ONLINE APPENDIX

``Central Banks at War''

*** ROBUSTNESS TEST 1: BORROWING COSTS WITH CREDIT ACCESS SELECTION**

Stata Command:

```
. heckman avg_spread Lavg_spread cb war cb_war comp /*cent*/ topitaxrate2 trade gdp lnpop
growth urban internal_disruption GS Default cw colwar year year2 year3 year4,
select(f_credit_access = cb war cb_war comp trade gdp lnpop growth urban
internal_disruption GS Default cw s_lead colwar topitaxrate2) twostep
```

Regression Output:

Spread Model	
Central Bank	0.08
	(0.07)
Interstate War	0.06
	(0.15)
Central Bank	0.27
X Interstate War	(0.28)
Credit Access Model	
Central Bank	0.08
	(0.07)
Interstate War	0.06
	(0.15)
Central Bank	0.27
X Interstate War	(0.28)
Number of Observations	2,917

Note 1: Spread model includes time polynomial and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text.

Note 2: Credit Access Model does not include lagged dependent variable or time polymial. Credit Access Model also includes foreign policy similarity with system leader (UK).

Note 3: Results from control variables suppressed for ease of reading. Available in replication packet.

Note 4: Rho = 0.28

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.11	-0.01	-0.21

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that, even after accounting for selection effects, central banks reduce the spread when the state is at war.

*** ROBUSTNESS TEST 2: Split between "Rich" and "Poor"**

Stata Commands to Create Rich Variable:

```
. sum gdp, detail

. local median = r(p50)

. capture drop rich

. capture drop cb_rich

. capture drop comp_rich

. capture drop comp_rich_cb

. capture drop cb_comp

. gen rich = 0

. replace rich = 1 if gdp>`median'
(1399 real changes made)
```

Stata Commands to Run Model on Rich Countries:

```
. xtreg avg_spread Lavg_spread cb war cb_war comp topitaxrate2 trade gdp lnpop growth urban
internal_disruption GS Default cw colwar year year2 year3 year4 if rich==0, re
```

Stata Commands to Run Model on Poor Countries:

```
. xtreg avg_spread Lavg_spread cb war cb_war comp topitaxrate2 trade gdp lnpop growth urban
internal_disruption GS Default cw colwar year year2 year3 year4 if rich==1, re
```

Regression Output:

	"Rich" Countries	"Poor" Countries
Central Bank	-0.00	0.01
	(0.03)	(0.02)
Interstate War	-0.02	0.06
	(0.08)	(0.04)
Central Bank X Interstate War	-0.04	-0.34***
	(0.09)	(0.11)
Number of Observations	726	723

Note: Models include random effects, time polynomial, and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text. Results from control variables suppressed for ease of reading (available in replication packet).

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
RICH MODEL			
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.04	0.13	-0.21
POOR MODEL			
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.33	-0.12	-0.55

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows while the effect is identified as negative for both rich countries and poor countries, it is statistically signifficant only for poor countries. Since the confidence intervals do not overlap, this lends some credence to the North, Wallis, and Weingast (2009) story. However, one must keep in mind that, during the time period under evaluation, most countries would be considered `poor' by today's standards.

*** ROBUSTNESS TEST 3: Split by Regime Type**

Stata Commands to Run Model on Countries without Representative Institutions:

```
. xtreg avg_spread Lavg_spread cb war cb_war topitaxrate2 trade gdp lnpop growth urban
internal_disruption GS Default cw colwar year year2 year3 year4 if comp==0, re
```

Stata Commands to Run Model on Countries with Representative Institutions:

```
 . xtreg avg_spread Lavg_spread cb war cb_war topitaxrate2 trade gdp lnpop growth urban
internal_disruption GS Default cw colwar year year2 year3 year4 if comp==1, re
```

Regression Output:

	With Representative Institutions	Without Representative Institutions
Central Bank	-0.01	-0.01
	(0.03)	(0.02)
Interstate War	0.02	0.05
	(0.11)	(0.04)
Central Bank X Interstate War	-0.06	-0.13**
	(0.12)	(0.06)
Number of Observations	503	946

Note: Models include random effects, time polynomial, and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text. Results from control variables suppressed for ease of reading (available in replication packet).

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
With Representative Institutions (Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.07	0.17	-0.31
Without Representative Institutions (Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.14	-0.02	-0.27

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows while the effect is identified as negative for both countires with representative institutions and without representative institutions, it is statistically significant only for countries without representative institutions. However, since the confidence intervals for when the country has representative isntitutions contains the effect for when the country does not have representative institutions (indeed, the confidence intervals for when the country has representative institutions completely contain the confidence intervals for when the country does not have represenetative institutions), this suggests that, statistically speaking, the effect is indistinguishable between countries with and without representative institutions.

*** ROBUSTNESS TEST 4: REMOVE UK FROM SAMPLE**

Stata Command:

```
. xtreg avg_spread Lavg_spread cb war cb_war comp /*cent*/ topitaxrate2 trade gdp lnpop
growth urban internal_disruption GS Default cw colwar year year2 year3 year4 if
ccode~=200, re
```

Regression Output:

Central Bank	0.01 (0.02)
Interstate War	0.04 (0.04)
Central Bank X Interstate War	-0.12** (0.05)
Number of Observations	1,352

Note: Model includes random effects, time polynomial, and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text. Results from control variables suppressed for ease of reading. Available in replication packet.

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.11	-0.01	-0.21

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that, even after removing the UK from the sample, central banks reduce the spread when the state is at war.

*** ROBUSTNESS TEST 5: CONTROL FOR CENTRALIZATION**

Variable Description:

A *Centralization* score of 1 indicates that the country is a unitary state in which no more than moderate decision-making authority is vested in local or regional governments. The United Kingdom is a classic case of such a country, though the majority of states in the Polity dataset (48) fall into this category. A score of 3 indicates that the country has a federal system in which local and/or regional governments have substantial decision-making authority. The United States during the 19th century is a prime example of such a state. Eleven (11) countries, including Germany, fall into this category. A score of 2 suggests a mixture between centralization and a federal system, though only three (3) countries fall into this category.

Stata Command:

```
. xtreg avg_spread Lavg_spread cb war cb_war comp cent topitaxrate2 trade gdp lnpop
growth urban internal_disruption GS Default cw colwa
> r year year2 year3 year4, re
```

Regression Output:

Central Bank	0.01 (0.02)
Interstate War	0.04 (0.04)
Central Bank X Interstate War	-0.12** (0.05)
Number of Observations	1,446

Note 1: Model includes random effects, time polynomial, and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text. Results from control variables suppressed for ease of reading (available in replication packet).

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.11	-0.01	-0.21

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that, even after controlling for centralization, central banks reduce the spread when the state is at war.

*** ROBUSTNESS TEST 6: Moving Averages**

Stata Commands for Creating the Moving Average Variables:

```
. gen Move5_spread = (avg_spread + L.avg_spread + L2.avg_spread + L3.avg_spread + L4.avg_spread +
L5.avg_spread)/5

. gen Move5_cb = (cb + L.cb + L2.cb + L3.cb + L4.cb + L5.cb)/5

. gen Move5_war = (war + L.war + L2.war + L3.war + L4.war + L5.war)/5

. gen Move5_comp = (comp + L.comp + L2.comp + L3.comp + L4.comp + L5.comp)/5

. gen Move5_topitaxrate2 = (topitaxrate2 + L.topitaxrate2 + L2.topitaxrate2 + L3.topitaxrate2 +
L4.topitaxrate2 + L5.topitaxrate2)/5

. gen Move5_trade = (trade + L.trade + L2.trade + L3.trade + L4.trade + L5.trade)/5

. gen Move5_gdp = (gdp + L.gdp + L2.gdp + L3.gdp + L4.gdp + L5.gdp)/5

. gen Move5_lnpop = (lnpop + L.lnpop + L2.lnpop + L3.lnpop + L4.lnpop + L5.lnpop)/5

. gen Move5_growth = (growth + L.growth + L2.growth + L3.growth + L4.growth + L5.growth)/5

. gen Move5_urban = (urban + L.urban + L2.urban + L3.urban + L4.urban + L5.urban)/5

. gen Move5_internal_disruption = (internal_disruption + L.internal_disruption +
L2.internal_disruption + L3.internal_disruption + L4.in
> ternal_disruption + L5.internal_disruption)/5

. gen Move5_GS = (lnpop + L.lnpop + L2.lnpop + L3.lnpop + L4.lnpop + L5.lnpop)/5

. gen Move5_Default = (Default + L.Default + L2.Default + L3.Default + L4.Default + L5.Default)/5

. gen Move5_cw = (cw + L.cw + L2.cw + L3.cw + L4.cw + L5.cw)/5

. gen Move5_colwar = (colwar + L.colwar + L2.colwar + L3.colwar + L4.colwar + L5.colwar)/5

. gen Move5_cb_war = Move5_war*Move5_cb
```

Stata Estimation Commands:

```
. reg Move5_spread Move5_cb Move5_war Move5_cb_war Move5_comp /*cent*/ Move5_topitaxrate2
Move5_trade Move5_gdp Move5_lnpop Move5_growth Move5_urban Move5_internal_disruption
Move5_GS Move5_Default Move5_cw Move5_colwar
```

Regression Output:

Central Bank	-0.15***
	(0.02)
Interstate War	-0.09
	(0.08)
Central Bank X Interstate War	-0.05
	(0.11)
Number of Observations	1,319

Note 1: Results from control variables suppressed for ease of reading (available in replication packet).

Note 2: The Modifying Variable, Interstate War, now ranges from 0 to 1 (meaning 0 percent of the years in the five year period experienced war, to 100 percent of the years in the five year period experienced war).

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)*0	-0.15	-0.10	-0.20
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)*0.5	-0.17	-0.07	-0.28
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)*1	-0.20*	0.01	-0.41

* Significant at the 0.90 confidence level.

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that the amount by which having a central bank reduces the 5-year moving average spread increases as the country is at war for a higher proportion of years over the 5-year period.

*** ROBUSTNESS TEST 7: YIELD AS THE DEPENDENT VARIABLE**

Stata Command:

```
. xtreg master_yield Lyield cb war cb_war comp /*cent*/ topitaxrate2 trade gdp lnpop
growth urban internal_disruption GS Default cw colwar year year2 year3 year4, re
```

Regression Output:

Central Bank	-0.15 (0.17)
Interstate War	0.35 (0.41)
Central Bank X Interstate War	-0.15 (0.55)
Number of Observations	1,449

Note: Model includes random effects, time polynomial, and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text. Results from control variables suppressed for ease of reading (available in replication packet).

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.30	0.77	-1.37

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows central banks reduces the yield by more when the state is at war compared to when it is not at war. However, it should be noted that the effect is statistically indistinguishable from zero. As discussed in the text, this null result is of little concern, since theappropriate dependent variable is the spread.

*** ROBUSTNESS TEST 8: WITH YEAR FIXED EFFECTS**

Stata Command:

```
. xi: reg avg_spread cb war cb_war comp /*cent*/ topitaxrate2 trade gdp lnpop growth
urban internal_disruption GS Default cw colwar i.year
```

Regression Output:

Model Not identified. Specifically, the standard errors could not be computed (see the results reported in the online appendix), which is an extreme form of the consequences associated with near-collinearity (Cameron and Trivedi 2005, 350). Given that including these variables places a large number of dummy variables in a model with a limited number of observations and relatively short panels for several countries, such an error is unsurprising.

Citation: Cameron, A. Colin and Pravin K. Trivedi. 2005. *Microeconometrics: Methods and Applications*. New York, NY: Cambridge University Press

Below is the Stata output:

```
      Source |       SS       df       MS              Number of obs =    1449
-------------+------------------------------           F(111,  1337) =       .
       Model |  383.175603   111  3.45203246           Prob > F      =       .
    Residual |           0  1337           0           R-squared     =  1.0000
-------------+------------------------------           Adj R-squared =  1.0000
       Total |  383.175603  1448  .264624036           Root MSE      =       0

------------------------------------------------------------------------------
         avg_spread |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------------+---------------------------------------------------------------
                 cb |  -6.61e-14          .       .       .            .           .
                war |   2.03e-15          .       .       .            .           .
             cb_war |  -9.75e-15          .       .       .            .           .
               comp |  -9.02e-15          .       .       .            .           .
       topitaxrate2 |  -9.96e-15          .       .       .            .           .
              trade |   9.17e-14          .       .       .            .           .
                gdp |   2.78e-13          .       .       .            .           .
              lnpop |   4.33e-19          .       .       .            .           .
             growth |  -2.37e-13          .       .       .            .           .
              urban |   1.62e-14          .       .       .            .           .
internal_disruption |   1.36e-14          .       .       .            .           .
                 GS |   5.59e-14          .       .       .            .           .
            Default |   5.37e-14          .       .       .            .           .
                 cw |   1.22e-14          .       .       .            .           .
             colwar |  -1.99e-14          .       .       .            .           .
         _Iyear_1816 |          0  (omitted)
         _Iyear_1817 |          0  (omitted)
         _Iyear_1818 |   .7045832          .       .       .            .           .
         _Iyear_1819 |   .4794159          .       .       .            .           .
         _Iyear_1820 |   .9359326          .       .       .            .           .
         _Iyear_1821 |   1.838541          .       .       .            .           .
         _Iyear_1822 |   2.114991          .       .       .            .           .
         _Iyear_1823 |   2.052266          .       .       .            .           .
         _Iyear_1824 |   2.373666          .       .       .            .           .
         _Iyear_1825 |   2.839517          .       .       .            .           .
         _Iyear_1826 |   3.310249          .       .       .            .           .
         _Iyear_1827 |    3.19438          .       .       .            .           .
         _Iyear_1828 |   3.246824          .       .       .            .           .
         _Iyear_1829 |   3.307675          .       .       .            .           .
         _Iyear_1830 |   2.704999          .       .       .            .           .
```

_Iyear_1831	2.376913	.	.	.	.
_Iyear_1832	3.166475	.	.	.	.
_Iyear_1833	3.041191	.	.	.	.
_Iyear_1834	2.933216	.	.	.	.
_Iyear_1835	2.826825	.	.	.	.
_Iyear_1836	2.851082	.	.	.	.
_Iyear_1837	2.883945	.	.	.	.
_Iyear_1838	2.859242	.	.	.	.
_Iyear_1839	2.868141	.	.	.	.
_Iyear_1840	2.713074	.	.	.	.
_Iyear_1841	2.622733	.	.	.	.
_Iyear_1842	2.671528	.	.	.	.
_Iyear_1843	2.924458	.	.	.	.
_Iyear_1844	2.73387	.	.	.	.
_Iyear_1845	2.81299	.	.	.	.
_Iyear_1846	2.926765	.	.	.	.
_Iyear_1847	2.641799	.	.	.	.
_Iyear_1848	1.405611	.	.	.	.
_Iyear_1849	1.528122	.	.	.	.
_Iyear_1850	1.558191	.	.	.	.
_Iyear_1851	1.71514	.	.	.	.
_Iyear_1852	2.552434	.	.	.	.
_Iyear_1853	2.849728	.	.	.	.
_Iyear_1854	2.850935	.	.	.	.
_Iyear_1855	2.592599	.	.	.	.
_Iyear_1856	2.633985	.	.	.	.
_Iyear_1857	2.547482	.	.	.	.
_Iyear_1858	2.663995	.	.	.	.
_Iyear_1859	2.589517	.	.	.	.
_Iyear_1860	2.636519	.	.	.	.
_Iyear_1861	2.630502	.	.	.	.
_Iyear_1862	2.833847	.	.	.	.
_Iyear_1863	2.932203	.	.	.	.
_Iyear_1864	3.015348	.	.	.	.
_Iyear_1865	3.155064	.	.	.	.
_Iyear_1866	3.369262	.	.	.	.
_Iyear_1867	3.176586	.	.	.	.
_Iyear_1868	3.172514	.	.	.	.
_Iyear_1869	3.161265	.	.	.	.
_Iyear_1870	2.739394	.	.	.	.
_Iyear_1871	2.033083	.	.	.	.
_Iyear_1872	2.033083	.	.	.	.
_Iyear_1873	2.024149	.	.	.	.
_Iyear_1874	2.381416	.	.	.	.
_Iyear_1875	2.559608	.	.	.	.
_Iyear_1876	3.172679	.	.	.	.
_Iyear_1877	3.665492	.	.	.	.
_Iyear_1878	3.939954	.	.	.	.
_Iyear_1879	3.89167	.	.	.	.
_Iyear_1880	3.901536	.	.	.	.
_Iyear_1881	3.533532	.	.	.	.
_Iyear_1882	3.470718	.	.	.	.
_Iyear_1883	3.285205	.	.	.	.
_Iyear_1884	3.33808	.	.	.	.
_Iyear_1885	3.357781	.	.	.	.
_Iyear_1886	3.218485	.	.	.	.
_Iyear_1887	2.950424	.	.	.	.
_Iyear_1888	2.96565	.	.	.	.
_Iyear_1889	3.005058	.	.	.	.

```
  _Iyear_1890 |   3.105164          .       .      .           .           .
  _Iyear_1891 |   3.219885          .       .      .           .           .
  _Iyear_1892 |   3.249861          .       .      .           .           .
  _Iyear_1893 |   3.172016          .       .      .           .           .
  _Iyear_1894 |   3.150867          .       .      .           .           .
  _Iyear_1895 |   3.052952          .       .      .           .           .
  _Iyear_1896 |   3.048216          .       .      .           .           .
  _Iyear_1897 |   3.081946          .       .      .           .           .
  _Iyear_1898 |   3.163679          .       .      .           .           .
  _Iyear_1899 |   3.120852          .       .      .           .           .
  _Iyear_1900 |    3.14275          .       .      .           .           .
  _Iyear_1901 |   3.070358          .       .      .           .           .
  _Iyear_1902 |   2.967574          .       .      .           .           .
  _Iyear_1903 |   2.909011          .       .      .           .           .
  _Iyear_1904 |   2.947285          .       .      .           .           .
  _Iyear_1905 |   2.896102          .       .      .           .           .
  _Iyear_1906 |     2.8428          .       .      .           .           .
  _Iyear_1907 |   2.805844          .       .      .           .           .
  _Iyear_1908 |   3.050583          .       .      .           .           .
  _Iyear_1909 |   2.843459          .       .      .           .           .
  _Iyear_1910 |    2.90592          .       .      .           .           .
  _Iyear_1911 |   2.840904          .       .      .           .           .
  _Iyear_1912 |   2.809333          .       .      .           .           .
  _Iyear_1913 |   2.798737          .       .      .           .           .
        _cons |  -2.033083          .       .      .           .           .
------------------------------------------------------------------------------
```

*** ROBUSTNESS TEST 9: Results with Flandreau and Zumer Gold Standard measure**

Stata Command:

```
xtreg avg_spread Lavg_spread cb war cb_war comp /*cent*/ topitaxrate2 trade gdp lnpop
growth urban internal_disruption GS Default cw colwar year year2 year3 year4, re
```

Regression Output:

Central Bank	0.01 (0.03)
Interstate War	0.05 (0.04)
Central Bank X Interstate War	-0.11** (0.05)
Number of Observations	1,449

Note: Model includes random effects, time polynomial, and lagged dependent variable. Control variables are same as those used in Tables 3 and 4 in the main text. Results from control variables suppressed for ease of reading (available in replication packet).

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.10*	0.01	-0.21

* Significant at the 0.90 confidence level.

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that, even after using an alternative measure of the Gold Standard, central banks reduce the spread when the state is at war (though the effect is significant at the 0.90 confidence level, instead of the 0.95 confidence level).

*** ROBUSTNESS TEST 9: CORRELATION OF GFD TO FLAUDREAU AND ZUMER YIELD DATA.**

Flandreau and Zumer (2004) offer a dataset of yields for 17 countries over the 1880 to 1913 time period comprising of what they consider to be the most accurately and credibly recorded bond yields (see Flandreau and Zumer 2004, 105-106 for a listing of the bonds). While this is a smaller sample (both temporally and spatially), I estimate the correlation in the yields and spreads for countries and years found in both the GFD database and the Flandreau and Zumer database. I find the correlation to be 0.63 for yields and 0.81 for spreads (which is my primary variable of interests), thereby suggesting that the two datasets are capturing similar measurements.

*** ADDITIONAL TEST: CONTROL FOR INFLATION**

Though the Dincecco papers on which my base specification is based did not account for inflation (which, of course, is also a major determinant of the yield), such a control is included in the following recent paper:

Breen, Michael and Iain McMenamin. ``Political Institutions, Credible Commitment, and Sovereign Debt in Advanced Economies.'' *International Studies Quarterly*. Forthcoming.

Therefore, I collect Consumer Price data from the Global Financial Database and use this to compute the year-to-year change in inflation. I then include the new variable, *inflation*, in the model.

Stata Command:

```
xtregar avg_spread Lavg_spread cb war cb_war inflation comp /*cent*/ topitaxrate2 trade
gdp lnpop growth urban internal_disruption GS Default cw colwar, re
```

Regression Output:

Central Bank	-0.02 (0.03)
Interstate War	0.10* (0.06)
Central Bank X Interstate War	-0.17** (0.07)
Number of Observations	1,064

Note: Based on model 5 in Table 3 of the main text.

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.19**	-0.05	-0.33

** Significant at the 0.95 confidence level.

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that, even after controling for inflation, central banks reduce the spread when the state is at war. In fact, the effect is slightly larger than those shown for model 5 of Table 3 in the text. This is particularly notable, since including the inflation rate caused a noticable reduction in the sample size (from 1,499 observations to 1,064).

*** ADDITIONAL TEST: ONLY CONSIDER `LARGE' WARS**

The results in the paper use all wars. However, it might be the case that the ability to borrow a large amount of money in a short period of time is only important for `large' wars. Of course, it is ambiguous as to what is meant by `large'. Does it mean the number of participants, the war's duration, or the number of battle deaths? Since even some short wars can be quite expensive and devastating (such as the Franco-Prussian war), I will use battle deaths to identify `large' wars. Specifically, I will only consider wars where the average number of battle field deaths for all participants was above 10,000.

Stata Command:

```
xtregar avg_spread Lavg_spread cb war cb_war comp /*cent*/ topitaxrate2 trade gdp lnpop
growth urban internal_disruption GS Default cw colwar, re
```

Regression Output:

Central Bank	-0.03 (0.03)
Interstate War	0.09 (0.06)
Central Bank X Interstate War	-0.19* (0.10)
Number of Observations	1,449

Note: Based on model 5 in Table 3 of the main text.

Marginal Effect (from Spread Model)

	Effect	0.95 CI (upper)	0.95 CI (lower)
(Coefficient on Central Bank) + (Coefficient on Central Bank X Interstate War)	-0.22**	-0.03	-0.41

** Significant at the 0.95 confidence level.

Note: Computed using the `lincom` command in Stata.

Interpretation:

The Marginal Effect table shows that, even after only accounting for large wars, central banks reduce the spread when the state is at war. Perhaps not surprisingly, the effect is slightly larger. This makes sense since we are now only looking at the largest wars (and, hence, the most costly wars).

Data Note: Why use Nominal Yield to compute spread, not Real Yield

Data Note: Why use Nominal Yield to compute spread, not Real Yield

This paper, as well as other work that explores bond yields during the 19th century or earlier (Dincecco 2009; Stasavage 2003; Obsfeld and Taylor 2003), use nominal yields, rather than real (inflation adjusted) yields. The reason for this is well explained by Homer and Sylla in their *History of Interest Rates* (4th edition, pp. 431-433):

> ```The connection of historical fluctuations in real rates with wars and depressions goes far toward explaining why the concept of real interest rates was largely ignored until recent times. Indeed, there was no mention of the concept in the first two editions of this HISTORY or in most academic and financial community discussions. Wars and depressions— along with their inflationary or deflationary effects— were either unexpected or considered to be temporary, or both. Once they were over, a reasonably stable price level was expected to return. The experience of the gold standard before the 1930's and the gold exchange standard and the Bretton Woods system before the 1970's served in general to reinforce these expectations.
>
> ``What changed during the 1970's and 1980's was that persistent inflation came to be expected, an expectation that was reinforced by the cutting of the old ties of the dollar and other currencies to gold. As rates of inflation rose, so—with a lag—did bond yields and short-term rates. And as rates of inflation came down, so—again with a lag—did market rates and yields. In this new financial and economic environment, there is much more risk and uncertainty about the future value of money. An investor considering the purchase of a twenty- or thirty-year bond knows its current market yield, but to estimate its real yield to maturity requires forecasting the average rate of inflation for the next twenty or thirty years. That is a highly uncertain matter, depending as much or more on future politics than on economics. This uncertainty transformed the long-term, fixed-interest bond from the conservative investment it had been for much of U.S. history into a risky, rather speculative investment.
>
> ``During the 1970's and 1980's, an increasingly widespread understanding of the concept of real interest rates and of the risks of traditional lending and investment in an uncertain inflationary environment had a number of consequences for interest rates, market yields, and credit instruments. To compensate for increased risk and uncertainty of inflation, lenders and investors demanded what appeared to be higher real rates of interest. Borrowers, attempting to avoid getting locked into costly long-term commitments in case the inflation rate turned out to be less than expected, turned increasingly to shorter-term financing. These behaviors diminished the relative importance of the traditional longterm bond markets and fixed interest rate bonds after the mid-1970's.''

In other words, investors weren't really concerned about inflation, and, therefore, applying the real interest rate to this time period is might be anachronistic. Nevertheless, it could still be important to account for the inflation rate (which is a control in Obsfeld and Taylor 2003). Hence, please refer to my robustness check to controls for the inflation rate.

Qualitative Evidence of Central Banks Reducing Borrowing Costs

The favorable financing offered to sovereigns by a central bank is palpable. For instance, when Napoleon wrote his Minister of Finance Martin Gaudin that ``I wish you would have the governor of the Bank convene a meeting to put the rate [down to] 4 percent'' it was, quite unsurprisingly, promptly done.[1] As for the United States, the Federal Reserve facilitated the financing of the allied war effort during World War I, not by directly purchasing government securities (in the form of the Liberty and Victory loans), but by lending to member banks, who, in turn, purchased the securities (though it, like direct purchases, still increased the monetary base).[2] As Meltzer states in his history of the Federal Reserve system, ``The wartime policy achieved the Treasury's objective of marketing an extraordinary increase in debt at relatively low direct cost to the Treasury.''[3]

Previous debt repudiations made the British government a poor credit risk in the early 1690s. When war with France required higher government expenditures, creditors were wary to lend.[4] In a sense, the British government's difficulties illustrate Tomz's argument that a reputation for default can harm an government's ability to borrow.[5] Creating the Bank of England overcame investor reluctance because it invited subscribers to incorporate as the Bank and made the Bank responsible for handling government debt.[6] Thus, the government created ``an *additional*, private

[1]Quoted in Bopp 1952, 229.

[2]Meltzer 2003, 89.

[3]Ibid.

[4]In 1692, because a life annuity paying 10 percent brought in only £ 108,000 of an intended £ 1 million loan, the government raised the interest payment to 14 percent (Clapham 1944, 15). Despite this action, the offering remained undersubscribed.

[5]Tomz 2007: 223.

[6]Broz 1998, Hicks 1969, North and Weingast 1989. Moreover, the Bank could not lend the monarchy money without the explicit consent of Parliament. North and Weingast cite David Ogg, who explains "Thenceforth, the investor knew that, in lending money on a specified tax, he had parliamentary guarantee for the security of this investment, based not only on the particular fund, but on the whole of the national revenue" (David Ogg, England in the Reigns of James II and William III (Oxford, 1955), p. 413., cited in

constraint on its future behavior by making it difficult to utilize funds of a current loan if it failed to honor its previous obligations.''[7] As Broz asserts, ``as a consequence of the Bank's ability to enforce a credit boycott, the sanctity of government loan contracts improved markedly. And with creditors' rights more secure, the government was able to borrow to finance wars on a scale that the Stuarts could only dream of.''[8]

Individuals at the time recognized how the Bank of England, by easing the government's ability to borrow, directly enhanced Britain's military prowess.[9] In 1770, Fond Montyon, a senior civil servant in the French Finance Ministry, noted how the ease with which Britain could acquire finance through debt (as opposed to taxation), gave England a large military advantage relative to France. This led Montyon to recommend that France consider adopting the same institution:

> ``Great Britain finances by taxation neither all nor part of the costs of war, it finances them by loans and increases the annual tax burden only by the amount necessary to face the interest and redemption of the loan. That is the regime that France must adopt.''[10]

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footnote 39 of North and Weingast 1989). However, as will be explained below, the effectiveness of a central bank is not conditioned by the existence of representative institutions.

[7]North and Weingast 1989: 821. Emphasis added.

[8]Broz 1998: 248.

[9]Bordo and White 1991.

[10]Quoted in Sargent and Velde 1995: 489.

Sources for Central Bank Data

Capie, Forrest; Goodhart, Charles, and Schnadt, Norbert. ``The Development of Central Banking.'' • in Capie, Forrest; Goodhart, Charles; Fischer, Stanley; and Schnadt, Norbert (eds.) *The Future of Central Banking. The Tercentenary Symposium of the Bank of England*. Cambridge University Press. 1994.

Appendix B; ``Table 1: Years of Establishment." from *Central Bank Directory 2005*. Central Banking Publications Ltd. Provided via e-mail from Paul Brione of Centralbanking.co.uk;

Broz ``The Origins of Central Banking: Solutions to the Free-Rider Problem." *International Organization*. 1998. Table 2;

Central Bank Websites accessed via *Bank of International Settlements*, Central Bank Websites (*www.bis.org/cbanks.htm*).