Appendix to Forced Coexistence and Economic Development: Evidence from Native American Reservations

May 28, 2014

Section-Overview: Section 1 provides additional information on data sources. Section 2 shows additional figures. Section 3 reports tables on additional tests. Section 4 shows a complete list of all tribes in the data, their reservations and the sources used for coding forced coexistence. Section 5 shows an example of the reasoning behind each reservation's coding of forced coexistence for the 20 Chippewa reservations. Section 6 uses a simple model of reservation formation to derive more formally the argument in section 3.5.5 of the paper about why the IV estimates may be expected to be larger than the OLS if IV estimates a LATE and OLS the treatment effect on the treated.

1 Data Sources for Controls

1.1 2000 Data

Reservation-level outcome variables for the 2000 US Census come from the Census American Fact Finder. The Census reports per capita income and demographic variables directly as aggregates of each reservation's Native American population. To construct measures of the economic environment, I average county-level outcomes reported in the 2000 US Census American Fact Finder over the set of counties that are within 30 kilometers of a reservation's boundary but do not overlap with it to more than 25%. To measure remoteness, I overlay the reservation map with a data-set of US cities with populations above 50,000 in GIS to calculate each reservation's distance to its nearest city. To measure reservations' land characteristics, I overlay reservation maps with grid-cell level data on ruggedness. The data on casino-operations comes from in Taylor et al. (2005) that codes for every reservation whether it has a gambling operation in the period 1990-2000.

1.2 Panel Data

The economic environment for 1970-1990 is calculated by averaging over the same counties as for the 2000 results. 1970 county level data is obtained from the ICPSR file "DS4: Counties, Count 4C Data", ICPSR project number 9694, `http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/9694`. 1980 county level data is obtained from the ICPSR file "DS6: Counties, STF 3A Data", ICPSR project number 9693. 1990 county level data is obtained from the ICPSR file "DS5: Counties, Count 3A Data", ICPSR project number 2889.

2 Additional Figures

In this Section, I present a number of additional figures and tables that aid in understanding the data as well as providing valuable robustness checks. Several of the tables in the Appendix are based on the many useful recommendations made by referees. Figure 1 shows the residual regression plot of the regression in Table 3, column 3. One single tribe's reservations are highlighted to provide an illustration of how within-tribe variation in forced coexistence shows up in the regressions. I illustrate this with the Chippewa because the Chippewa have the most reservations of any tribe. Figures 2, 3 and 4 provide more detail on the maps that went into constructing the instruments. Figures 2 shows the "Map of Early Indian Tribes, Culture Areas, and Linguistic Stocks" in the *National Atlas of the United States* (Gerlach (1970)). This map was the basic building block of the ancestral homelands map used in the paper. This map is supplemented by maps from the *Smithsonian Handbook of Native Americans* (Sturtevant (1981)), where those maps were more detailed. Figure 3 shows the map for the South-Western volume of the Smithsonian Handbook. Figure 4 shows the gold mining map from the 1880 US Census.

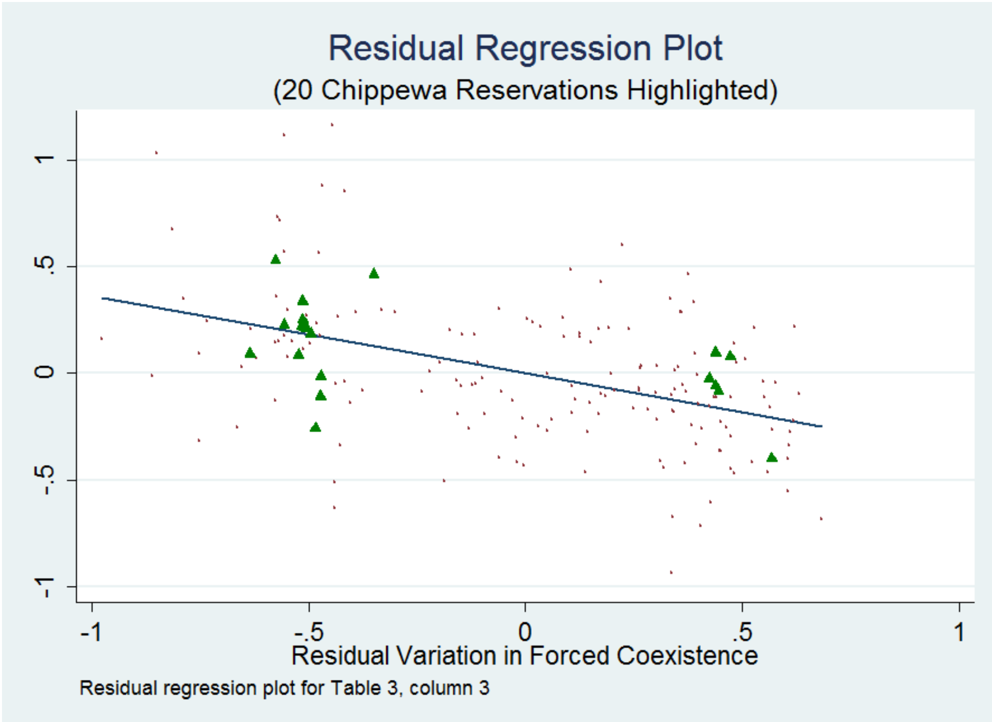


Figure 1: Residual Regression Plot

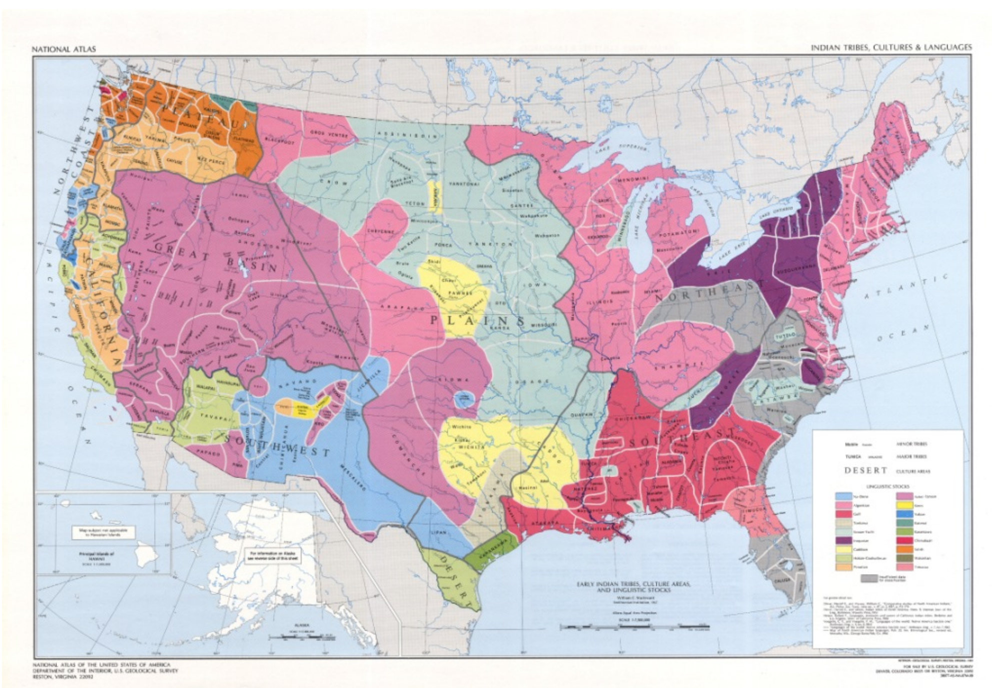


Figure 2: 1970 National Atlas Map

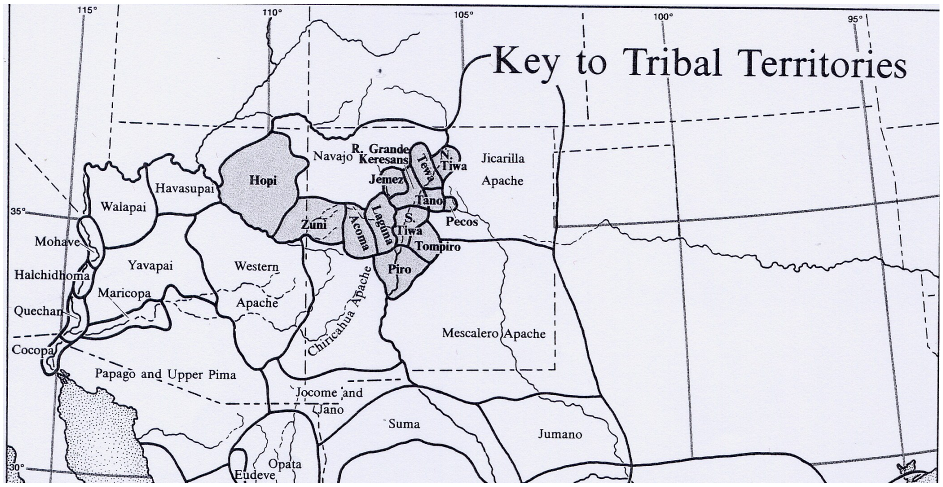


Figure 3: 1981 Smithonian Handbook Map of the South-West

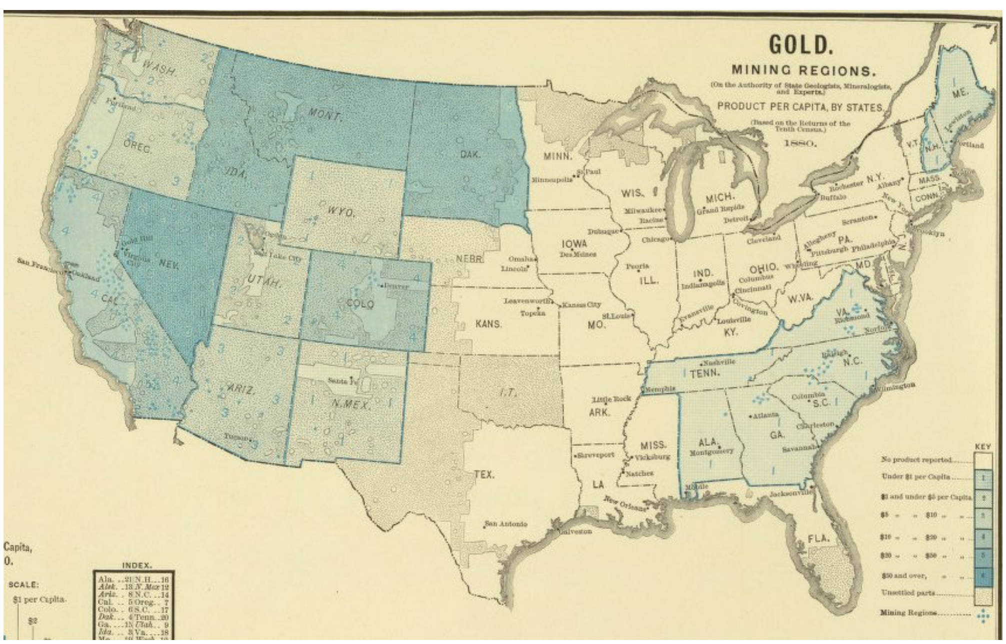


Figure 4: Gold Mines (1880 Census)

3 Additional Tables

Table 1 shows the equivalent of Table 1 in the paper, using the EA's original categorical breakdown of historical centralization instead of the binary breakdown used in the paper. It is apparent that this breakdown leads to cells that are fairly under-populated.

Table 2 shows the relationship between historical centralization and the other EA variables. This table is not so much a robustness check to the results, but rather it is of independent interest in light of the literature on cultural anthropology (Driver (1975)).

Table 3 shows the equivalent of Table 3 in the paper, but it displays the coefficients on the controls, as well as introducing the sets of controls separately.

Table 4 tests whether the effects of forced coexistence and historical centralization are more pronounced when the economic environment is more affluent. They are.

Table 5 tests how the effect of forced coexistence depends on historical centralization. In Panel A, I do not control for historical centralization. Not surprisingly, given the correlation patterns in the paper's table 1, this reduces the estimated coefficient on forced coexistence. (The reason is that forced coexistence and historical centralization are positively correlated but work in opposite directions.) In Panel B, I take a different approach, and simply drop the reservations whose tribes were historically centralized. This generates results similar to the tribe-fixed-effects specification in the paper's table 3, panel B.

Table 6 shows the results of regressing each of the five reservation-level and five tribe-level controls on the instruments. In panel A, this is done with the two instruments as the only regressors. The instruments are clearly correlated with several of the controls, in particular the tribe-level ones. Most of this is due to spatial correlation. Mining occurred where land was rugged. In particular, it occurred in the Rocky Mountains, where there was little agriculture, little sedentariness and little historical political centralization of Native American tribes. Much of this spatial variation is absorbed by simply including state fixed effects in Panel B. In Panel C, I add further reservation controls, which absorb additional within-state spatial variation. In Panel C, there is no residual correlation left between the instruments and any controls.

Table 7 studies the divergence over time in cross-sections instead of the panel approach taken in Table 6 in the paper. Table 7 in the appendix reports the cross-sectional results for different subsamples: In panel A, I use each decade's full available sample. In panel B, I report cross-sectional results by decade for only the 87 reservations for which there is data in 1970. In Panel C, I do the same for only the 159 reservations available in 1980. The key results are robust across these different ways of slicing the samples.

Table 8 reports on exactly the same regressions as Table 7 in the paper. The difference is only that it reports a more complete set of coefficients, omitted from the paper for brevity. The additional coefficients reported all make intuitive sense: historical centralization is negatively associated with all four counts of conflict and corruption while casinos are positively associated with all four. Overall press-exposure is positively correlated with all four counts.

Table 1: Distribution with Non-Binary Historical Centralization

	forced coexistence = 0		forced coexistence = 1		Total:
	No.	log(pc income)	No.	log(pc income)	
historical centralization (categorical) = 0	64	9.34 (0.41)	80	8.98 (0.27)	144
historical centralization (categorical) = 1	2	9.73 (0.41)	22	9.13 (0.29)	24
historical centralization (categorical) = 1	1	9.28 n/a	13	9.48 (0.24)	14
Total:	67		115		182

Note: The total number of reservations is 182. For each of cells, the table reports the number of reservations as well as the mean and standard deviation (in brackets) of log(per capita income).

Table 2: Historical Centralization and Other Tribal Traits

Dependent (below):	coeff.	t-stat	R^2
percent calories from agriculture (EA var 5)	1.078*	(1.727)	0.029
sedentariness (EA var 30)	0.990	(1.233)	0.041
complexity of local community (EA var 32)	0.239*	(1.698)	0.040
D(wealth distinctions) (EA var 66)	-0.279**	(-2.495)	0.030

*Note: Each row reports a regression of one of the four EA characteristics on historical centralization. The number of observations is 182 in all regressions. Cultural ecology explains historical centralization as evolving to optimally manage different geographic endowments (Driver 1975). In arid areas without large game, tribes like the Ute obtained most calories through gathering, a decreasing returns to scale activity undertaken in mobile bands, with little political organization beyond the local community. On coastlines and rivers, tribes like the Makah relied mostly on fishing, with a sedentary lifestyle and a caloric surplus that sustained a hereditary elite but typically did not give rise to political integration of local communities. Where there was large game, tribes like the Comanche would seasonally congregate in larger groups to hunt more effectively. Some degree of political coordination across tribal sub-groups was necessary for the allocation of the hunted game and to resolve conflicts between different groups. Agriculture evolved where soil was suitable for squash and corn. Examples include the North-Eastern Iroquois, the South-Eastern Cherokee, the Mandan in the Plains and the Pueblo Nations in the South-West. Agriculture tended to encourage more political coordination between neighboring communities, in particular to support against raids on stored food. This gives rise to the correlations in this table: centralized tribes obtained a higher share of their calories from agriculture, were more likely to be sedentary, had more complex societal organization at the level of the local community and were less likely to have wealth distinctions.Reported t-statistics are for standard errors clustered at the tribe level. *** p<0.01, ** p<0.05, * p<0.1.*

4 List of Reservations and Sources for Coding of Forced Coexistence

There are three encyclopedic sources of information: Tiller (1996)'s encyclopedia of reservations, the multi-volume Smithonian Handbook of Native Americans, and the University of Oklahoma's online database of treaties at `http://digital.library.okstate.edu/kappler/Vol2/Toc.htm`. The following provides a comprehensive list of all reservations in the data as well as any additional sources that were used to determine the coding of reservations' forced coexistence:

- The Twana, EA-id 71 (Chehalis Reservation, Skokomish Reservation):
  - `http://hood.hctc.com/~skok1/historyculture.htm`
- The Nomlaki, EA-id 72 (Grindstone Reservation):
- The Southern Ute, EA-id 74 (Southern Ute Reservation):
  - `http://www.southern-ute.nsn.us/`
- The Winnebago, EA-id 78 (Ho-Chunk Reservation, Winnebago Reservation):
  - `http://www.essays.cc/free_essays/a3/myv106.shtml`
- The Yurok, EA-id 172 (Yurok Reservation)
- The Yokuts, EA-id 174 (Tule River Reservation, Santa Rosa Rancheria):
  - `http://www.tachi-yokut.com/`
- The Sanpoil, EA-id 176 (Spokane Reservation)
- The Crow, EA-id 178 (Crow Reservation)
- The Omaha, EA-id 179 (Omaha Reservation)
- The Creek, EA-id 180 (Brighton Reservation, Poarch Creek Reservation, Hollywood Reservation):
  - `http://www.semtribe.com/TourismAndEnterprises/`
- The Navaho, EA-id 182 (Navajo Nation Reservation)
- The Zuni, EA-id 183 (Zuni Reservation)
- The Papago, EA-id 184 (Gila River Reservation, Tohono O'odham Reservation, Salt River Reservation, Maricopa (Ak Chin) Reservation):
  - `http://www.ak-chin.nsn.us/about.html`
- The Tolowa, EA-id 271 (Cow Creek):
  - `http://www.cowcreek.com/`
- The Miwok, EA-id 273 (Tuolumne Rancheria):
  - `http://www.mewuk.com/cultural/history.htm`

Table 3: Controlling For Sets of Regressors One-at-a-Time

Dependent:	log(per capita income)				
	(1)	(2)	(3)	(4)	(5)
forced coexistence	-0.358***	-0.334***	-0.385***	-0.274***	-0.381***
	(-3.662)	(-4.090)	(-5.359)	(-3.085)	(-3.914)
historical centralization	0.278***	0.304***	0.319***	0.259***	0.327**
	(3.887)	(4.812)	(5.477)	(3.992)	(2.747)
Surr. p.c. income		0.384*			
		(2.043)			
Surr. p.c. unempl.-rate		0.008			
		(0.085)			
Distance to major city		-0.083**			
		(-2.509)			
log(Ruggedness, Reserv.)		0.013			
		(0.512)			
log(Re-Area in sqkm)		-0.014			
		(-0.838)			
percent calories from agriculture			-0.009		
			(-0.840)		
sedentariness			-0.022		
			(-0.901)		
complexity of local community			0.020		
			(0.535)		
D(wealth distinctions)			0.021		
			(0.414)		
log(Population)				-0.007	
				(-0.029)	
log(Population-Squared)				-0.005	
				(-0.330)	
Pop-Share Adult (0-100)				0.012***	
				(3.425)	
D(Casino)				0.196**	
				(2.630)	
R^2	0.212	0.360	0.302	0.328	0.426

*Note: There are 182 observations in all regressions. Controls are introduced in the same way as in Table 3 except that sets of controls are included one-at-a-time instead of cumulatively. Reported t-statistics are for standard errors that are clustered two-way at tribe and state level. *** p<0.01, ** p<0.05, * p<0.1.*

Table 4: Interactions with the Economic Environment

Dependent:	log(per capita income)		
	(1)	(2)	(3)
forced coexistence	-0.302***	6.808**	-0.679***
	(-4.913)	(2.195)	(-2.908)
historical centralization	0.313***	-10.199*	0.655**
	(4.875)	(-1.798)	(2.573)
forced coexistence * Surr. p.c. income		-0.724**	
		(-2.267)	
historical centralization * Surr. p.c. income		1.077*	
		(1.858)	
forced coexistence * Distance to major city			0.107*
			(1.793)
historical centralization * Distance to major city			-0.092
			(-1.357)
Surr. p.c. income	0.462**	0.765**	0.504***
	(2.676)	(2.463)	(2.900)
Distance to major city	-0.085***	-0.097***	-0.138**
	(-3.347)	(-4.395)	(-2.699)
R^2	0.457	0.480	0.475
reservation-controls	Y	Y	Y
tribe controls	Y	Y	Y
additional reservation controls	Y	Y	Y

*Note: This table tests whether the internal political factors of reservations matter more if there is potentially more to be gained by the economic environment. Column 1 is column 4 of Table 3 in the paper. Columns 2 and 3 test interaction terms between forced coexistence (and historical centralization) and the two important proxies for the economic environment. There are 182 observations in all regressions. Reported t-statistics are for standard errors that are clustered two-way at tribe and state level. *** p<0.01, ** p<0.05, * p<0.1.*

Table 5: Sensitivity to Historical Centralization

Dependent:	log(per capita income)				
	(1)	(2)	(3)	(4)	(5)
	PANEL A: not controlling for historical centralization				
forced coexistence	-0.284**	-0.263***	-0.275***	-0.213**	-0.255***
	(-2.541)	(-2.809)	(-3.805)	(-2.594)	(-3.855)
N	182	182	182	182	182
R^2	0.132	0.273	0.298	0.385	0.580
	PANEL B: drop reservations with historical centralization = 1				
forced coexistence	-0.362***	-0.342***	-0.402***	-0.325***	-0.305***
	(-3.374)	(-3.860)	(-9.609)	(-6.183)	(-5.329)
N	144	144	144	144	144
R^2	0.216	0.374	0.440	0.516	0.577
reservation-controls		Y	Y	Y	Y
tribe controls			Y	Y	Y
additional reservation controls				Y	Y
state fixed effects					Y

*Note: Panel A re-runs the same specification as the paper's table 3, except without controlling for historical centralization in any specifications. Panel B re-runs the same table for only those reservations whose tribe's historical centralization was 0. As in the paper's table 3, reservation-controls are surrounding-county. p.c. income and unempl.-rate, distance to the nearest major city, log(ruggedness) and log(res-area). Tribe-characteristics are subsistence patterns, sedentariness, wealth distinctions and social complexity of local communities. Additional reservation-controls in column 4 are log(population), log(population-squared), adult population-share and D(casino). T-statistics reported for two-way clustered standard errors, at tribe and state level. Column 3 of Panel B is the same as column 2 because EA characteristics are not identified with tribe fixed effects. *** p<0.01, ** p<0.05, * p<0.1.*

Table 6: Instruments's Balancedness to other Controls

	Panel A					Panel B					Panel C				
	historical gold-mining		historical silver-mining			historical gold-mining		historical silver-mining			historical gold-mining		historical silver-mining		
Dependent (below):	coeff.	t-stat	coeff.	t-stat	R^2	coeff.	t-stat	coeff.	t-stat	R^2	coeff.	t-stat	coeff.	t-stat	R^2
Surr. p.c. income	-0.008	(-0.950)	0.002	(0.442)	0.012	-0.013	(-1.133)	0.006	(1.030)	0.346	-0.004	(-0.984)	0.004	(0.756)	0.734
Surr. p.c. unempl.-rate	0.019	(1.597)	0.000	(0.052)	0.030	0.015	(0.947)	-0.006	(-0.633)	0.406	0.003	(0.445)	0.004	(0.519)	0.759
Distance to major city	-0.007	(-0.190)	-0.006	(-0.109)	0.000	0.018	(0.541)	-0.021	(-0.368)	0.276	0.000	(0.000)	0.000	(0.002)	1.000
log(Ruggedness, Reserv.)	0.054	(1.427)	0.060**	(2.058)	0.025	0.017	(0.349)	0.012	(0.454)	0.488	0.031	(0.646)	-0.009	(-0.323)	0.544
log(Re-Area in sqkm)	-0.154	(-1.423)	0.085	(0.607)	0.014	-0.000	(-0.001)	-0.028	(-0.314)	0.477	-0.025	(-0.274)	0.037	(0.349)	0.613
historical centralization	-0.027**	(-2.380)	-0.021**	(-2.370)	0.046	-0.003	(-1.189)	-0.006	(-0.770)	0.743	-0.001	(-0.373)	-0.004	(-0.509)	0.768
percent calories from agriculture	-0.237***	(-2.865)	-0.186***	(-3.414)	0.087	-0.013	(-0.535)	-0.076*	(-1.694)	0.756	-0.057	(-1.215)	-0.036	(-0.975)	0.871
sedentariness	-0.038	(-0.529)	-0.159***	(-3.164)	0.041	0.057	(0.912)	-0.072**	(-2.028)	0.632	0.058	(0.987)	-0.016	(-0.588)	0.822
complexity of local community	-0.038**	(-2.150)	-0.054***	(-3.222)	0.120	-0.015	(-0.637)	-0.024	(-1.312)	0.506	-0.015	(-0.769)	-0.023	(-1.389)	0.611
D(wealth distinctions)	0.011	(0.482)	-0.032**	(-2.293)	0.012	0.008	(0.379)	-0.010	(-0.742)	0.574	0.002	(0.134)	0.002	(0.182)	0.670

*Note: This table reports results or relating the excludable instruments to the other, non-excludable, regressors. The 10 rows consider each of the reservation-level controls and then each of the tribe-level controls in turn. Each row is one regression, reporting the coefficients on the two instruments. In Panel A, the instruments are the only regressors. Without further conditioning, the insturments appear quite unbalanced, particularly in the tribe controls. This primarily reflects spatial variation in mining. When state fixed effects are included in Panel B, most of the correlations between the instruments and other controls disappears. When the full set of controls is included in Panel C to further soak up within-state regional variationin, the correlations disappear altogether. The number of observations is 180 in all specifications in this table because I drop two outliers. Reported t-statistics are for standard errors that are clustered two-way at tribe and state level. *** p<0.01, ** p<0.05, * p<0.1.*

Table 7: Balanced Panel Data Breakdowns

Dependent:	log(per capita income)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
year:	1970	1980	1990	2000	1970	1980	1990	2000	1970	1980	1990	2000
PANEL A:												
forced coexistence	-0.038	-0.071	-0.089	-0.358***	0.010	-0.066	-0.054	-0.334***	-0.010	-0.069	-0.056	-0.364***
	(-0.437)	(-1.573)	(-1.521)	(-3.662)	(0.134)	(-0.849)	(-1.048)	(-4.090)	(-0.207)	(-0.702)	(-0.959)	(-7.192)
Observations	87	159	175	182	87	159	175	182	87	159	175	182
R^2	0.032	0.032	0.022	0.212	0.207	0.098	0.286	0.360	0.312	0.108	0.293	0.393
PANEL B:												
forced coexistence		-0.027	-0.149	-0.220***		-0.009	-0.078	-0.117*		-0.049	-0.090	-0.159**
		(-0.332)	(-1.441)	(-2.947)		(-0.069)	(-1.017)	(-1.821)		(-0.326)	(-1.492)	(-2.369)
Observations		87	87	87		87	87	87		87	87	87
R^2		0.061	0.105	0.248		0.208	0.378	0.482		0.245	0.469	0.524
PANEL C:												
forced coexistence			-0.123*	-0.349***			-0.076	-0.299***			-0.074	-0.330***
			(-1.747)	(-3.522)			(-1.326)	(-3.588)			(-1.065)	(-7.049)
Observations			159	159			159	159			159	159
R^2			0.046	0.211			0.328	0.366			0.335	0.416

*Note: Columns 1-4 regress log(per capita income) in forced coexistence and historical centralization, column 5-8 add the five reservation controls from Table 3 in the paper, columns 9-12 add the 4 tribe controls. Each set of four columns reports results for 1970, 1980, 1990 and 2000 with the data size increasing over time. Panel A reports results for each decade's full data-sample. Columns 4, 8 and 12 in Panel A are the same regression as columns 1, 2 and 3 in Table 3 in the paper. Panel B reports results for the same 87 reservations fir which data is available in 1970. Panel C does the same for the same 159 for which data is available in 1980. Reported t-statistics are for standard errors that are clustered two-way at tribe and state level. *** p<0.01, ** p<0.05, * p<0.1.*

Table 8: Full Set of Results on Newspaper-Count Data

	Count: Conflict AND Government		Count: Conflict NOT Government		Count: Corruption AND Government		Count: Corruption NOT Government	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
forced coexistence	1.101**		0.451		0.117		-0.014	
	(2.247)		(1.435)		(0.553)		(-0.110)	
D(1990)*forced coexistence		0.860*		0.512		0.043		-0.024
		(1.810)		(1.261)		(0.160)		(-0.144)
D(2000)*forced coexistence		1.139**		0.471		0.185		0.012
		(2.262)		(1.445)		(0.905)		(0.086)
D(2000)	-0.629	-2.598**	-0.014	-0.844	-0.014	-0.728	0.079	0.555
	(-1.080)	(-2.111)	(-0.025)	(-0.850)	(-0.033)	(-1.300)	(0.889)	(1.286)
log(All-Count)	0.831***	0.812***	0.940***	0.935***	0.682***	0.683***	0.885***	0.895***
	(10.532)	(10.638)	(17.032)	(17.247)	(21.195)	(21.054)	(32.498)	(32.337)
D(2000)*casino	0.518	0.554	0.616**	0.660**	-0.080	0.065	0.196*	0.250**
	(1.620)	(1.580)	(2.446)	(2.314)	(-0.394)	(0.333)	(1.914)	(2.240)
log(population)	1.888*	1.680*	0.643	0.739	0.986*	0.966*	-0.160	-0.183
	(1.848)	(1.694)	(0.736)	(0.818)	(1.753)	(1.753)	(-0.636)	(-0.759)
log(population-squared)	-0.117*	-0.102	-0.041	-0.048	-0.050	-0.049	0.010	0.011
	(-1.734)	(-1.570)	(-0.733)	(-0.828)	(-1.408)	(-1.421)	(0.611)	(0.681)
log(Surr. p.c. income)	2.117**	1.940**	0.619	0.626	0.391	0.407		
	(2.470)	(2.488)	(0.680)	(0.706)	(0.927)	(1.012)		
log(Surr. p.c. unempl.-rate)	0.662	0.642	0.545	0.660	0.308	0.360*		
	(1.519)	(1.638)	(1.120)	(1.403)	(1.641)	(1.811)		
historical centralization	-2.578***		-0.759**		-0.285**		-0.699***	
	(-3.889)		(-2.123)		(-1.969)		(-4.958)	
v5	-0.190		-0.040		-0.001		-0.086***	
	(-1.027)		(-0.399)		(-0.019)		(-2.832)	
v30	0.073		-0.016		0.019		0.230***	
	(0.351)		(-0.154)		(0.355)		(5.581)	
v32	0.581*		0.072		-0.095		0.127	
	(1.744)		(0.439)		(-1.125)		(1.642)	
v66	-1.470*		-0.972***		0.098		-0.383*	
	(-1.799)		(-2.684)		(0.934)		(-1.950)	
D(1990)*historical centralization		-1.454***		-0.752		-0.087		-0.573***
		(-2.701)		(-1.637)		(-0.483)		(-2.804)
D(2000)*historical centralization		-2.899***		-0.751**		-0.479***		-0.817***
		(-3.805)		(-2.024)		(-2.917)		(-5.866)
D(1990)*v5		-0.094		-0.024		0.021		-0.005
		(-0.656)		(-0.143)		(0.300)		(-0.098)
D(2000)*v5		-0.263		-0.055		-0.018		-0.122***
		(-1.223)		(-0.492)		(-0.427)		(-3.381)
D(1990)*v30		0.069		-0.081		-0.066		0.111
		(0.412)		(-0.479)		(-0.683)		(1.644)
D(2000)*v30		0.141		0.019		0.084		0.289***
		(0.588)		(0.157)		(1.522)		(6.088)
D(1990)*v32		-0.669**		-0.450*		-0.138		0.242*
		(-1.982)		(-1.799)		(-1.424)		(1.794)
D(2000)*v32		0.919**		0.202		-0.058		0.100
		(2.284)		(1.085)		(-0.602)		(1.209)
D(1990)*v66		-0.271		-0.300		0.049		-0.077
		(-0.554)		(-0.566)		(0.301)		(-0.248)
D(2000)*v66		-1.835*		-1.185***		0.082		-0.504**
		(-1.743)		(-2.937)		(0.585)		(-2.454)
Constant	-32.014***	-28.052***	-12.994	-12.918	-9.858**	-9.632**	-1.935**	-2.286***
	(-2.978)	(-2.899)	(-1.208)	(-1.232)	(-2.082)	(-2.091)	(-2.207)	(-2.647)
Pseudo R^2	0.654	0.668	0.743	0.747	0.748	0.752	0.841	0.843

- The Cheyenne, EA-id 275 (Northern Cheyenne Reservation)
- The Cherokee, EA-id 278 (Eastern Cherokee Reservation)
- The Delaware, EA-id 279 (Stockbridge-Munsee Community):
  - http://mohican-nsn.gov/Departments/Library-Museum/Mohican_History/index.htm
- The Diegueno, EA-id 339 (Mesa Grande, Viejas Reservation, Campo Reservation, Barona Reservation, San Pasqual Reservation, Santa Ysabel Reservation):
  - http://www.baronatribe.org/
  - http://www.campo-nsn.gov/
  - http://www.viejasbandofkumeyaay.org/
- The Washo, EA-id 340, (Dresslerville Colony, Susanville Rancheria, Woodfords Community, Stewart Community, Carson Colony, Reno-Sparks Colony):
  - http://www.rsic.org/
  - http://sir-nsn.gov/history.html
  - http://www.washoetribe.us/documents/Washoe_Tribe_History.pdf
- The Fox-Kickapoo, EA-id 383, (Kickapoo (KS) Reservation, Sac and Fox/Meskwaki Reservation)
- The Jemez, EA-id 387, (Jemez Pueblo):
- The Isleta, EA-id 434, (Picuris Pueblo, Taos Pueblo Isleta Pueblo)
- The Tewa, EA-id 435, (Pojoaque Pueblo, San Ildefonso Pueblo, Nambe Pueblo, San Juan Pueblo, Santa Clara Pueblo, Tesuque Pueblo)
- The Acoma, EA-id 437, (Acoma Pueblo, Cochiti Pueblo, Laguna Pueblo, San Felipe Pueblo, Santa Ana Pueblo, Santo Domingo Pueblo, Zia Pueblo)
- The Apache, EA-id 441, (Fort Apache Reservation, Jicarilla Apache Reservation, Mescalero Reservation, San Carlos Reservation, Tonto Apache Reservation)
  - Cornell and Gil-Swedberg (1995)
  - Cole (1988)
- The Hopi, EA-id 442, (Hopi Reservation)
- The Cocopa, EA-id 443, (Cocopah Reservation):
  - http://www.cocopah.com/
- The Mohave, EA-id 445, (Colorado River Reservation, Fort Mojave Reservation):
  - http://www.fortmojave.com/
- The Yuma, EA-id 446, (Fort Yuma Reservation)

- The Squamish, EA-id 475, (Squaxin Island Reservation, Tulalip Reservation, Port Madison Reservation, Upper Skagit Reservation, Swinomish Reservation, Muckleshoot Reservation, Nooksack Reservation):
  - http://www.goia.wa.gov/Tribal-Information/Tribes/uperskagit.htm
- The Lummi, EA-id 477, (Lummi Reservation)
- The Klallam, EA-id 478, (Lower Elwha Reservation, Port Gamble Reservation, Jamestown S'Klallam):
  - http://www.jamestowntribe.org/jstweb_2007/history/hist_jst.htm
  - http://www.u-s-history.com/pages/h1567.html
  - http://www.pgst.nsn.us/land-and-people-and-lifestyle/history
- The Puyallup, EA-id 479, (Puyallup Reservation, Nisqually Reservation)
  - http://digital.library.okstate.edu/kappler/Vol2/treaties/nis0661.htm
- The Quileute, EA-id 480, (Quileute Reservation)
- The Tillamook, EA-id 482, (Siletz)
- The Chippewa, EA-id 499, (Bad River Reservation, Bay Mills Reservation, Bois Forte Reservation, Fond du Lac Reservation, Grand Portage Reservation, Isabella Reservation, Lac Courte Oreilles Reservation, Lac du Flambeau Reservation, Lac Vieux Desert Reservation, L'Anse Reservation, Leech Lake Reservation, Mille Lacs Reservation, Minnesota Chippewa Trust Land, Red Cliff Reservation, Red Lake Reservation, Rocky Boy's Reservation, St. Croix Reservation, Sandy Lake Reservation, Sault Ste. Marie Reservation, Sokaogon Chippewa Community, Turtle Mountain Reservation, White Earth Reservation):
  - Bokern (1987), Meyer (1990)
  - http://digital.library.okstate.edu/kappler/Vol2/Toc.htm
  - http://www.boisforte.com/history.htm
  - http://en.wikipedia.org/wiki/Lake_Superior_Chippewa
  - http://www.lvdtribal.com/
- The Ottawa, EA-id 503, (Little River, Little Traverse Bay):
  - https://www.lrboi-nsn.gov/
  - http://www.ltbbodawa-nsn.gov/TribalHistory.html
- The Micmac, EA-id 504, (Penobscot Reservation, Pleasant Point Reservation, Indian Township Reservation):
  - http://www.passamaquoddy.com/
- The Makah, EA-id 507, (Makah Reservation)
  - Colson (1977)

- The Karok, EA-id 517, (Karuk Reservation):
  - http://www.karuk.net/
- The Hupa, EA-id 518, (Hoopa Valley Reservation, Laytonville Rancheria):
  - http://www.hoopa-nsn.gov/culture/villages.htm
  - http://www.cahto.org/about.html
- The Achomawi, EA-id 525, (Pit River)
  - Tiller (1996)
- The Pomo, EA-id 534, (Big Valley Rancheria, Manchester-Point Arena Rancheria):
  - http://www.big-valley.net/
- The Cahuilla, EA-id 546, (Torres-Martinez Reservation, Morongo Reservation, Agua Caliente Reservation):
  - http://www.aguacaliente.org/HistoryCulture/tabid/57/Default.aspx
  - http://www.morongonation.org/
  - http://www.torresmartinez.org/
- The Luiseno, EA-id 548, (Soboba Reservation, La Jolla Reservation, Pala Reservation, Pechanga Reservation, Rincon Reservation)
- The Kalispel, EA-id 555, (Kalispel Reservation)
  - Fahey (1986)
  - http://www.kalispeltribe.com/history/
- The Coeur d'Alene , EA-id 556, (Coeur d'Alene Reservation):
  - http://www.cdatribe-nsn.gov/TribalGov/Ancestral.aspx
- The Nez Perce, EA-id 562, (Nez Perce Reservation):
  - http://www.colvilletribes.com/past.htm
- The Kidutokad, EA-id 566, (Fort Bidwell Reservation, Fort McDermitt Reservation):
  - http://www.sierraserviceproject.org/SiteInformation_files/fortmcdermitt.history.pdf
- The Wadatkuht, EA-id 568, (Burns Paiute Colony):
  - http://www.burnspaiute-nsn.gov/index.php?option=com_content&view=category&id=37&Itemid=57
- The Kuyuidoka, EA-id 569, (Pyramid Lake Reservation, Walker River Reservation, Yerington Colony):
  - http://plpt.nsn.us/plpt.html

  - http://www.wrpt.us/
  - http://www.ypt-nsn.gov/

- The Toedokado, EA-id 570, (Fallon Reservation):
  - http://www.fpst.org/
- The Mono, EA-id 572, (Big Pine Reservation, Bishop Reservation):
  - http://www.bishoppaiutetribe.com/history.html
  - http://lppsr.org/
- The Elko Shohone, EA-id 584, (Battle Mountain Reservation, Elko Colony, Duck Valley Reservation, South Fork Reservation):
  - http://www.temoaktribe.com/elko.shtml
  - http://www.shopaitribes.org/spt-15/index.php?option=com_content&view=article&id=46&Itemid=82
- The Moapa, EA-id 593, (Moapa River Reservation)
- The Paiute, EA-id 594, (Paiute Reservation):
  - http://en.wikipedia.org/wiki/Paiute_Indian_Tribe_of_Utah
- The Chemehuevi, EA-id 596, (Chemehuevi Reservation):
  - http://www.chemehuevi.net/home.php
- The Ute, EA-id 600, (Ute Mountain Reservation, Uintah and Ouray Reservation)
  - http://www.utah.com/tribes/ute_main.htm
- The Moache, EA-id 602, (Cold Springs)
- The Bannock, EA-id 605, (Fort Hall Reservation):
  - Ruby and Brown (1986)
  - http://digital.library.okstate.edu/kappler/Vol2/treaties/sho1020.htm
- The Windriver, EA-id 606, (Wind River Reservation)
- The Walapai, EA-id 607, (Hualapai Reservation, Havasupai Reservation)
- The Yavapai, EA-id 608, (Yavapai-Apache Nation Reservation, Yavapai-Prescott Reservation, Fort McDowell Reservation):
  - http://yavapai-apache.org/history.html
- The Arapahoe, EA-id 616, (Wind River Reservation)
- The Blackfoot, EA-id 619, (Blackfeet Reservation)

- The Sioux, EA-id 627, (Cheyenne River Reservation, Crow Creek Reservation, Flandreau Reservation, Fort Peck Reservation, Lake Traverse Reservation, Lower Brule Reservation, Lower Sioux Reservation, Pine Ridge Reservation, Prairie Island Indian Community, Rosebud Reservation, Santee Reservation, Spirit Lake Reservation, Standing Rock Reservation, Upper Sioux Reservation, Yankton Reservation)
- The Potawatomi, EA-id 660, (Hannahville Community, Forest County Potawatomi Community, Prairie Band Potawatomi):
  - `http://www.fcpotawatomi.com/content/view/132/80/`
- The Menominee, EA-id 661, (Menominee Reservation)
- The Catawba, EA-id 662, (Catawba Reservation):
  - `http://www.catawbaindiannation.com/`
- The Iroquois, EA-id 663, (Allegany Reservation, Cattaraugus Reservation, Oneida (NY) Reservation, Oneida (WI) Reservation, Onondaga Reservation, St. Regis Mohawk Reservation, Tonawanda Reservation, Tuscarora Reservation)
- The Choctaw, EA-id 1159, (Mississippi Choctaw Reservation)
- The Choctaw, EA-id 1224, (Chitimacha Reservation)

5 Sample of Codings of Forced Centralization for Chippewa and Sioux Tribes

- Bad River Reservation is coded with forced centralization of 0 because it is home to only the Pointe Band of the Chippewa
- Bay Mills Reservation is coded with forced centralization of 0 because it is home to only Bay Mills band of the Sault Ste. Marie Chippewa
- Bois Forte Reservation is coded with forced centralization of 0 because it is home to only the Bois Forte Band of Lake Superior Chippewa
- Fond du Lac Reservation is coded with forced centralization of 0 because it is home to only the Fond Du Lac Band of Lake Superior Chippewa
- Grand Portage Reservation is coded with forced centralization of 0 because it is home to only the Grand Portage Band
- Lac Courte Oreilles Reservation is coded with forced centralization of 0 because it is home to only the Lac Court Oreilles Band of Lake Superior Chippewa
- Lac du Flambeau Reservation is coded with forced centralization of 0 because it is home to only the Lac du Flambeau Band of Lake Superior Chippewa
- Lac Vieux Desert Reservation is coded with forced centralization of 0 because it is home to only the Lac Vieux Desert Band of Lake Superior Chippewa
- L'Anse Reservation is coded with forced centralization of 0 because it is home to only the LAnse Band
- Leech Lake Reservation is coded with forced centralization of 1 because Leech Lake Reservation was formed from the Leech Lake, Cass Lake and Lake Winnibigoshish Pillager Bands, the removable Lake Superior Band of Chippewa Indians and the White Oak Point Mississippi Chippewa
- Mille Lacs Reservation is coded with forced centralization of 1 because it combined several Mississippi Chippewa Bands
- Red Cliff Reservation is coded with forced centralization of 0 because it is home to only the Red Cliff Band of Lake Superior Chippewa
- Red Lake Reservation is coded with forced centralization of 1 because it combined Bands of the Lac du Bois and Pembina Chippewa
- Rocky Boy's Reservation is coded with forced centralization of 1 because it combined Asiniiwin's Band and Little Bear Band
- St. Croix Reservation is coded with forced centralization of 0 because it is home to only the St. Croix Band
- Sault Ste. Marie Reservation is coded with forced centralization of 1 because it combined Sault and Mackinac Bands

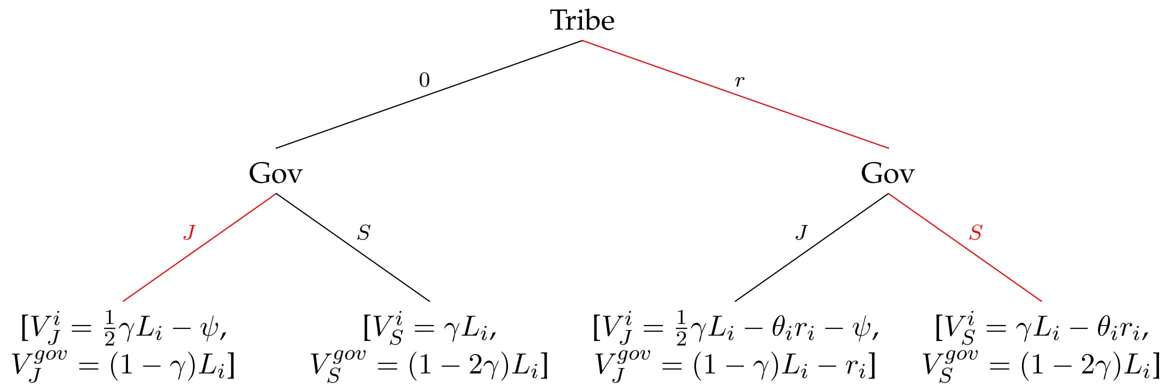
- Sokaogon Chippewa Community is coded with forced centralization of 0 because it is home to only the Mole Lake Band
- Turtle Mountain Reservation is coded with forced centralization of 0 because it is home to only the Turtle Mountain Band of the Pembina Chippewa
- White Earth Reservation is coded with forced centralization of 1 because it combined several Mississippi Chippewa Bands

6 LATE

The key concern when testing for an effect of forced integration on economic outcomes is that tribes or bands self-selected into more integrated reservations. The following very simple model of the process of reservation formation highlights the nature of this selection bias. The model is highly stylized but captures the main trade-offs in the formation of reservations that are salient in the historical record. On the one hand, the government strove to free up more land for settlers and to reduce administrative costs by reducing the number of reservations per tribe (Fahey (1986)). On the other hand, integrating previously autonomous bands was associated with increased resistance by these bands because they wanted to retain their independence and remain on their ancestral homelands. I model the process of reservation formation as a simple two-stage game in which two bands making up a tribe i first determine the level of resistance they put up against being integrated on a joint reservation. Then the government makes a binary decision on whether to create separate reservations for each band or one integrated reservation for the tribe as a whole. In the model, there is no conflict in equilibrium, but band strength matters through the off-equilibrium threat of violence. Let the total value of the whole tribe's land be L_i and let each reservation take up size γL_i.[1] Bands jointly choose resistance r_i against being moved onto one integrated reservation. Resistance to being put on separate reservations is normalized to 0. The government's payoff from forming two separate reservations is $V_S^{gov} = (1-2\gamma)L_i$ and the payoff from forming one joint reservation is $V_J^{gov} = (1-\gamma)L_i - r_i$. Forming one integrated reservation frees up more land but is also associated with increased resistance. The threshold amount of resistance at which $V_J^{gov} = V_S^{gov}$ is $\hat{r}_i = \gamma L_i$. If resistance is weakly higher than $\hat{\mathbf{r}}_i$, the government optimally grants two separate reservations to the bands. When the value of tribal land is higher, the government is willing to overcome more resistance. If bands resist, they obtain separate reservations if the resistance they put up is at least $\hat{r}_i$. Resistance below $\hat{r}_i$ is futile. Tribes therefore optimally either do not resist or put up resistance $\hat{r}_i$. Tribes trade off resistance costs θ_i against a cost ψ of sharing a joint reservation.[2] Cross-tribal variation in the strength of resistance is conceptualized as variation in θ_i. Stronger tribes have a lower θ_i. Each band's population is normalized to 1 so that the average tribal member's payoff is $V_S^i = \gamma L_i - \theta_i r_i$ when obtaining separate reservations and $V_J^i = \frac{1}{2}\gamma L_i - \theta_i r_i - \psi$ when obtaining an integrated reservation. This is because separate reservations are associated with more land and no cost of having to cooperate with other bands but there is a resistance cost to achieving this. The payoffs are shown in the tree-diagram below where the tribe chooses a resistance level from $\{0, r = \hat{r}_i\}$ and the government chooses creates either one integrated or two separate reservations, $\{J, S\}$. Payoffs to the tribe are listed first and payoffs to the government second at the end of each branch of the game tree.

[1] One integrated reservation is therefore half the size of 2 separate reservations which captures the returns to more centralized reservations to the government. This is isomorphic to introducing a fixed administrative cost to the government for each reservation.

[2] This cost reflects the fact that tribal members from separate bands do not cooperate as well as tribal members from the same band.



Bands optimally do not resist (and consequently receive a joint reservation) if $V_J^i(r_i = 0) = \frac{1}{2}\gamma L_i - \psi \geq V_S^i(r_i = \hat{r}_i) = \gamma L_i - \theta_i r_i$. Substituting $\hat{r}_i = \gamma L_i$, this is equivalent to $\frac{1}{2}\gamma L_i - \psi \geq (1-\theta_i)\gamma L_i$. Letting $\mathbf{FC}_i$ denote forced coexistence on a joint reservation, this implies that tribes select into $\mathbf{FC}_i$ according to the following selection equation:

$$\mathbf{FC}_i = \begin{cases} 1 & \text{if} \quad (\theta_i - \frac{1}{2})\gamma L_i > \psi \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

Forced coexistence was more likely if groups were weaker or if they occupied more valuable land, consistent with the historical record. This selection could be at the tribal level (as in the model) or at the band level. Selection on observable characteristics of tribal territories L_i can be controlled for, but selection on unobservable θ_i will bias the OLS estimate of the effect of forced integration if θ_i has an independent effect on long run reservation outcomes. In the model, θ_i is military strength but it also proxies for other important characteristics that are salient in the historical record on reservation formation. Internal group coherence, the willingness to adopt English language and U.S. legal custom and technologies all mattered to the process of reservation formation and may plausibly also have impacted long run economic outcomes on reservations. An IV strategy can be based around an instrument that shifts this selection equation and that is exogenous to tribal characteristics and has no direct effect on long run outcomes. Characteristics of tribal territories that were orthogonal to tribe and band characteristics at the time of formation but that raised the value of their land to the U.S. government satisfy this criterion if they did not impact long run economic outcomes on reservations other than through forced integration.[3]

I use a continuous measure of $\mathbf{Z}_i$ in the empirical work but the IV strategy also delivers robust and qualitatively similar results with mining-dummies. In this appendix, I treat $\mathbf{Z}_i$ as a dummy variable because it simplifies the discussion of biases and comparisons of OLS and IV in the language of treatment evaluation using the Holland-Rubin notation for the evaluation of treatment effects.[4] The observed difference in outcomes conditional on treatment is $E[Y_i|\mathbf{FI}_i = 1] - E[Y_i|\mathbf{FC}_i = 0]$ and we are interested in estimating $E[Y_{1i} - Y_{0i}]$, the average treatment effect

[3] Adding a dimension of land values $\mathbf{Z}_i$ to the government payoff functions but not the tribal payoffs, the threshold level of resistance is then given by solving $\tilde{V}_S^{gov} = (1-2\gamma)(L_i + \mathbf{Z}_i) = (1-\gamma)(L_i + \mathbf{Z}_i) - r_i = \tilde{V}_J^{gov}$ for $\tilde{r}_i = \gamma(L_i + \mathbf{Z}_i)$ and the selection equation becomes

$$\mathbf{FC}_i = \begin{cases} 1 & \text{if} \quad (\theta_i - \frac{1}{2})\gamma L_i + \theta_i\gamma\mathbf{Z}_i > \psi \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

[4] See Deaton (2009) and Angrist and Pischke (2008) for a discussion of the Holland-Rubin framework.

(ATE) of $\mathbf{FI}_i$.[5]

The observed difference in outcomes is equal to the treatment effect on the treated (ToT), $E[Y_{1i} - Y_{0i}|\mathbf{FI}_i = 1]$, plus a selection term.

$$E[Y_i|\mathbf{FC}_i = 1] - E[Y_i|\mathbf{FC}_i = 0] = E[Y_{1i} - Y_{0i}|\mathbf{FC}_i = 1] + (E[Y_{0i}|\mathbf{FC}_i = 1] - E[Y_{0i}|\mathbf{FC}_i = 0]) \quad (3)$$

This observed difference is an estimator of the ATE but it is biased if either the treatment effect is heterogenous (so that the ToT is different from the ATE) or if the selection term is non-zero. In the following I consider two cases: First, selection on unobservable group strength θ_i only and, secondly, a heterogenous treatment effect ψ_i without selection. In the first case, I allow unobserved group strength (lower θ_i) to have a positive long run effect reservation outcomes. In the second case, I allow friendly ties in the past (a smaller ψ_i) to reduce the long run cost of forced integration on reservations. The simplest way to operationalize this is to let θ_i enter the error term directly as a negative and to let ψ_i be the coefficient on forced integration.

In the first case, unobservable group strength (θ_i) varies across tribal groups but ψ does not. Then the observed difference between reservations with and without forced integration equals the ToT, which is identical to the ATE, plus a negative selection term:

$$E[Y_i|\mathbf{FC}_i = 1] - E[Y_i|\mathbf{FC}_i = 0] = \mathbf{ToT} - (E[\theta_i|\theta_i \geq \frac{1}{2} + \frac{\psi}{\gamma L}] - E[\theta_i|\theta_i < \frac{1}{2} + \frac{\psi}{\gamma L}]) \quad (4)$$

In the second case there is selection only on unobservable variation in the heterogenous effect of treatment with forced integration, ψ_i. In this case, the observed difference in outcomes equals the ToT but the ToT is not the ATE because treated groups are selectively less negatively affected by the treatment than non-treated groups would be:

$$E[Y_i|\mathbf{FC}_i = 1] - E[Y_i|\mathbf{FC}_i = 0] = E[\psi_i|\psi_i < (\theta - \frac{1}{2})\gamma L] \quad (5)$$

IV gives consistent estimates of the causal effect in both cases but the interpretation varies. An IV based on mining-dummies identifies the causal effect of those groups that would have received separate reservations had it not been for mining. In the first case, when the treatment effect is homogenous, this population is not different from the rest so that IV gives a consistent estimate of the ToT and the ATE. In the second case, when the treatment effect is heterogenous, IV gives a consistent estimate of the local average treatment effect (LATE) on those groups for which the treatment effect falls in the range $(\theta - \frac{1}{2})\gamma L + \theta\gamma\mathbf{Z}_i > \psi_i > (\theta - \frac{1}{2})\gamma L$ (Angrist and Pischke (2008, ch. 4)).

In the first case, IV estimates should be smaller in absolute terms than OLS estimates. In the second case, they should be larger because there was no bias in the OLS to begin with. When there is both selection and heterogenous treatment effects, IV can be both smaller or larger than OLS.

[5] Where Y_{1i} and Y_{0i} are defined as:

$$Y_i = \begin{cases} Y_{1i} & \text{if} \quad \mathbf{FC}_i = 1 \\ Y_{0i} & \text{if} \quad \mathbf{FC}_i = 0 \end{cases}$$

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