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Income and armed civil conflict: An instrumental variables approach

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JEL classification codes
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1 Introduction

Economic variables have long been established in the empirical conflict literature as the most robust predictors of armed civil conflict (see e.g., Fearon and Laitin 2003; Hegre and Sambanis 2006). However, although the link between economic variables and conflict incidence seems strong, the causality is uncertain due to endogeneity issues, mainly arising from reverse causality and omitted variables bias. Several recent articles use 2SLS estimations, often with weather-based instruments and sub-Saharan African samples, to analyze the effects of economic shocks on the likelihood of armed civil conflict (Miguel et al. 2004; Brückner and Ciccone 2010; Bergholt and Lujala 2012; Hodler and Raschky 2014). In this article, we introduce three new exogenous instruments for income levels and use these to test whether higher income levels still decrease the likelihood of the onset of civil conflict in a large panel dataset including 156 countries from 1946-2011. We confirm the importance of income levels for explaining the onset of conflict, and find that the magnitude of the effect is larger than in conventional OLS estimations.

2 Methodology and data description

[Table 1 here]

We follow the literature and explain the onset of armed *conflict* in year t in country i with income per capita levels and a vector of other covariates X according to:

$$conflict_{it} = a + b + \alpha_1 \cdot incomepc_{it} + \alpha_2 \cdot X_{it} + \epsilon_{it}, \tag{1}$$

where a is the constant term and ϵ the error term. Conflict is a zero-one dummy taken from the UCDP/PRIO Armed Conflict Database v.4-2012 (Gleditsch et al. 2002; Pettersson and Wallensteen 2015). It indicates the onset of a new armed civil conflict with over 25 battle related deaths or reactivation of a conflict after more than two years since the last

observed fighting. Information for income per capita and population size comes from the Maddison dataset (Bolt and van Zanden 2013).[1] Other covariates include lagged conflict; a polity measure and its square from the Polity IV dataset (Marshall et al. 2013); ethnic fractionalization (Alesina et al. 2003);[2] mountainousness (Fearon and Laitin 2003); a dummy for the post-Cold War period; and decade dummies b.[3]

To take into account the likely endogeneity of income per capita, we use pooled 2SLS and introduce the following first-stage estimation:

$$incomepc_{it} = d + b + \beta_1 \cdot I_i + \beta_2 \cdot X_{it} + \varepsilon_{it}. \tag{2}$$

We have a total of three different exogenous instruments I, which allows us to achieve a strong first-stage identification and to test for overidentifying restrictions.[4] Summary statistics are provided in Table 1.

Our first instrument is based on mailing times in 1903 from either London or Washington, D.C. – whichever is faster – to the rest of the world. The two cities were chosen as they were the capitals of the world's most powerful economy at the time and of the world's soon-to-be most powerful economy, respectively. We used data on mailing times and distances for regular correspondence from Post Office Department (1903) and Post Office (1903),[5] supplemented by own calculations for missing cases. The "mailing speeds" are calculated as miles covered per "mailing day". We then took the natural logarithm to construct our final measure, *Mailingspeed.* Mailing times are positively linked to economic development: not only did it take longer for correspondence to reach the more remote parts of the world; but at equal distances, letters reached a more developed and better-connected country before its

[1] We also used only the Penn World Tables (PWT 8.0, Feenstra et al. 2013) for the economic and population variables. The sample loses three countries and over 1000 observations, but the results are remarkably similar.

[2] Religious and language fractionalization and ethnic polarization measures gave qualitatively similar results.

[3] Year dummies gave similar results.

[4] Detailed descriptions of the instruments will be made available in an online codebook.

[5] We are grateful to Jenny Lynch from the US Postal Service and to The Royal Mail Archive for their help.

"backwater" counterpart.

The second instrument is international *telegram* charges from Britain in (log) pence in 1903, from Post Office (1903). Telegram pricing principles were similar across the globe: they depended on distance and the number of words in the message, and also included labor costs right down to final delivery. A stated charge would apply to the first ten words together, and then to each additional word (Ross 1928, Downey 2002). The resulting pattern meant that it cost less to send a telegram from London to Australia than to the West African coast, for example, so that telegram charges should be negatively related to income levels.

Our third and final instrument is the *urbanization* rate (for towns 20'000 or larger) in 1920, taken mainly from UN (1969) and supplemented by information from McEvedy and Jones (1978), the Statesman's Yearbook (1922), and Bairoch (1988). Urbanization is strongly linked to the level of economic development. For example, Acemoglu et al. (2002) use historical urbanization rates as proxies for economic prosperity and development. We expect that higher urbanization rates in 1920 are related to higher income per capita in more recent decades. Urbanization from a century ago is unlikely to affect conflict after WWII directly. Also, post-war urbanization patterns particularly in the developing world differed significantly from those seen earlier in the century (Bairoch 1988). So while cities may often be the epicenters of social unrest today, urbanization rates no longer have the strong positive link with economic development that they used to have.

[Table 2 here]

We do not have the space to put forward all our theoretical arguments, but we believe that the three instruments satisfy the exclusion restriction. In the reduced-form estimations in Table 2, each instrument has the right sign and is highly significant when introduced on its own, and the three instruments are jointly significant at the 1-percent level (column 4). We provide results of statistical tests of instrument strength with the estimation results.

3 Results

[Table 3 here]

Table 3 first shows results using pooled OLS to confirm the standard findings from the empirical conflict literature (columns 1-2). The remaining columns show the results of 2SLS estimations, initially using only one instrument at a time, and finally using all three instruments together. Pairwise inclusion of the instruments (not shown) yielded very similar results. Income per capita is negative and significant across all specifications. However, the magnitude of the coefficient increases in the 2SLS estimations: one standard deviation increase in logged per capita income reduces the likelihood of conflict by two percentage points, all other things equal. This is substantial considering that the mean likelihood of conflict onset is 3.4 percent (see Table 1).

Looking at the first-stage information, all instruments have the expected sign and are highly significant both on their own (columns 3-5) and together (columns 6-7). Test statistics further confirm instrument strength and validity; tests based on Kleibergen-Paap rk Wald F statistics (not shown) also reject that we have weak instruments.

4 Conclusion

We introduce three new instruments for income per capita and use these to test the relationship between income levels and the likelihood of armed civil conflict. We confirm that lower income levels increase the risk of conflict onset, but the effect is larger than with OLS.

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Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Conflict onset	7825	0.033	0.179	0	1
Income p.c.	7831	5104.845	5717.053	203.413	42916.24
Mailingspeed	7831	351.831	158.631	75.702	1000
Telegram	7831	36.785	31.414	0.5	171
Urbanization1920	7831	12.945	14.378	0	90

Notes: For easier interpretation, *Income p.c.*, *Telegram* and *Mailingspeed* are not reported in natural logs.

Table 2: Reduced-form estimations

	(1)	(2)	(3)	(4)
Mailingspeed	-0.011*			-0.005
	(-1.740)			(-0.779)
Telegram		0.005**		0.002
		(2.136)		(0.789)
Urbanization1920			-0.001***	-0.001***
			(-3.240)	(-3.206)
Observations	7,875	7,875	7,875	7,875
Countries	158	158	158	158
R^2	0.017	0.017	0.019	0.019

Notes: The dependent variable is onset of an armed civil conflict. All specifications include a dummy for an ongoing conflict, polity and polity squared, (log) population, decade dummies and a constant term (not shown). All time-varying variables are lagged one year. S.e. are clustered at the country level. Robust t-statistics in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Income and armed civil conflict onset

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS
Income p.c.	-0.013***	-0.011**	-0.016*	-0.018**	-0.021***	-0.020***	-0.017***
	(-3.06)	(-2.38)	(-1.65)	(-2.18)	(-3.72)	(-3.41)	(-2.65)
Population	0.011***	0.012***	0.011***	0.011***	0.011***	0.011***	0.012***
	(3.06)	(3.02)	(3.14)	(3.12)	(3.18)	(3.16)	(3.09)
Polity	0.0041*	0.0037	0.0034	0.0029	0.0023	0.0026	0.0027
	(1.71)	(1.49)	(1.22)	(1.01)	(0.92)	(1.04)	(1.07)
Polity squared	-0.00020*	-0.00017	-0.00015	-0.00013	-0.000089	-0.00011	-0.00011
	(-1.70)	(-1.46)	(-1.00)	(-0.82)	(-0.70)	(-0.84)	(-0.85)
Ethnic fractionalization		0.022*					0.015
		(1.85)					(1.18)
Mountainousness		0.000053					0.000036
		(0.34)					(0.22)
Post Cold War		-0.040***					-0.040***
		(-2.74)					(-2.76)
Mailingspeed			5.03			2.63	2.32
Telegram				-7.19		-2.56	-1.97
Urbanization1920					7.57	7.02	6.88
Excluded IV F-statistic			25.3	51.7	57.2	25.7	20
Partial R^2			0.11	0.14	0.26	0.33	0.28
Hansen J-stat. p-value						0.80	0.50
Observations	7636	7380	7636	7636	7636	7636	7380
Countries	157	150	157	157	157	157	150

Notes: The dependent variable is onset of an armed civil conflict. Columns (1)-(2) show pooled OLS estimations; columns (3)-(7) show pooled 2SLS estimations. All specifications include a dummy for an ongoing conflict, decade dummies and a constant term (not shown). All time-varying variables except the post-Cold War dummy are lagged one year. First stage information includes exogenous instruments' t-statistics, partial R-squareds, excluded instruments' F-statistics, and Hansen J statistic p-value. S.e. are clustered at the country level. Robust t-statistics in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$