the time period immediately before the end of the event, but relative to the long-term trend. In our estimation, the only dividend to democratization analogous to what was found in the literature is the relief from the effects of the unrest that were associated with that democratization.

$\Delta Investment_t$	(1)	(2)	(3)	(4)
$Coup_t$	-0.027*	-0.031*	-0.012	-0.020
	(0.01)	(0.01)	(0.01)	(0.01)
$Interregnum_t$	-0.251**	-0.160*	-0.198*	-0.116
	(0.08)	(0.08)	(0.08)	(0.08)
$Unrest_t$	-0.047**	-0.050**	-0.145***	-0.145***
	(0.01)	(0.02)	(0.02)	(0.02)
$MoreThanFiveYearsAfterUnrest_t$	-0.003	-0.014	0.004	-0.006
	(0.01)	(0.01)	(0.01)	(0.01)
$Polity_t$	0.000	0.001	-0.006***	-0.006***
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t^2$	-0.000*	-0.000*	-0.002***	-0.002***
	(0.00)	(0.00)	(0.00)	(0.00)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})$			-7.187***	-6.919***
			(0.64)	(0.62)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})^2$			12.174***	11.496***
			(2.49)	(2.42)
Constant	0.074***	0.058***	0.265***	0.247***
	(0.01)	(0.01)	(0.02)	(0.02)
ΔY_{t-1}	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.015	0.055	0.140	0.172
N	4816.000	4558.000	4717.000	4532.000

Table 3: Investment: coefficient estimates. *: $p < 0.1$. **: $p < 0.05$. ***: $p < 0.01$

Table 3 shows that the disruptive effects of unrest and the probability of unrest are generally twice as big for investment as output. Also in contrast to output, the other political covariates are not statistically significant here. This is broadly consistent with (Noe and Shiferaw 2013), who find micro panel evidence that low-intensity internal armed conflict depresses the level of investment by about 5% of the firm's total capital stock.

$\Delta Exports_t$	(1)	(2)	(3)	(4)
$Coup_t$	-0.032**	-0.028**	-0.034**	-0.030**
	(0.01)	(0.01)	(0.01)	(0.01)
$Interregnum_t$	-0.061	-0.080	-0.060	-0.082
	(0.06)	(0.06)	(0.06)	(0.06)
$Unrest_t$	-0.008	-0.010	-0.018	-0.018
	(0.01)	(0.01)	(0.02)	(0.02)
$MoreThanFiveYearsAfterUnrest_t$	0.014	0.010	0.014	0.012
	(0.01)	(0.01)	(0.01)	(0.01)
$Polity_t$	-0.000	0.000	-0.001	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t^2$	-0.000	-0.000*	-0.000*	-0.000*
	(0.00)	(0.00)	(0.00)	(0.00)
$\hat{P}(Unrest_t \vert \sim Unrest_{t-1})$			-0.680	-0.539
			(0.69)	(0.74)
$\hat{P}(Unrest_t \vert \sim Unrest_{t-1})^2$			3.750*	3.710*
			(1.69)	(1.54)
Constant	0.070***	0.067***	0.086***	0.079***
	(0.01)	(0.01)	(0.02)	(0.02)
ΔY_{t-1}	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.004	0.016	0.006	0.019
N	4794.000	4557.000	4717.000	4532.000

Table 4: Exports: coefficient estimates. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

$\Delta Imports_t$	(1)	(2)	(3)	(4)
$Coup_t$	-0.027**	-0.022*	-0.017	-0.015
	(0.01)	(0.01)	(0.01)	(0.01)
$Interregnum_t$	-0.023	-0.024	0.013	0.006
	(0.06)	(0.06)	(0.05)	(0.05)
$Unrest_t$	-0.014	-0.010	-0.092***	-0.084***
	(0.01)	(0.01)	(0.01)	(0.01)
$MoreThanFiveYearsAfterUnrest_t$	0.011	0.009	0.016*	0.016
	(0.01)	(0.01)	(0.01)	(0.01)
$Polity_t$	-0.000	0.000	-0.005***	-0.005***
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t^2$	-0.000	-0.000	-0.001***	-0.001***
	(0.00)	(0.00)	(0.00)	(0.00)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})$			-5.606***	-5.341***
			(0.43)	(0.46)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})^2$			12.182***	11.444***
			(1.49)	(1.83)
Constant	0.059***	0.052***	0.206***	0.196***
	(0.01)	(0.01)	(0.01)	(0.02)
ΔY_{t-1}	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.003	0.026	0.116	0.125
N	4794.000	4557.000	4717.000	4532.000

Table 5: Imports: coefficient estimates. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

Tables 4 and 5 offer an unexpected asymmetry between real export growth and real import growth. The responses of real import growth to unrest and its probability are roughly larger than that of output and smaller than that of investment. However, the responses of real export growth are not significant even at the 10% level. The mechanism behind this asymmetry is an interesting line of research but left as an open question. One result is the same across both imports and exports: both grow at a rate faster than trend in the period starting five years after the conclusion of unrest. One of the legacies of unrest seems to be a substantially more open economy.

$\Delta ExchangeRate_t$	(1)	(2)	(3)	(4)
$Coup_t$	0.013	0.011	0.001	0.014
	(0.02)	(0.02)	(0.03)	(0.02)
$Interregnum_t$	-0.095	-0.088	-0.086	-0.082
	(0.07)	(0.08)	(0.08)	(0.10)
$Unrest_t$	0.010	0.025	0.019	0.041
	(0.02)	(0.03)	(0.04)	(0.04)
$MoreThanFiveYearsAfterUnrest_t$	0.031	0.036	0.025	0.035
	(0.02)	(0.02)	(0.02)	(0.03)
$Polity_t$	-0.002	-0.002	-0.002	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t^2$	-0.000*	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})$			0.421	1.117
			(2.01)	(2.09)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})^2$			-5.536	-8.272
			(5.92)	(7.04)
Constant	0.012	0.020	0.008	-0.004
	(0.01)	(0.01)	(0.06)	(0.06)
ΔY_{t-1}	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.001	0.098	0.002	0.100
N	4816.000	4558.000	4717.000	4532.000

Table 6: Exchange Rate Appreciation: coefficient estimates. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

$\Delta Inflation_t$	(1)	(2)	(3)	(4)
$Coup_t$	-0.003	0.006	-0.013	-0.002
	(0.02)	(0.02)	(0.02)	(0.02)
$Interregnum_t$	-0.070	-0.083	-0.110	-0.115
	(0.07)	(0.09)	(0.11)	(0.13)
$Unrest_t$	0.025	0.036	0.103***	0.112***
	(0.02)	(0.02)	(0.03)	(0.03)
$MoreThanFiveYearsAfterUnrest_t$	-0.003	-0.000	-0.008	-0.008
	(0.01)	(0.01)	(0.01)	(0.01)
$Polity_t$	-0.001	-0.001	0.005***	0.004***
	(0.00)	(0.00)	(0.00)	(0.00)
$Polity_t^2$	-0.000	-0.000	0.001***	0.001***
	(0.00)	(0.00)	(0.00)	(0.00)
$\hat{P}(Unrest_t \vert \sim Unrest_{t-1})$			5.683***	5.541***
			(1.09)	(1.17)
$\hat{P}(Unrest_t \vert \sim Unrest_{t-1})^2$			-11.046***	-10.899***
			(2.94)	(3.07)
Constant	-0.004	-0.000	-0.154***	-0.150***
	(0.01)	(0.01)	(0.03)	(0.03)
ΔY_{t-1}	No	Yes	No	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.002	0.015	0.064	0.076
N	4738.000	4533.000	4717.000	4532.000

Table 7: Inflation: coefficient estimates. *: $p < 0.1$. **:$p < 0.05$. ***:$p < 0.01$

In table 7, we see that an increase in the probability of unrest is associated with an increase in inflation. In addition, the incidence of unrest is statistically significantly associated with higher levels of inflation. The lack of many statistical significant results in Table 6 is consistent with the generally held result that exchange rates are difficult to predict.

4 Dynamics of Revolutions: Actual and Anticipated

We perform two experiments to convey the dynamics of a representative episode of unrest and the effects of anticipation of unrest. These experiments illustrate the timing assumptions of the model, the combination of several effects that occur before, during, and after an episode of unrest, and the effects of unrest on the persistence of other shocks. We present impulse response functions of each endogenous variable Y for each experiment, under the coefficients in specification (4) above, that is, including both lagged endogenous variables ΔY_{it-1} and fitted probabilities $\hat{P}_{it}$. For all experiments, we sample coefficients from the multivariate normal distribution implied by the regression results, calculate impulse responses for each coefficient draw, then plot the median and the periodwise 95% confidence interval over 200 draws.

The nonlinearity of $\hat{P}_{it}$ in ΔY_{it-1} poses some problems. For convenience, we linearize $\hat{P}_{it}$ in ΔY_{it-1}. This guarantees, for each value of polity, a unique tranquil[8] steady state of ΔY_{it-1}. We do this to rule out exotic dynamics arising from transition between various possible steady states of the nonlinear model. Since the sample growth rates are usually small, this is a reasonable first-order approximation. For each draw, we assume a draw-specific country fixed effect such that the ergodic growth rate of output across all draws was constant.

For the **first experiment**, suppose that a hypothetical country starts at the pre-unrest trend in year 1, is in the unrest state in years 2 through 7 (shaded), and emerges into a post-unrest state from year 8 onward. In Figure .1 we plot responses of the growth rates of output, investment, exports, imports, nominal exchange rate depreciation, and inflation in response to these regime changes, relative to a country that stays at the pre-unrest trend throughout. The shocks ϵ are held constant at 0 in these responses.

In this experiment we have a number of effects that occur in sequence. The timing of these effects is as follows: In period 1, the country is at trend, or its ergodic mean. An unanticipated shock hits the country in period 2. This is the spark which plunges the country into a state of unrest. In period 2 the country still has the effect from anticipation since period 1 was not a period of unrest. This effect is not present in period 3. After period 2 the country quickly move to a new in-unrest ergodic mean. The confidence intervals widen over the next 3 periods, indicating uncertainty in the estimates of the VAR autoregressive matrix. The country emerges from unrest in period 8. There are spikes in output, investment and imports in period 8 because the direct effect of unrest has lifted, and the effect of anticipation is not yet present. From period 9 onward, the anticipatory effect is back, together with the post-unrest effect. The limiting value is the ergodic mean in a post-unrest state. The confidence interval around this point is the combination of the estimation uncertainty about the effect of the post-unrest state, estimation uncertainty about the effect of the anticipation of unrest, and the estimation uncertainty on the VAR autoregressive matrix.

For the **second experiment**, suppose that a hypothetical country starts at the pre-unrest trend in year 1, and experiences an exogenous shock to ϵ_{it} that causes the growth

[8] That is, conditional on there being no unrest, no coup and no state failure.

rate of output to fall by one percent in period 2 only. In Figure .2 we plot responses of the growth rates of economic quantities relative to a country that stays at a trend where the shocks ϵ are held constant at 0 throughout. The goal of this exercise is to show how endogenous changes in the probability of unrest influence the propagation of shocks. To this end, experiment 2 plots the responses of two countries to the same shock: one with a polity score of 10, and one with a polity score of 5. In these experiments, the polity scores do not change over time. We have also chosen country fixed effects for each country so that they share the same ergodic mean growth rate of output.

For the high-polity country, the probability of unrest stays close to 0 throughout the experiment. For the middling-polity country, the probability of unrest varies more over time. This is a consequence of the nonlinearity of $\hat{P}_{it}$ in polity and ΔY_{it-1}. Consider the linearization of $\hat{P}_{it}$ in ΔY_{it-1} about the ergodic mean $\bar{\Delta}$:

$$\hat{P}_{it} = \Phi(Q_{it-1}\hat{\beta}_z + \Delta Y_{it-1}\hat{\gamma}_z) \tag{4.1}$$

$$\approx \Phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z) + \phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z)(\Delta Y_{it-1} - \bar{\Delta})\hat{\gamma}_z \tag{4.2}$$

For the high-polity country, $Q_{it-1}\hat{\beta}_z$ is negative and large. This means both $\Phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z)$ and $\phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z)$ are close to zero for the high-polity country. For the middling-polity country, $Q_{it-1}\hat{\beta}_z$ is still negative but not so large, so both $\Phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z)$ and $\phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z)$ and $\phi(Q_{it-1}\hat{\beta}_z + \bar{\Delta}\hat{\gamma}_z)$ are not as small as for the high-polity country. Therefore, for the middling-polity country, not only is the ergodic mean of $\hat{P}_{it}$ larger, but it also responds more to movements in ΔY_{it-1}.

Figure .2 illustrates this. For the high-polity country, the shock to output growth propagates more or less strictly as a VAR; the effect from the variation in $\hat{P}_{it}$ is negligible. However, for the middling-polity country, the shock to output growth in period 2 lives on as an increase in $\hat{P}_{it}$ into period 3. The increase in the probability of unrest dampens output growth in period 3 relative to the high-polity country. This dampening, in turn, implies that $\hat{P}_{it}$ remains elevated into period 4, which dampens output in period 4, and so on. The total effect of the responsiveness of $\hat{P}_{it}$ to shocks to output growth is to increase the persistence of those shocks.

Figure .2 shows that a higher probability of revolution is associated with a large loss of output relative to trend. To this extent, our findings are consistent not only with the rare disaster literature (e.g., (Barro 2006)) but also with studies that estimate the macroeconomic consequences of shocks to uncertainty, such as in (Christiano et al. 2013) and (Bloom 2009). Our main contribution to this literature is that our constructed index of uncertainty is derived from well-identified events and the observable covariates that predict them.

This difference in propagation between these two countries implies a difference in the unconditional moments associated with endogenous economic series as well. Suppose that both the high-polity and the middling-polity countries are subject to innovations drawn from the same distribution. Using the VAR model, we can calculate the unconditional moments of the time series for the endogenous economic variables for both countries. Table 8 shows that, even when subject to the same distribution of shocks, the less stable country has a greater volatility in output growth, investment growth, import growth, and inflation. The endogenously time-varying probability of unrest acts as an amplification mechanism for volatility.

Unconditional std. dev. of:	Shock	Stable ΔY	Revolution-prone ΔY	Ratio
$\Delta Output$	0.01	0.0102	0.0112	1.0958
		(0.0101,0.0105)	(0.0102,0.0171)	(1.0119,1.6100)
$\Delta Investment$	0.01	0.0122	0.0180	1.4866
		(0.0110,0.0145)	(0.0126,0.0383)	(1.0910,2.7012)
$\Delta Exports$	0.01	0.0107	0.0110	1.0183
		(0.0102,0.0119)	(0.0102,0.0135)	(0.9726,1.1830)
$\Delta Imports$	0.01	0.0108	0.0143	1.3115
		(0.0103,0.0124)	(0.0108,0.0267)	(1.0404,2.2184)
$\Delta ExchangeRate$	0.01	0.0118	0.0123	1.0249
		(0.0109,0.0136)	(0.0110,0.0193)	(0.9613,1.6392)
$\Delta Inflation$	0.01	0.0102	0.0120	1.1819
		(0.0100,0.0110)	(0.0101,0.0239)	(1.0021,2.3179)

Table 8: Comparing unconditional standard deviations implied by VAR model between stable ($Polity = 10$) and revolution-prone ($Polity = 5$) country for shared process for innovations to endogenous economic series ΔY: $E[\epsilon] = 0$ and $E[\epsilon'\epsilon] = (0.01)^2$ times the identity matrix. Means and ninety-five percent confidence intervals given. The potential for unrest increases propagation of shocks and thereby increases unconditional volatility.

In conclusion, our estimates and experiments show: One, periods of mass unrest are rare and need sparks. Two, when mass unrest happens, the effects on the growth rates of output, investment, imports, exports, and inflation can be large and persistent. Three, the time-varying probability of such events acts both as an economically significant shock to uncertainty and as a mechanism which increase the propagation of other shocks.

5 Conclusion

This paper employs a new database on political campaigns, and provides a novel empirical panel vector-autoregression framework, to analyze the two-way relationship between political disruptions and business cycles. First, we find that countries with polity scores in the middle zone (not too high, not too low) are vulnerable to revolutions and coups. Second, we document that the direct impacts of revolutions and coups on business cycles are statistically and economically significant. Third, we provide evidence that uncertainty have large effects on the business cycles of countries vulnerable to political disruptions.

We believe that exploring the complex relationship between political disruptions/transitions and business cycles is an exciting avenue for future research, especially in light of the recent uprisings in many developing countries following the 2008 global economic crisis. This short paper attempts to be a building block in that wider project.

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Appendix

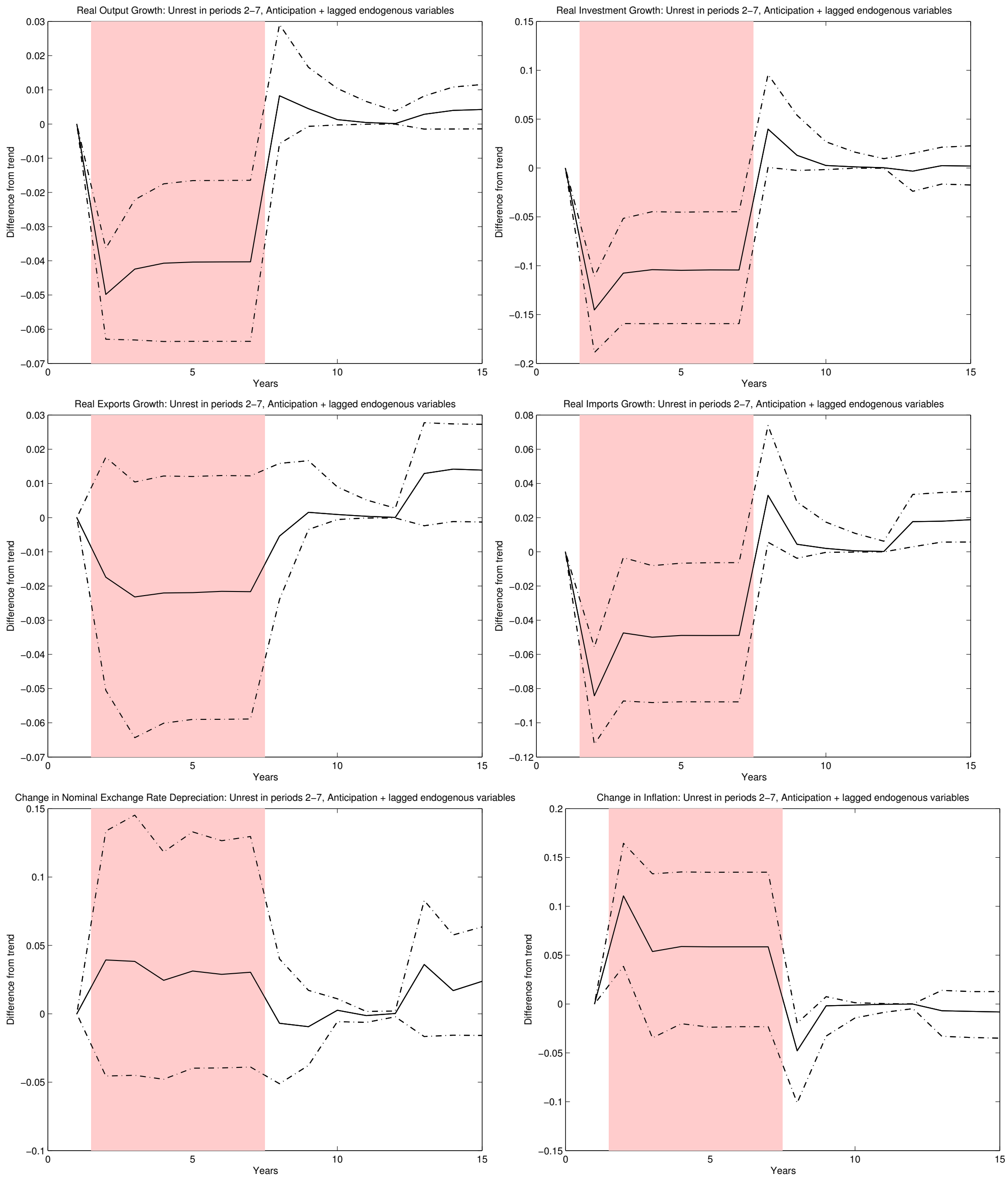

Figure .1: Experiment 1: Unrest in years 2-7, no other shocks. Growth rates relative to trend, 95% CI with medians

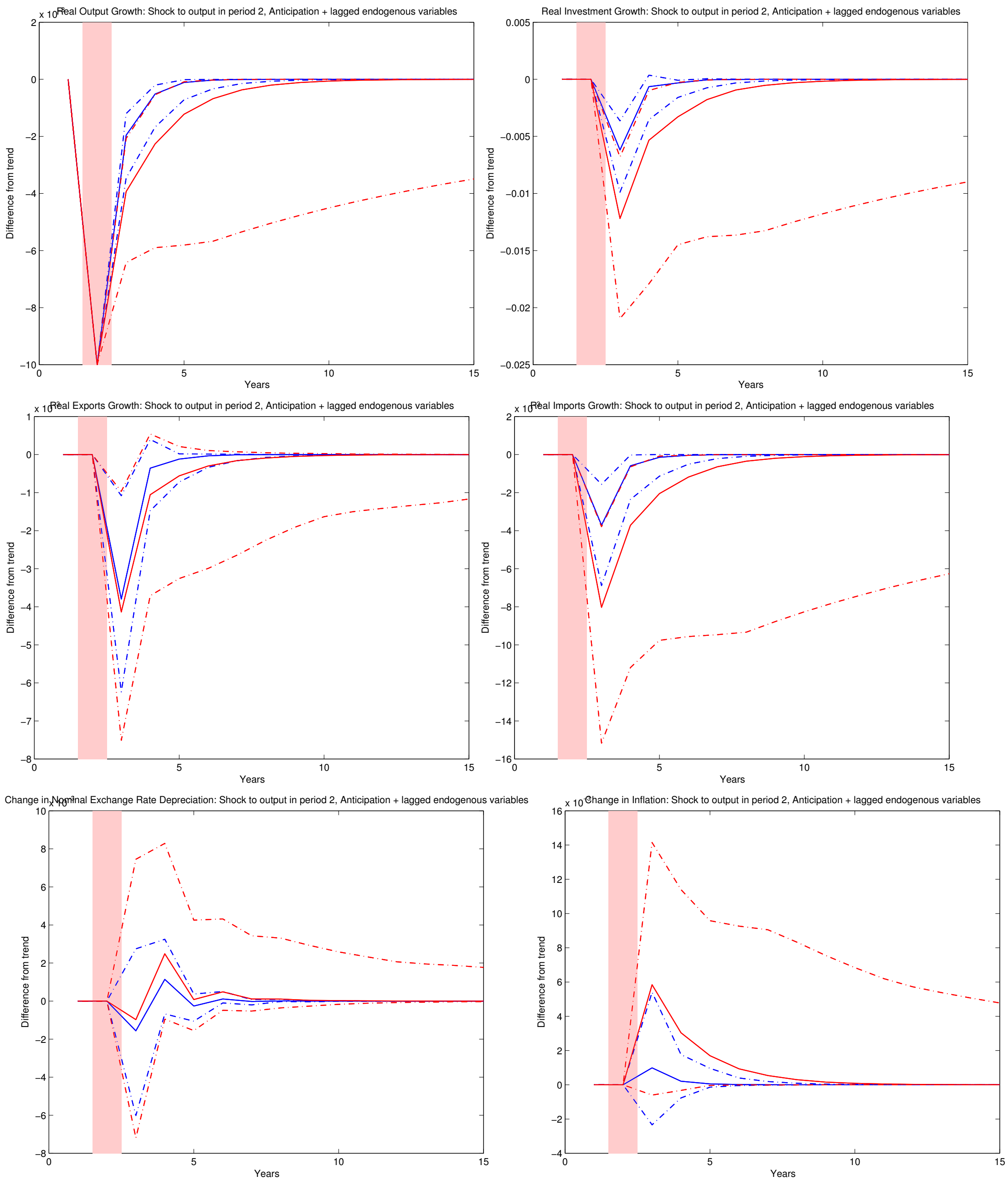

Figure .2: Experiment 2: A shock to output growth via ϵ, comparing responses of countries with high (red) and low (blue) probability of subsequent unrest. Growth rates relative to trend, 95% CI with medians

$Unrest_t \| \sim Unrest_{t-1}$	(1)	(2)	(3)	(4)
$Polity_{t-1}$	-0.031***	-0.024**	-0.034***	-0.026*
	(0.01)	(0.01)	(0.01)	(0.01)
$Polity^2_{t-1}$	-0.006***	-0.009***	-0.007***	-0.009***
	(0.00)	(0.00)	(0.00)	(0.00)
$\Delta Output_{t-1}$	-2.852**	-2.679*	-3.096**	-2.985*
	(1.00)	(1.11)	(1.05)	(1.19)
$\Delta Investment_{t-1}$	-0.131	-0.180	-0.116	-0.158
	(0.24)	(0.26)	(0.24)	(0.27)
$\Delta Exports_{t-1}$	0.294	0.137	0.265	0.149
	(0.29)	(0.31)	(0.30)	(0.32)
$\Delta Imports_{t-1}$	-0.294	-0.359	-0.380	-0.613
	(0.38)	(0.42)	(0.40)	(0.45)
$\Delta ExchangeRate_{t-1}$	-0.158	-0.110	-0.145	-0.064
	(0.14)	(0.16)	(0.15)	(0.16)
$\Delta Inflation_{t-1}$	0.478	0.251	0.391	0.141
	(0.28)	(0.31)	(0.27)	(0.30)
constant	-1.727***	-1.742***	-1.681***	-1.634***
	(0.09)	(0.38)	(0.10)	(0.40)
Country FE	No	No	Yes	Yes
Time FE	No	Yes	No	Yes

Table 9: Probit to predict incipience of unrest, with country and time fixed effects. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

$Coup_t| \sim Unrest_{t-1}$	Coefficient (standard error)	Marginal effect (standard error)
$Polity_{t-1}$	-0.023***	-0.0015***
	(0.01)	(0.000)
$Polity^2_{t-1}$	-0.009***	-0.0006***
	(0.00)	(0.000)
$\Delta Output_{t-1}$	-5.017***	-0.343***
	(0.81)	(0.056)
$\Delta Investment_{t-1}$	-0.064	-0.004
	(0.19)	(0.013)
$\Delta Exports_{t-1}$	-0.286	-0.020
	(0.24)	(0.016)
$\Delta Imports_{t-1}$	0.484	0.033
	(0.30)	(0.020)
$\Delta ExchangeRate_{t-1}$	-0.174	-0.012
	(0.11)	(0.008)
$\Delta Inflation_{t-1}$	0.130	0.009
	(0.19)	(0.013)
constant	-1.196***	
	(0.07)	
N	4625.000	

Table 10: Probit to predict coups. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

$Polity_t - Polity_{t-k}$	$k=1$	$k=2$	$k=3$	$k=4$	$k=5$	$k=6$
$EndUnrest_{t-1}$	0.351***					
	(0.09)					
$EndUnrest_{t-2}$		0.184*				
		(0.09)				
$EndUnrest_{t-3}$			0.270			
			(0.15)			
$EndUnrest_{t-4}$				0.330		
				(0.19)		
$EndUnrest_{t-5}$					0.192	
					(0.31)	
$EndUnrest_{t-6}$						0.837
						(0.49)
Constant	0.078***	0.105***	0.229***	0.370***	0.565***	0.738***
	(0.02)	(0.02)	(0.03)	(0.05)	(0.07)	(0.09)
R^2						
N	4744.000	4744.000	4592.000	4442.000	4294.000	4146.000

Table 11: Change in Polity following NAVCO episodes. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$

$\Delta Output_t$	(5)	(4)
$Coup_t$	-0.013***	-0.013***
	(0.00)	(0.00)
$StateFailure_t$	-0.033**	-0.037**
	(0.01)	(0.01)
$Unrest_t$	-0.032***	-0.050***
	(0.01)	(0.01)
$ViolentUnrest_t$	-0.027**	
	(0.01)	
$MoreThanFiveYearsAfterUnrest_t$	0.004*	0.005*
	(0.00)	(0.00)
$Polity_t$	-0.002***	-0.002***
	(0.00)	(0.00)
$Polity_t^2$	-0.001***	-0.001***
	(0.00)	(0.00)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})$	-2.114***	-2.079***
	(0.11)	(0.11)
$\hat{P}(Unrest_t \| \sim Unrest_{t-1})^2$	2.175***	2.089***
	(0.27)	(0.25)
Constant	0.102***	0.101***
	(0.00)	(0.00)
ΔY_{t-1}	Yes	Yes
Country fixed effects	Yes	Yes
R^2	0.394	0.389
N	4447.000	4447.000

Table 12: Output: coefficient estimates with and without Violent Unrest. *: $p < 0.1$. **: $p < 0.05$. ***:$p < 0.01$