Examining the effects of transitory and permanent economic shocks on civil conflict

presentation by Antonio Ciccone, UPF

based on two papers:

-- “Transitory Economic Shocks and Civil Conflict” by Ciccone

-- “International Commodity Prices and the Outbreak of Civil War in Sub-Saharan Africa” by **Markus Brückner, UPF** &Ciccone

available at www.antoniociccone.eu

This presentation and the literature

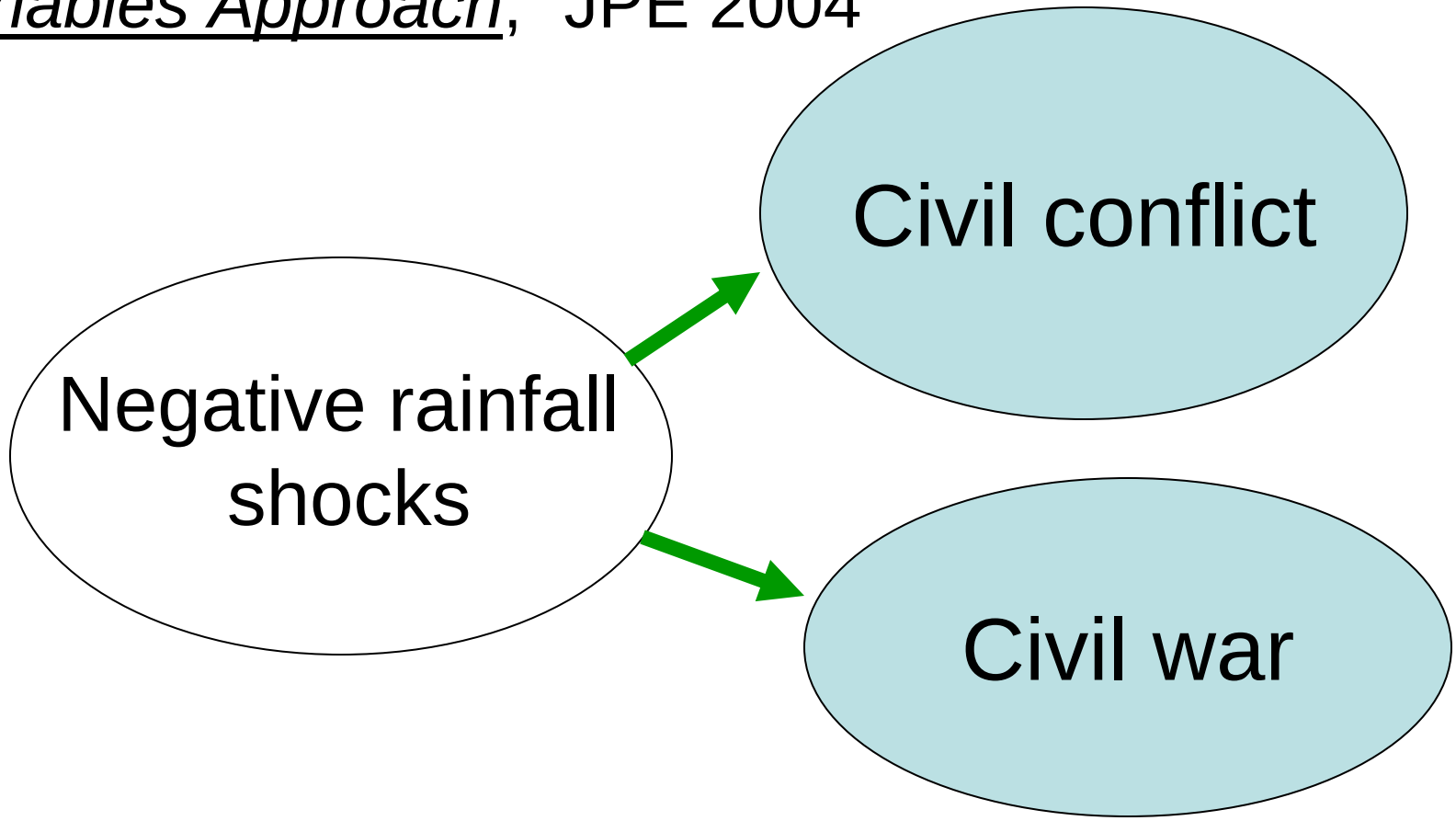
- aim to contribute to literature on economic shocks and civil conflict

(1) (transitory) rainfall shocks and civil conflict in Sub-Saharan Africa?

(2) (persistent) commodity price shocks and civil conflict in SSA?

(1) Rainfall shocks and civil conflict

- Existing evidence: Miguel, Satyanath, and Sergenti "*Economic Shocks and Civil Conflict: An Instrumental-Variables Approach*," JPE 2004



(1) MSS empirical evidence

Low interannual rain growth→more civil conflict and civil war

- **But rainfall shocks are transitory**

- **Low rainfall growth may therefore be due to:**

-- negative rainfall shock

-- mean reversion after positive rainfall shock

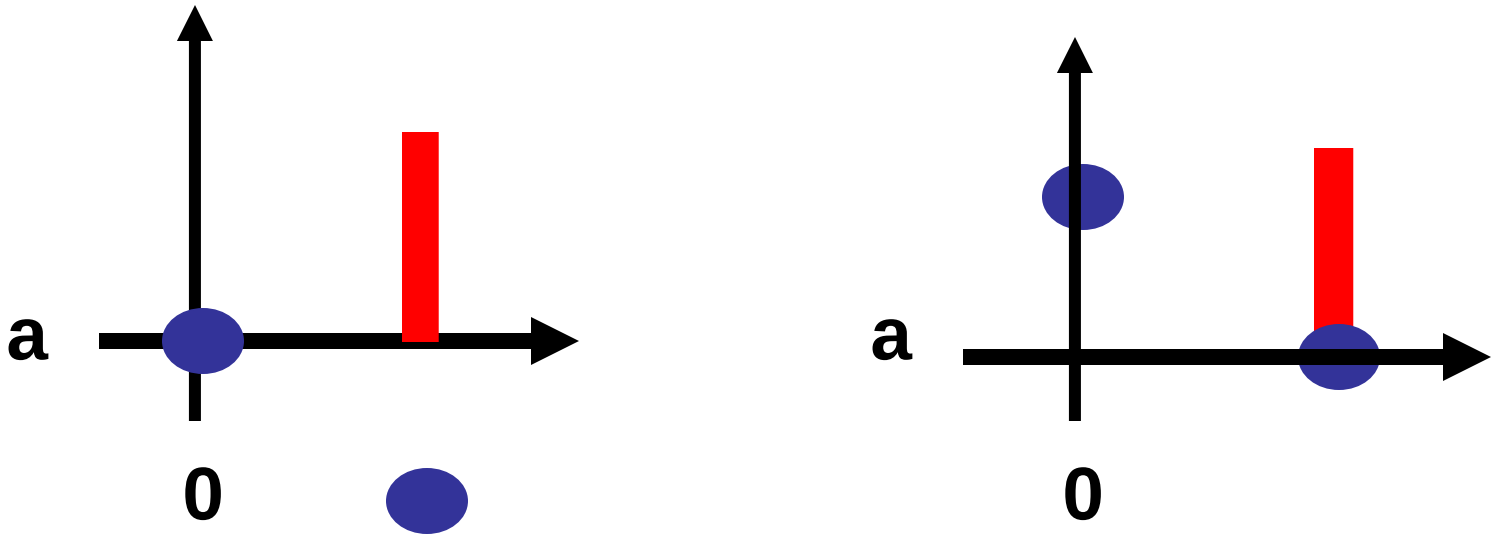
Simplified statistical model of rainfall

$$\log Rain_t = a + iidShock_t$$

Figure 1: Conflict risk and rainfall shocks

Rainfall, relative to expectation

Conflict probability in MSS (2004), relative to country average



→ **High conflict risk caused by negative shock (⇔rain less than expected)**

→ **High conflict risk caused by <u>POSITIVE</u> shock**

Or, formally,

$$\text{logRain}_t = a + \text{iidShock}_t$$

$$\text{logRain}_t - \text{logRain}_{t-1} = \text{iidShock}_t - \text{iidShock}_{t-1}$$

MSS (2004) "*Economic Shocks and Civil Conflict*" does not tell us whether:

- conflict is caused by negative rainfall shocks
- or by positive rainfall shocks

Civil conflict onset and transitory shocks

MSS specification

$$\text{Probability}(\text{Onset}_{ct}) = a_{ct} + b*(\text{logRain}_{ct} - \text{logRain}_{ct-1}) + c*(\text{logRain}_{ct-1} - \text{logRain}_{ct-2})$$

Rainfall shock specification

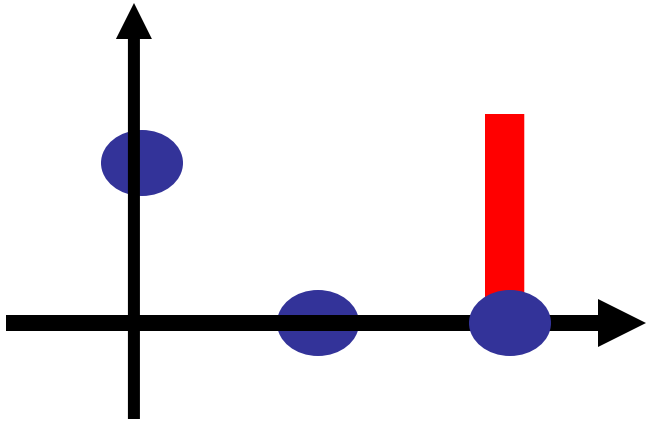
$$\text{Probability}(\text{Onset}_{ct}) = a_{ct} + b*\text{logRain}_{ct} + c*\text{logRain}_{ct-1} + d*\text{logRain}_{ct-2}$$

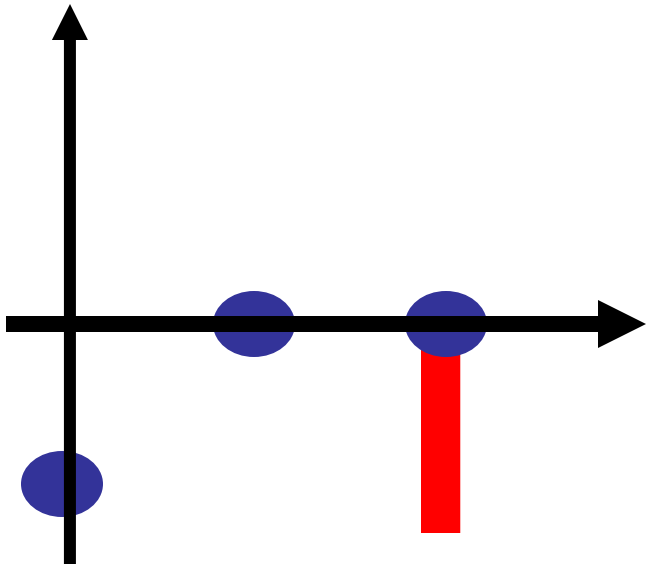
Table 1: Rainfall and Civil Conflict Onset

	Miguel et al. (1981-1999)	
	(1)	(2)
	LS	LS
Rainfall Growth, t	-0.066	
	(-1.39)	
Rainfall Growth, t-1	-0.126*	
	(-1.83)	
Log Rainfall, t		-0.083
		(-1.05)
Log Rainfall, t-1		-0.034
		(-0.45)
Log Rainfall, t-2		0.157**
		(2.12)
Country Fixed Effects	Yes	Yes
Country Specific Time Trend	Yes	Yes
Common Time Effects	No	No
Number of Observations	555	555

Note: Method of estimation is least squares. Huber robust standard errors are clustered at the country level; t-values in brackets. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Empirical findings using MSS data





→ High conflict risk caused by <u>POSITIVE</u> past shock

→ Low conflict risk caused by <u>negative</u> past shock

TABLE. Rainfall Growth and Civil Conflict Onset

	Civil Conflict Onset			
	(1)	(2)	(3)	(4)
	LS	LS	LS	LS
Rainfall Growth, t	-0.066	-0.032	0.036	0.043
	(-1.39)	(-0.65)	(0.60)	(0.86)
Rainfall Growth, t-1	-0.126*	-0.091	-0.087	-0.071
	(-1.83)	(-1.47)	(-1.56)	(-1.01)
Post-Cold War Dummy		0.123**		
		(2.00)		
Country FE	Yes	Yes	Yes	Yes
Time Trends	Yes	Yes	No	Yes
Year FE	No	No	Yes	Yes
No. Observations	555	555	555	555

Note: Method of estimation is least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable is civil conflict onset. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Where does this leave us?

- MSS finding linking low rainfall growth to civil conflict appears non-robust to common shocks to conflict
- In any case, the MSS finding does not tell us about whether negative rainfall shocks cause civil conflict
- If we re-examine the MSS data to look for the effects of rainfall shocks, we get the opposite of their conclusion: civil conflict preceded by positive rain shocks

Latest conflict data

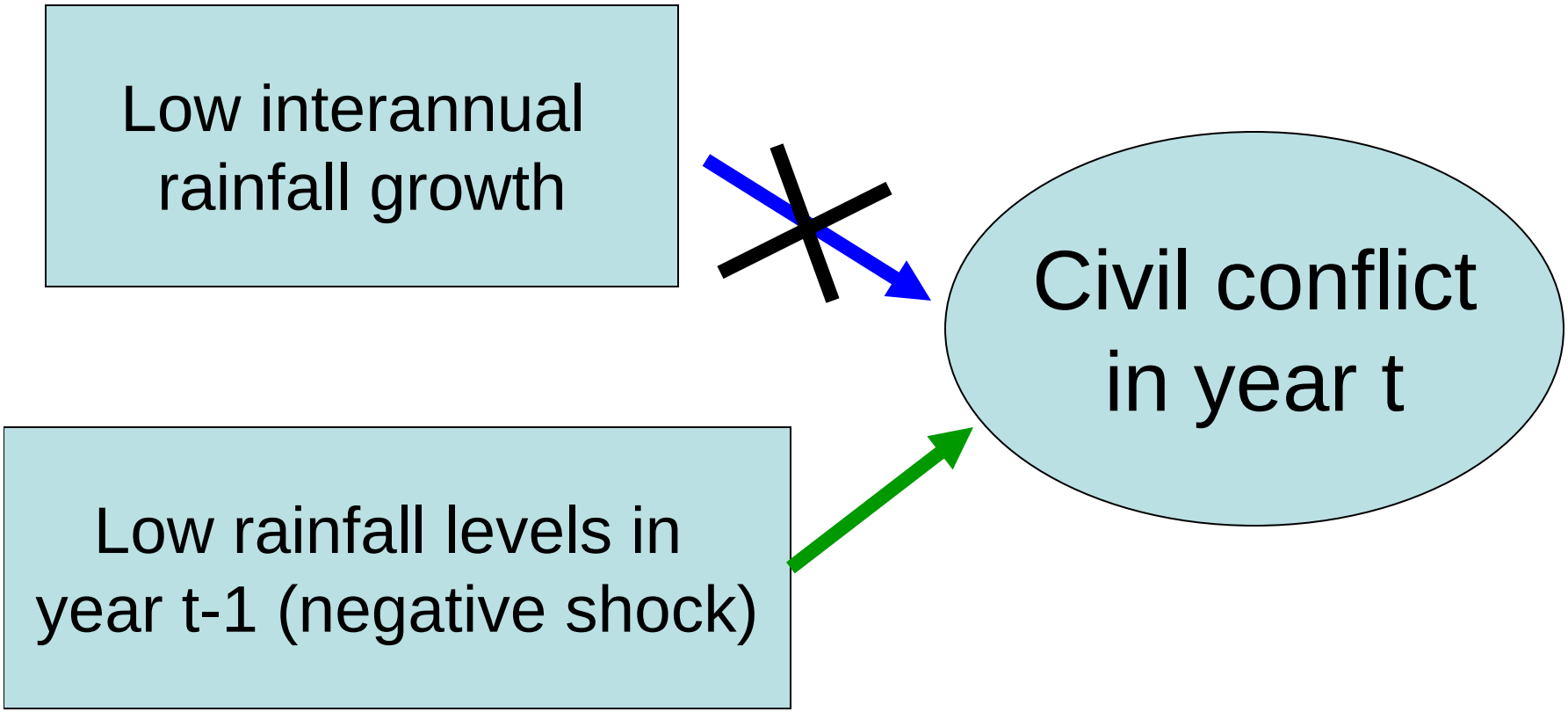
Table 3: Rainfall and Civil Conflict Onset

PRIO 2007 (1981-2006)

	(1)	(2)	(3)	(4)
	LS	LS	LS	LS
Rainfall Growth, t	0.033	0.076*		
	(0.75)	(1.67)		
Rainfall Growth, t-1	-0.064	-0.049		
	(-1.63)	(-1.44)		
Log Rainfall, t			0.024	0.067
			(0.45)	(1.13)
Log Rainfall, t-1			-0.111**	-0.145**
			(-2.29)	(-2.59)
Log Rainfall, t-2			0.053	0.030
			(1.31)	(0.77)
Country Fixed Effects	Yes	Yes	Yes	Yes
Country Specific Time Trend	Yes	Yes	Yes	Yes
Common Time Effects	No	Yes	No	Yes
Number of Observations	800	800	800	800

Note: Method of estimation is least squares. Huber robust standard errors are clustered at the country level; t-values in brackets. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

Conclusion: Rain and civil conflict



Civil war?

No effect of rainfall shocks on civil war onset

Instrumental variables approach

- Use rainfall as instrument for deviation of income per capita from trend

Table 4: Rainfall and Per Capita GDP **(First stage)**

	Per Capita GDP	
	(1)	(2)
	LS	LS
Log Rainfall, t	0.057**	0.060***
	(2.61)	(2.85)
Log Rainfall, t-1	0.045	0.044
	(1.52)	(1.47)
Country Fixed Effects	Yes	Yes
Country Specific Time Trend	Yes	Yes
Common Time Effects	No	Yes
Number of Observations	866	866

Note: Method of estimation is least squares. Huber robust standard errors are clustered at the country level; t-values in brackets. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

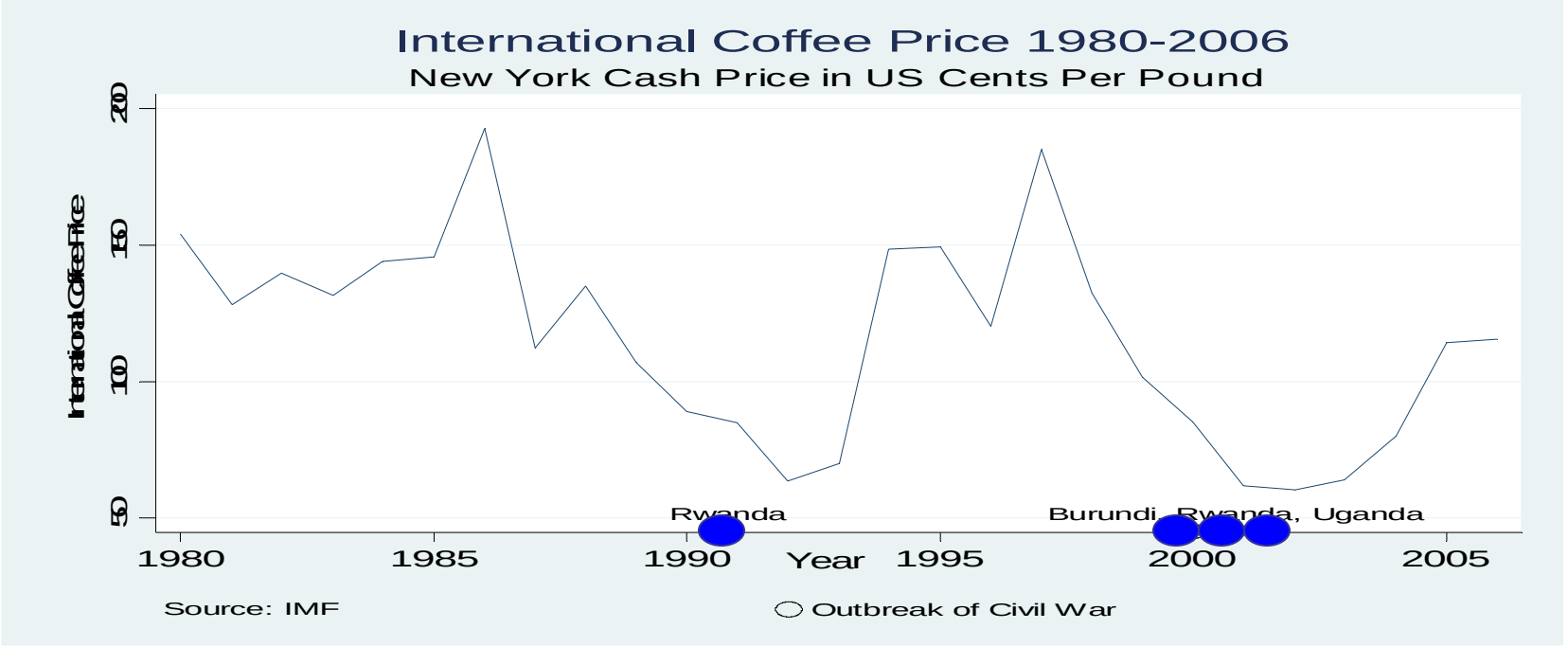
Table 5: Per Capita GDP and Civil Conflict **(Second stage)**

	Civil Conflict Onset	Civil Conflict Incidence
	(1)	(2)
	2SLS	2SLS
Log GDP, t	0.587	-0.266
	(0.32)	(-0.18)
Log GDP, t-1	-4.561*	-2.482**
	(-1.80)	(-2.14)
Country Fixed Effects	Yes	Yes
Country Specific Time Trend	Yes	Yes
Common Time Effects	Yes	Yes
Number of Observations	667	866

Note: Method of estimation is two-stage least squares. Huber robust standard errors are clustered at the country level; t-values in brackets. The instruments are current and lagged rainfall. *Significantly different from zero at 90 percent confidence, ** 95 percent confidence, *** 99 percent confidence.

(2) Commodity prices and civil war?

- The timing of civil wars in Uganda, Rwanda, and Burundi appear to be related to fall in price of coffee, their biggest export

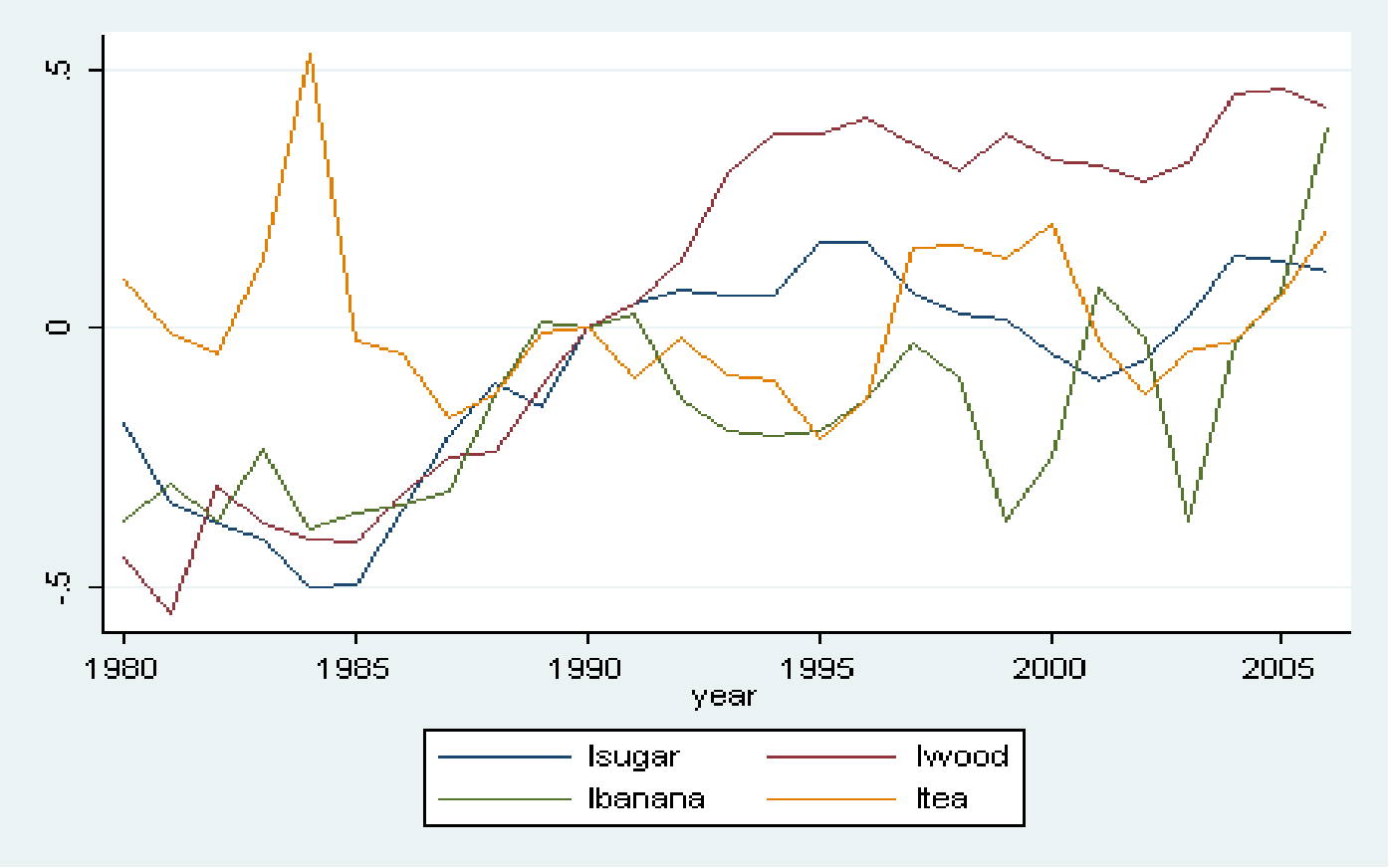


(2) Commodity prices and civil conflict/war?

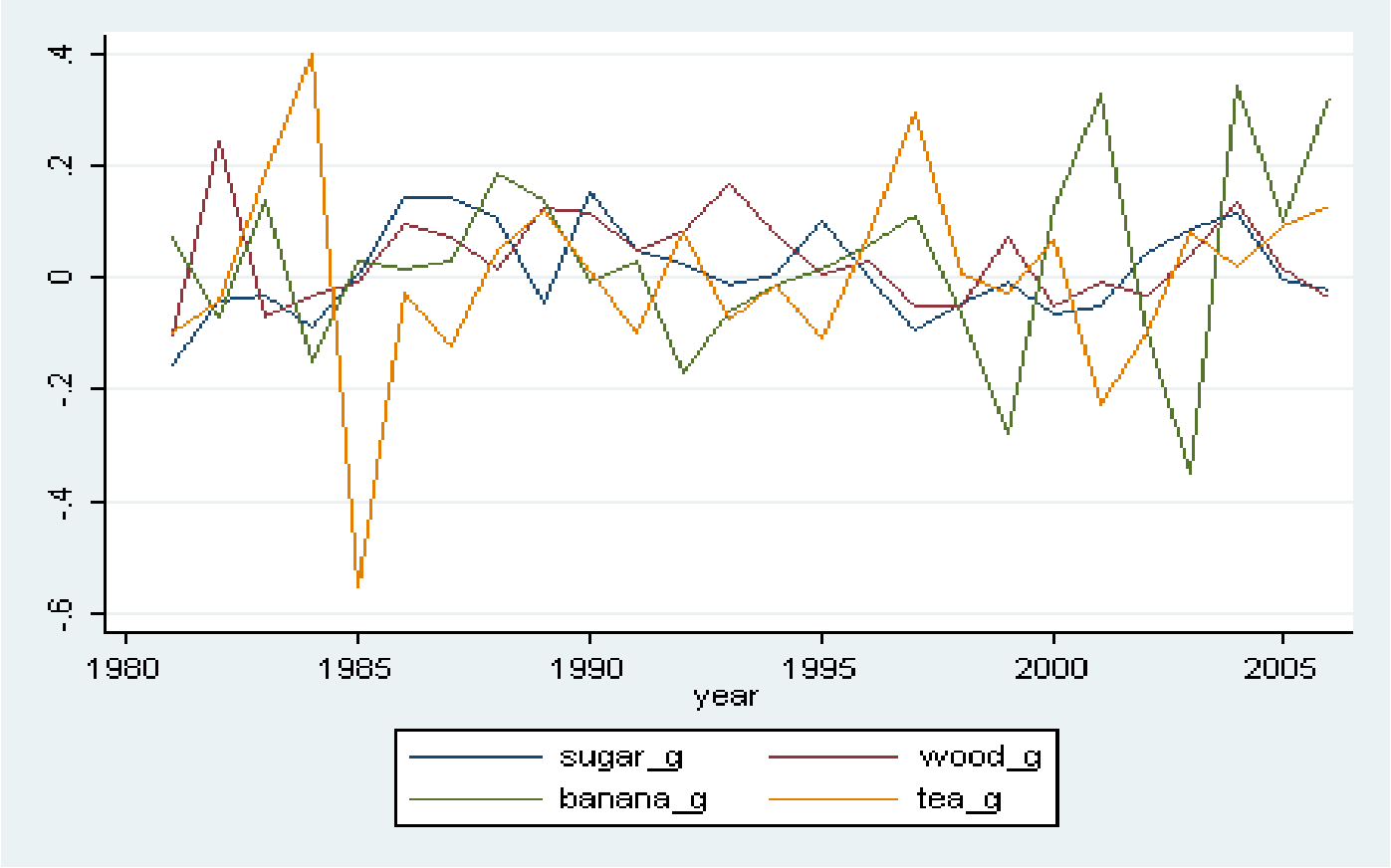
- Is there evidence of a more generalized link between commodity export prices and civil war?

- Can commodity price fluctuations be used to estimate the effects of economic growth shocks on civil war?

Persistent Fluctuations of Agricultural Commodity Prices (Log Levels)



Growth Rates of Agricultural Commodity Prices (Log points)



Simplified statistical model of commodity prices

$$\text{logPrice}_t = \text{logPrice}_{t-1} + \text{iidShock}_t$$

Civil conflict onset and permanent shocks

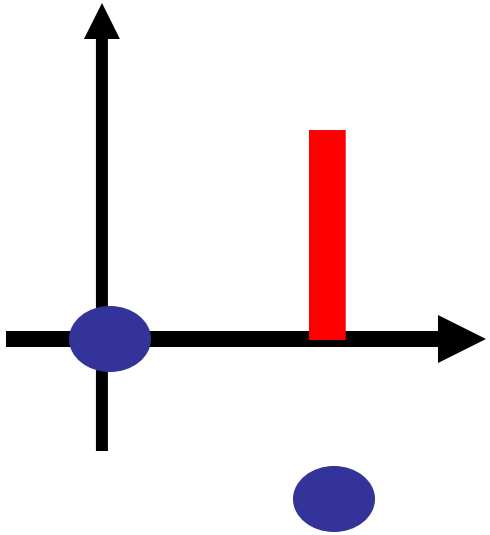
Growth specification

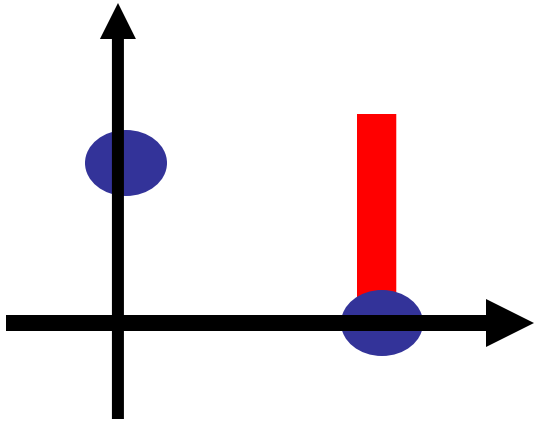
$Conflict_{ct}$
$=a_{ct}+b*Shock_{ct}=a_{ct}+b*(logPrice_{ct}-logPrice_{ct-1})$

Conflict risk and TRANSITORY shocks

Rainfall, relative to expectation

Conflict probability in MSS (2004), relative to country average





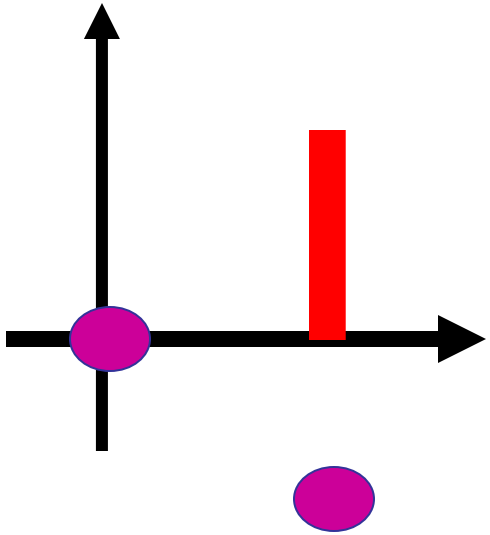
→ High conflict risk caused by negative shock

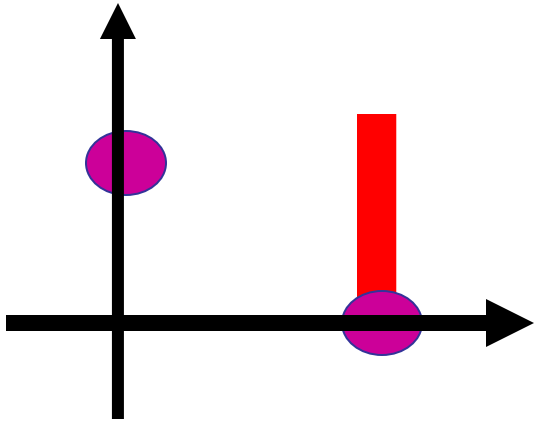
→ High conflict risk caused by <u>POSITIVE</u> shock

Conflict risk and PERMANENT shocks

Commodity prices

Conflict probability,
relative to country average





→ High conflict risk caused by negative shock

→ High conflict risk caused by NEGATIVE shock

International Commodity Price Index

$$ComPI_{ct} = \sum_{i=1}^{19} P_{it} w_{ic}$$

AGRICULTURAL COMMODITIES: bananas, cocoa, coffee, cotton, fish, groundnuts, livestock, sugar, tea, tobacco, wood.

NATURAL RESOURCES: aluminium, copper, gold, iron, nickel, oil, phosphates, uranium.

Sources: Deaton, 1999 JEP, UN ComTrade, IMF

TABLE 6. Commodity Price Shocks and Civil War Onset

	Civil War Onset		
	(1)	(2)	(3)
	LS	LS	LS
Commodity Price Growth, t	-0.084**	-0.065**	
	(-1.98)	(-2.15)	
Commodity Price Growth, t-1	-0.021	-0.048	
	(-0.86)	(-1.25)	
Commodity Price Growth, t-2	-0.072*	-0.105**	
	(-1.75)	(-2.29)	
3-Year Commodity Price Growth			-0.060**
			(-2.15)
Country FE	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes
Year FE	No	Yes	Yes
No. Observations	814	814	814

Note: Method of estimation is least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable is civil war onset. *3 Year Commodity Price Growth* is the commodity price growth rate between *t* and *t*-3. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Robustness

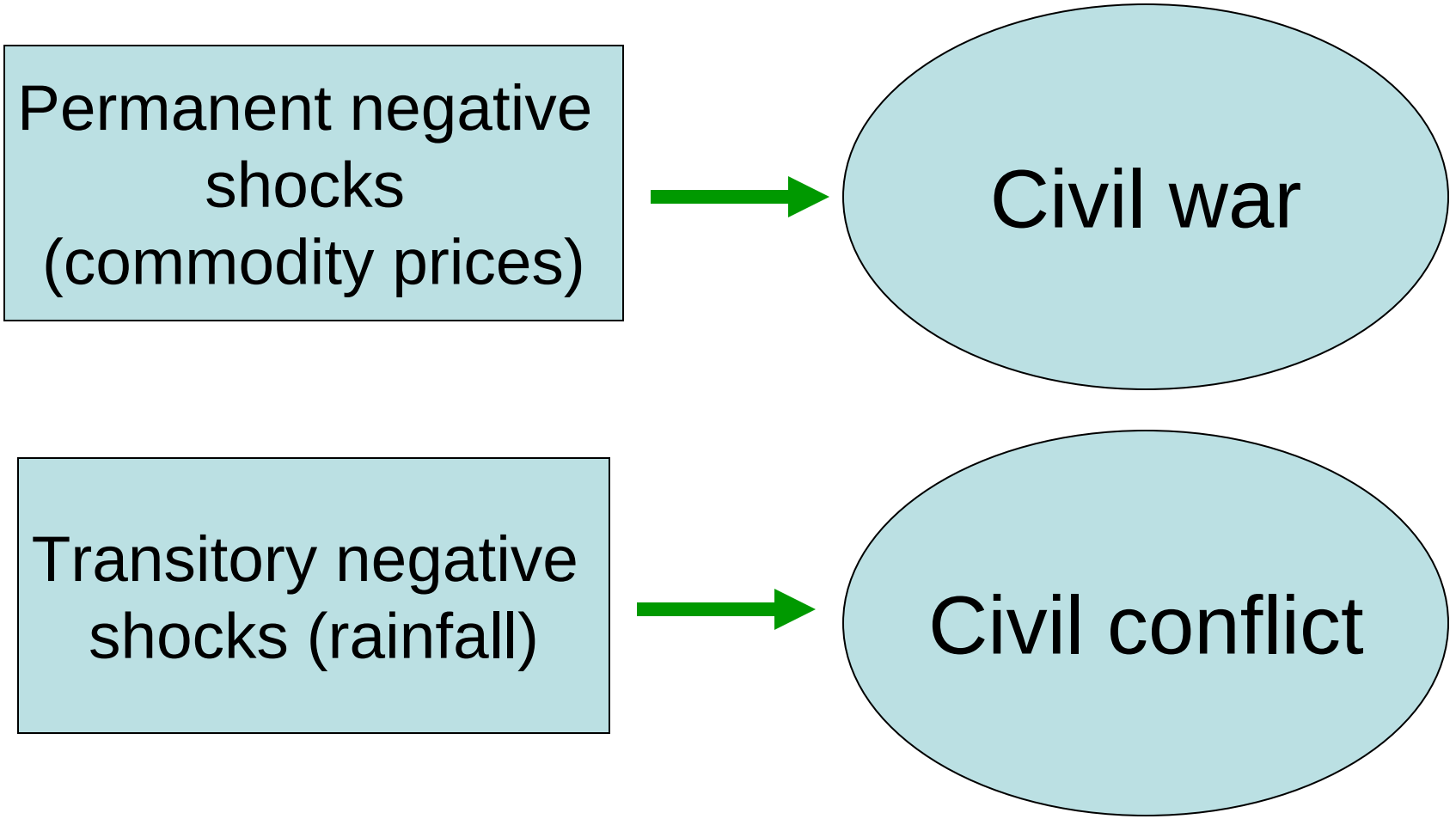
- excluding large commodity suppliers (more than 3% of world supply)
- agricultural vis-à-vis natural resource commodities

TABLE 11. Commodity Price Shocks and Civil War Onset

	Civil War Onset		
	(1)	(2)	(3)
	LS	LS	LS
	Excluding > 3% World Supply	Agriculture Only	Mining and Oil Only
3-Year Commodity Price Growth	-0.073**	-0.089**	-0.001
	(-2.27)	(-2.21)	(-0.04)
Country FE	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
No. Observations	766	652	588

Note: Method of estimation is least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable is civil war onset. Column (1) drops commodities from a country's (time-invariant) commodity basket if the country produces more than 3% of world supply of the commodity (see Appendix Table 1). Column (2) drops commodities from a country's commodity basket that are produced in the mining and oil sector, column (3) drops those commodities that are produced in the agricultural sector. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Conclusions



Appendix

Instrumental variables approach

- Use commodity price growth as instrument for economic growth

Table 7. Economic Growth and Civil War Onset

	GDP Per Capita Growth	Civil War Onset	
	(1)	(2)	(3)
	LS	LS	2SLS
3-Year Commodity Price Growth	0.025*** (3.42)		
GDP Per Capita Growth		-0.365** (-2.55)	-1.953** (-1.96)
Country FE	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
No. Observations	916	814	814

Note: The method of estimation in columns (1) and (2) is least squares, column (3) two-stage least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable in column (1) is per capita GDP growth, columns (2)-(3) civil war onset. The instrumental variable in column (3) is the commodity price growth rate between *t* and *t*-3. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Second instrument

$$\text{OECD ExportDemandGrowth}_{c,t} = \sum_{j \in OECD} \theta_{c,j} GDPGrowth_{j,t}$$

time-invariant export shares

Table 8. Export Demand, Economic Growth, and Civil War Onset

	GDP Per Capita Growth	Civil War Onset	
	(1)	(2)	(3)
	LS	LS	2SLS
3-Year Commodity Price Growth	0.028***	-0.062**	
	(3.53)	(-2.19)	
OECD Growth	0.010***	-0.006***	
	(10.53)	(-4.16)	
GDP Per Capita Growth			-0.803***
			(-5.45)
Hansen J, p-value			0.1642
Country FE	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
No. Observations	916	814	814

Note: The method of estimation in columns (1)-(2) is least squares, column (3) two-stage least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable in column (1) is per capita GDP growth, columns (2)-(3) civil war onset. The instrumental variables in column (3) are the commodity price growth rate between *t* and *t*-3 and OECD growth. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 9. Export Demand, Economic Growth, and Civil War Onset

	Civil War Onset	
	(1)	(2)
	2SLS	2SLS
3-Year Commodity Price Growth	-0.041 (-1.36)	
OECD Growth		0.011 (1.27)
GDP Per Capita Growth	-0.639*** (-5.68)	-1.867** (-2.02)
Country FE	Yes	Yes
Time Trends	Yes	Yes
Year FE	Yes	Yes
No. Observations	814	814

Note: The method of estimation is two-stage least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable is civil war onset. The instrumental variable in column (1) is OECD growth; column (2) commodity price growth between *t* and *t*-3. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 10. Another Look at Channels

	Government Expenditure Share	Military Expenditure Share	Growth of Terms of Trade	Growth of Exports	Growth of Development Aid
	(1)	(2)	(3)	(4)	(5)
	LS	LS	LS	LS	LS
3-Year Commodity Price Growth	0.011 (0.59)	-0.054 (-0.79)	0.115*** (5.09)	0.131*** (4.03)	0.096 (0.71)
OECD Growth	-0.001 (-0.49)	0.018 (0.50)	0.009** (2.49)	0.013** (2.13)	-0.001 (-0.26)
Country FE	Yes	Yes	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
No Observations	777	532	773	873	898

Note: Method of estimation is least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable in column (1) is the growth rate of the share of government expenditure in GDP; the dependent variable in column (2) is the growth rate of the share of military expenditure in GDP; in column (3) the dependent variable is terms of trade growth; in column (4) the dependent variable is export growth; and in column (5) the dependent variable is the growth rate of (net) official development aid (ODA). *3 Year Commodity Price Growth* is the commodity price growth rate between *t* and *t*-3. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Heterogenous effects

- high versus low initial income
- democracies versus autocracies

Table 12. Heterogeneity in the Effect of Commodity Prices On Civil War Onset

	Civil War Onset				
	(1)	(2)	(3)	(4)	(5)
	LS	LS	LS	LS	LS
3-Year Commodity Price Growth	-0.101**	-0.099**	-0.047*	-0.875**	-0.088**
	(-2.49)	(-2.25)	(-1.90)	(-2.40)	(-2.04)
3-Year Commodity Price Growth* Democracy [Polity IV]	0.074*			0.067*	
	(1.76)			(1.67)	
3-Year Commodity Price Growth* Democracy [Freedom House]		0.088*			0.080
		(1.72)			(1.59)
3-Year Commodity Price Growth* GDP79			0.053*	0.045**	0.026
			(1.84)	(2.22)	(1.14)
Democracy	0.050	0.002		0.052*	0.002
	(1.56)	(0.08)		(1.64)	(0.09)
Country FE	Yes	Yes	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
No. Observations	749	689	814	749	689

Note: Method of estimation is least squares; t-values reported in parentheses are based on Huber robust standard errors that are clustered at the country level. The dependent variable is civil war onset. *Democracy [Polity IV]* is an indicator variable that is 1 if between *t*-1 and *t*-3 the country has a strictly positive Polity2 score, 0 if between *t*-1 and *t*-3 the country's Polity2 score was smaller or equal to 0, and missing if between *t*-1 and *t*-3 the country switched between positive to negative Polity2 scores. *Democracy [Freedom House]* is an indicator variable that is 1 if between *t*-1 and *t*-3 Freedom House classifies a country as free or partially free, 0 if between *t*-1 and *t*-3 the country is not free, and missing if between *t*-1 and *t*-3 the country switched from free or partially free to not free. *GDP79* is the difference between a country's log real per capita GDP in 1979 and the log of the 1979 sample average real per capita GDP. * Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.