Supplementary Materials for

When Distance Mattered: Geographic Scale and the Development of European Representative Assemblies

David Stasavage

New York University

david.stasavage@nyu.edu

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1 Introduction

This appendix provides information on additional analyses referred to in the main body of the paper. It also includes a list of all references used to compile the data on representative assemblies. The format of the appendix follows the order of appearance of material in the main paper. Section 2 of the appendix develops my core argument using an explicit game theoretic model. As discussed in the main body of the paper, the result of the model is sufficiently intuitive that an informal presentation probably suffices to convey the logic of the argument and the assumptions upon which it is based. However, for those seeking a more extended presentation, a simple formalization of the argument is presented here. In Section 3 of the appendix I present additional results involving the expenditure prerogative estimation, followed in Section 4 by a further set of results on generalized estimation of expenditure prerogatives, Section 5 then reports further estimates of meeting frequency, and Section 6 reports further results using French provincial data. Section 7 reports full results of the tests used to consider the issue of reverse causality. Finally, the bibliography to this appendix lists all individual sources used to compile the data set on representative assemblies.

2 A Formal Model of Scale and Representation

In this section I construct a very simple game theoretic model to specify more explicitly how geographic scale may have determined the type of assembly that would form. I draw upon a basic insight from the literature on corporate finance - when investors are uncertain about their preferences over future alternative actions, and they also know that these preferences may not coincide with the preferences of those who manage a firm, then managers of the firm may need to cede a control right over future decisions in order to attract finance.[1] The model makes explicit one set of assumptions under which the core prediction of my paper would hold, but in this exercise in formalization I am certainly not implying that this is the only set of assumptions under which we could derive a prediction that geographic scale constrains

[1] For a canonical model see Aghion and Bolton (1992) and Tirole (2006 ch.10) for a textbook illustration.

possibilities for maintaining an active form of political representation.

Consider a game with two players the first of whom is an executive (either a monarch or ruling magistrate) and the second of whom is a representative citizen (better described as a member of an elite group). The executive seeks to finance a military project of exogenous and fixed cost g. The level of g would be determined by factors such as the state of military technology (to the extent that this is exogenous) and the size of armies fielded by neighboring states. If the citizen agrees to finance the project, with exogenous probability p the project succeeds, resulting in a payoff of 1 for the executive and with probability $1-p$ it fails resulting in a payoff of 0. Success here would represent a public good involving security of territory and citizenry. In the case that the citizen refuses to finance the project security is maintained with a probability of q (with $q < p$), and if security is maintained the executive receives a payoff 1.

In addition to benefiting from investment to the extent that it is likely to generate security, I assume that the executive in this model also derives an additional private benefit αg if the project is financed.[2] In what follows I will restrict my attention to a case where $\alpha > 0$.

Like the executive, the citizen also receives a payoff of 1 in the event that security is maintained and 0 otherwise. Finally, in the case where the project is financed, the representative citizen bears the cost of this financing.

Expected utility for each player in the case where the project is financed is as follows. There is common knowledge of all parameters so far presented.

$$\begin{aligned} U_{exec}(g) &= p + \alpha g \\ U_{citizen}(g) &= p - g \end{aligned} \tag{1}$$

In the above framework without any further additions to the model there would be two

[2] The motivation behind this assumption is similar to that in Aghion and Bolton's (1992) corporate financing model where an entrepreneur cares about both pecuniary and non-pecuniary rewards from a project (such as prestige). In the context of medieval and early modern Europe it is very plausible to imagine that an executive might derive personal prestige or other "ego-rents" from the pursuit of military activities. See Downs and Rocke (1994) for an important early example where the public relies on an executive to make decisions regarding defense, but the executive may be subject to "adventurism". Rosenthal (1998) presents a model specifically tailored to the early modern European context.

possible outcomes in equilibrium - if the difference between the probability of success with financing and success without financing $(p-q)$ exceeds the project cost g then the representative citizen will choose to finance the project. Otherwise, he will choose not to do so. These would represent the possible outcomes if the role of an assembly was limited to approving or rejecting taxes, as was the case with many European assemblies.

Consider now the following two modifications to the model.

First, depending on the realization of an exogenous binary state variable ω (with each state occurring with equal probability) after the project is financed if $\omega = 1$ it is possible to reduce the project cost to g' (with $g' < g$) without reducing the probability of success. This can be thought of as a reduced form for the following situation - a representative assembly agrees to a certain level of financing via tax revenues, but exerts subsequent control over spending authorizations.[3] After the initial financing decision is made, the state ω is realized and is observed by the executive, but it is not automatically observed by the representative citizen. In the case to which I have restricted myself, where the executive derives ego rents from spending $(\alpha > 0)$, this creates a problem of moral hazard because the executive has no incentive ex post to reduce the project cost to g'.[4]

The second modification is that at the time that financing is granted the executive has the option of conceding a control right to the citizen, allowing the citizen to take an intermediate action to alter the level of financing after the state variable has been realized. However, in order to observe the realization of the state variable the citizen must first incur an exogenously determined monitoring cost m.

The full timing of the game is as follows.

1. The executive chooses whether to concede a control right to the citizen

[3] Hoffman and Norberg (1994) have previously argued that European states with representative assemblies that had this spending prerogative were able to raise more revenues than those with assemblies that lacked this prerogative. See the contributions in their edited volume as well as the concluding chapter by Hoffman and Norberg (1994) in particular.

[4] Since under the assumptions I have made the executive would never have an incentive to take the corrective action, it actually makes no difference whether we specify that the executive observes or does not observe the state at this stage. What matters is that the citizen does not observe the state.

2. The citizen chooses whether to finance the project - resulting in revenues either of g or of 0.

3. The state of the world ω is realized and is observed by the executive but not the citizen.

4. If the executive has conceded a control right, the citizen chooses whether to incur the monitoring cost m. If he does so, then he observes the state of the world ω.

5. If the citizen has paid the monitoring cost m he may take a corrective action to reduce the project cost to g'.

6. If the project is financed it "succeeds" with probability p. If the project is not financed security is maintained with probability q.

The choice faced by the citizen will now be governed by the following two constraints.

First, conditional on agreeing to finance, the citizen will only be willing to incur the cost of monitoring if the following inequality is satisfied

$$m \leq \tfrac{1}{2}(g - g') \tag{2}$$

Second, the citizen will only agree to financing in the first place if the expected increase in the likelihood of success at least equals the expected cost. The constraint in (3) will apply if the citizen does not exercise a control right, and the constraint in (4) will apply if the citizen does exercise a control right.

$$p - q \geq g \tag{3}$$

$$p - q \geq \tfrac{1}{2}(g + g') + m \tag{4}$$

Now consider the problem faced by the executive. Since the executive's utility is strictly increasing in spending, the only relevant choice is whether to concede a control right to the citizen. Take the case where the inequality in (4) is satisfied, but the inequality in (3) is not, implying that the citizen will be unwilling to consent to taxation in the absence of a control right. In this case, for the executive conceding control will have the benefit of raising the probability of success. As long as there are ego rents to be incurred from spending, then conceding control will also result in an increase in the private benefit for the executive relative to the case where the project is not financed. Now take the case where the inequality in (3) is satisfied, so the citizen would agree to finance the project even in the absence of a control right. In this case the executive will gain nothing by extending a control right.

We can conclude with the following statement.

Proposition 1 *The executive will concede a control right over spending, and the citizen will exercise this control right if and only if* $m \leq \frac{1}{2}(g - g')$ *and* $g \geq p - q \geq \frac{1}{2}(g' + g) + m$.

The model above can be used to draw several simple comparative statics. For one, we are less likely to observe an assembly with a control right when exogenous monitoring costs m are high. This result is not surprising since it is driven by assumption. I have argued that geographic scale was an important determinant of m in medieval and early modern Europe.

The model is also useful for identifying several less obvious results regarding potential confounding factors. The first of these is external risk. It might be the case that smaller polities are at greater risk from invasion by their neighbors, and if this is the case, we might observe that smaller polities are more likely to have an assembly with a control right even if exogenous monitoring costs m do not in fact matter in the way that I have suggested. However, before drawing a hasty conclusion about external risk, we should first observe that the predicted effect of external risk in the model is actually contingent on the values of other parameters. An increase in the difference between p and q may prompt a citizen to be willing to shift to favor financing the project provided that a control right is conceded, but an increase in the difference between p and q may also prompt the citizen to be willing to finance the project even if the executive does not concede a control right.

Another potential confounding factor involves the exogenous cost of funding the project g. This will be influenced by factors such as the state of military technology and the size of armies fielded by opponents. In per capita terms g will be higher in less populous states. To the extent that less populous states also tend to be smaller in terms of geographic scale, there would then be a potential positive correlation between g and m. Empirically, it has been suggested that a series of revolutions in military technology in Europe beginning in the sixteenth century led to a drastic increase in army sizes, a consequent increase in the financial requirements of war, and contemporaneously a waning in the power of representative assemblies.[5] It has also been suggested that changes in military technology led to an increase in the optimum size of states (Bean, 1973). The model presented here shows that, in fact, an exogenous increase in g could have an ambiguous effect on political representation. On the one hand, as g increases the monitoring constraint in (2) is more likely to be satisfied. Therefore, if in a smaller polity g is higher we might expect to be more likely to observe that there is an assembly with a control right irrespective of the level of m. On the other hand, as g increases the inequalities in (3) and (4) are less likely to be satisfied and so citizens will be less likely to assent to taxation in the first place.

3 Control of Expenditure

In the paper I referred to two additional sets of estimates of the following equation where $y = 1$ if a polity has a representative assembly that has a prerogative over expenditure.

$$\Pr(y_{it} = 1) = F(\alpha + \beta S_{it} + \theta G(T_t) + \varepsilon_{it}) \tag{A1}$$

The first set of additional estimates involved dividing the sample between polities in northern and southern Europe with the Alps and the Pyrenees as a dividing line. The first two columns of Table A1 report an estimate of equation A1 using alternatively either northern European or southern European polities and *log area* as a measure of geographic scale. As can be seen, the two sets of estimates are very similar. The coefficient on *log area* is slightly smaller in the southern sample, and it also has a larger standard error, but the number of observations in the southern sample is also smaller than that for the north. The coefficient in both sub-samples is close to that observed in the full sample estimate (column 1 of Table 3 in

[5] The clearest exposition of this idea can be found in Downing (1992). Downing emphasized representative assemblies as an obstacle, rather than an aid, to raising finance.

the main paper). Columns 4 and 5 in Table A1 repeat the same exercise while using the *polity scale* measure. Here as well the coefficients observed in the two sub-samples are similar, and they are also close to that observed in the full sample regression (column 7 of Table 3 in the main paper).

I also considered how my estimates of expenditure prerogatives changed after adding nine city-states for which data on representative institutions was available but GIS data on geographic scale were not. For Basel, Geneva, and Zurich I proxied for their area by using the area of the modern cantons to which they correspond. For the remaining cities of Bruges, Ghent, Nuremberg, Barcelona, Dortmund, and Mainz I proxied for their area by using the average of the area of the three Swiss cities. Like the rest of the city-states in my data set, all nine of these cities had assemblies that met at least once a year and which had a prerogative with regard to expenditures. The sources used to identify this information are listed in the following footnote with full references at the end of this appendix.[6] Column 3 in Table A1 reports a pooled estimate of equation A1 after adding these nine cities to the sample. The result is very similar to that observed in the original regression (located in column 1 of Table 3 in the main paper).

4 Generalized Estimation of Assembly prerogatives.

In Section 5 (page 23) of the main paper I referred to binary logit estimates of the probability that a polity has an assembly with veto power over taxation. These were based on an estimate of the following equation where $y = 1$ if a polity has an assembly with this tax prerogative (irrespective of whether it also has a spending prerogative).

$$\Pr(y_{it} = 1) = F(\alpha + \beta S_{it} + \boldsymbol{\gamma}\mathbf{X}_{it} + \theta G(T_t) + \varepsilon_{it}) \tag{A2}$$

[6] Basel: Gilliard (1965), Gilomen (2003), Schib (1954), and Liebeskind (1939). Geneva: Gilliard (1965) and Liebeskind (1939). Zurich: Gilliard (1965) and Schib (1954). Bruges: van Houtte (1967) and Murray (2005). Ghent: van Werveke (1946) and Pirenne (1910). Nuremburg: Dollinger (1954, 1955) and Schneider (1954). Barcelona: Font y Rius (1954). Dortmund: Dollinger (1954, 1955) and Schneider (1954). Mainz: Dollinger (1954, 1955) and Schneider (1954).

In Table A2 I report four separate estimates of this equation using alternative measures of geographic scale and with and without controls for urbanization and population. For the *log area* estimates we see that the coefficient on this scale variable is negative in both specifications. While it approaches statistical significance in the specification without controls (p=0.059), the magnitude of the implied effect is quite small. A polity at the 25th percentile of the distribution in terms of log area would be estimated to have a 0.63 probability of having an assembly with veto power over taxation. A polity at the 75th percentile of the size distribution would still have a 0.45 probability of having the same time of assembly. The results of the two specifications using the polity scale measure suggest that there is not a statistically significant relationship between this measure and the presence of an assembly with veto power over taxation.

In the main paper I also reported predicted probabilities from generalized estimates of assembly prerogatives using a multinomial logit estimation of the following equation.

$$\Pr(\textit{representation} = j) = F(\alpha + \beta S_{it} + \boldsymbol{\gamma}\mathbf{X}_{it} + \theta G(T_t) + \varepsilon_{ti}) \qquad \text{(A3)}$$

In this equation the variable *representation* takes one of the following four values: 0 if a polity had no assembly, 1 if a polity had an assembly but which lacked tax and spending prerogatives, 2 if the polity had an assembly with veto power over taxation but not control of spending, and 3 if the assembly had control of both taxation and spending. Table A3 of the appendix reports coefficients from estimates of equation A3 using the two alternative geographical scale measures, as well as including and not including controls.

5 Estimates of Meeting Frequency

In the paper I also referred to two separate estimates of meeting frequency but did not report the complete regressions. The first involved a regression using the 33 polity sample after adding the nine city states for which I do not have GIS data on their geographic scale. Since I was only able to obtain a single proxy measure for area for each of these nine city states, and I lack data on control variables for these states, this analysis is limited to repeating the specification in column 1 of table 5. When adding the nine additional city states to obtain a sample of 263 observations, the coefficient on the log area measure was -0.095 with a standard error of 0.14, and the r-squared for this regression was 0.36.

In the paper I also referred to the alternative of using a tobit procedure to estimate meeting frequency given that it is censored at 1. Table A4 below reports four separate tobit estimates using the two alternative measures of geographic scale and alternatively including or excluding controls for urbanization and population. As one would expect, the coefficients on *log area* and the *polity scale* measure now suggest a somewhat larger negative effect of scale on meeting frequency than would be implied by the estimates in Table 6 of the main paper.

6 French Provincial Evidence

Table A5 provides full information for the French provincial assemblies evidence used in section 7 of the main paper. In the main paper I used data that were artificially censored at a value of 1 to increase comparability with the cross country data. Appendix table A6 reports regression estimates of meeting frequency identical to those in Table 6 of the main paper, except for the fact that I now use uncensored data for the French provinces. As can be seen from the data table, this affects only two observations. The estimate in the first column includes all thirteen French provinces; the second estimate excludes Brittany and Normandy as outliers, and the third estimate repeats the pooled estimate from column 2 of Table 6 of the main paper, but it uses uncensored data for the French provinces instead of censored data. As can be seen, shifting to using uncensored data for the French provinces does not produce a significant difference in the results.

7 Reverse Causality

In Section 8 of the paper I referred to results of a test to help indicate whether my estimation results may be biased by reverse causality because political representation itself influences scale. If this is true then using the time structure of the data we might expect to find that the current format of political representation is even more highly correlated with future values of geographic scale. Following Angrist and Pischke (2009) I suggested that this possibility could be assessed by estimating the following equation where R refers to a measure of representative institutions.

$$R_{it} = \alpha + \beta_1 S_{it} + \beta_2 S_{it+1} + \boldsymbol{\gamma}\mathbf{X}_{it} + \theta G(T_t) + u_i + \varepsilon_{it} \tag{A4}$$

If political regime is determining geographic scale, then we would expect to observe a negative and statistically significant coefficient β_2. Table A7 reports four different specifications for this test.

8 Sources on Representative Institutions

In footnote 19 of the paper I provided a list of all sources used to code the data on representative assemblies. These sources are not cited in the main references for the paper, unless the source was also cited in another location in the paper. I now provide a complete list of references for all sources used to code the data on representative assemblies. This list also includes the sources used to code data on the nine additional city-states for which I lack GIS data. In what follows I first provide a list of all countries with their corresponding sources. A more extensive discussion of the collection of this data can be found in Stasavage (2011).

Austria: Dickson (1987) and MacHardy (2003). Burgundy (Estates of Flanders) Dhondt (1950, 1966). Castile: Marongiu (1968), Thompson (1982) and Beneyto (1966). Cologne: Dollinger (1954, 1955), Schneider (1954), and Knipping (1898). Denmark: Lonnroth (1966), Jespersen (2000), and Graves (2001). England: Marongiu (1968), Keir (1938), and Hayton (2002). Florence: Finer (1995) and Rubinstein (1966). France: Major (1960), Dumont and Timbal (1966), Mousnier (1966), and Soule (1965). Genoa: Epstein (1996) and Heers (1961). Holland: Tracy (1990), Grever (1982), Gilissen (1966), and Israel (1995). Hungary: Bonis (1965). Milan: Epstein (1993) and Belfanti (2001). Naples: Marongiu (1968) and Koenigsberger (1977). Piedmont: Marongiu (1968) and Koenigsberger (1971). Poland: Bardach (1977) and Jedruch (1982). Portugal: Payne (1973). Prussia (Brandenburg): Carsten (1954).

Saxony: Carsten (1959). Siena: Boswky (1981, 1970). Sweden: Schuck (1987) and Rystad (1987). Tuscany: Koenigsberger (1977). Venice: Lane (1973). Wurttemberg: Folz (1966), Carsten (1966), and Wilson (1992).

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	South Europe	North Europe	33 polities	South Europe	North Europe
ln(*area*)	-1.00	-1.21	-1.13		
	(0.53)	(0.32)	(0.23)		
polity scale				-0.87	-0.75
				(0.42)	(0.40)
Mcfadden R^2	.21	.58	.50	.24	.25
observations	81	148	263	81	148

Table 1: **Logit estimates of probability of having an assembly with prerogative to monitor and make expenditure decisions**. Heteroskedastic consistent standard errors clustered to allow arbitrary within-country correlation Estimates include a cubic function of time but time coefficients are not reported. The 33 polity sample includes nine additional city-states for which GIS data on area was unavailable.

	(1)	(2)	(3)	(4)
ln(area)	-0.27	-0.26		
	(0.14)	(0.17)		
polity scale			-0.13	-0.05
			(0.17)	(0.19)
ln(urban population)		0.23		-0.03
		(0.25)		(0.21)
ln(regional urbanization)		0.19		0.32
		(0.49)		(0.50)
ln(urban potential)		(0.24)		0.83
		(1.01)		(0.95)
Smallest quartile included?	yes	yes	yes	yes
Largest quartile included?	yes	yes	yes	yes
City-states included?	yes	yes	yes	yes
Mcfadden R^2	.08	.11	.03	.08
observations	229	229	229	229

Table 2: **Logit estimates of probability of having an assembly with veto power over taxation**. Heteroskedastic consistent standard errors clustered to allow arbitrary within-country correlation. Estimates include a cubic function of time but time coefficients are not reported.

	assembly only				taxes only				taxes + spending			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
ln(area)	.109	.231			.269	1.17			-.919	-.891		
	(.265)	(.452)			(.312)	(0.80)			(.306)	(.419)		
polity scale			.244	.256			(.447)	.470			-.567	-.456
			(.185)	(.201)			(.325)	(.373)			(.229)	(.258)
ln(urban pop.)		-.137		-.052		-.824		.007		.391		-.158
		(.596)		(.292)		(.648)		(.272)		(.533)		(.348)
ln(regional urb.)		-.325		-.394		.527		-.041		.418		.770
		(.701)		(.565)		.877		(.644)		(.922)		(.898)
ln(urban pot.)		1.06		0.83		2.72		0.94		-.018		1.05
		(.149)		(1.22)		(1.72)		(1.18)		(1.86)		(1.50)

Table 3: **Multinomial Logit Estimates of Assembly Prerogatives**. Heteroskedastic consistent standard errors clustered to allow arbitrary within-country correlation Cubic function of time included but not reported.

	(1)	(2)	(3)	(4)
ln(area)	-0.17	-0.16		
	(0.05)	(0.06)		
polity scale			-0.14	-0.08
			(0.06)	(0.06)
ln(urban population)		0.01		-0.12
		(0.08)		(0.07)
ln(regional urbanization)		0.05		0.13
		(0.12)		(0.13)
ln(urban potential)		(0.04)		0.33
		(0.25)		(0.22)
pseudo R^2	.18	.19	.25	.14
observations	229	229	229	229

Table 4: **Tobit Estimates of Meeting Frequency.**. Heteroskedastic consistent standard errors clustered to allow arbitrary within-country correlation Time period dummies included but not reported.

French province	**Period of data**	**Meeting frequency** (censored)	**Meeting Frequency** (uncensored)	**area in** 1000**km**^{2}
Bearn	1391-1517	0.80	0.80	7.6
Limousin bas	1419-1450	0.80	0.80	8.5
Limousin haut	1420-1451	1.00	1.00	8.5
Vivarais	late 15th	1.00	1	10.5
Marche	1420-1451	0.90	0.9	13.3
Languedoc	1418-1517	1.00	1.27	13.7
Dauphine	1378-1500	0.77	0.77	19.5
Lorraine	1435-1506	0.50	0.50	24.5
Auvergne	1419-1459	0.70	0.70	28.8
Provence	late 15th	0.50	0.50	37.9
Poitou	1390-1514	0.50	0.50	45.6
Normandy	1420-1506	1.00	1.3	55.4
Brittany	1400-1630	1.00	1	74.1

Table 5: **Characeristics of French Provincial Assemblies (Estates)** Information on meeting frequencies as collected by Blockmans (1976). Area in kilometers calculated as described in text.

	Provinces	Provinces	Countries and Provinces
	(all)	(exclude Normandy & Brittany)	(excluding French Estates General)
ln(area)	-0.04	-0.27	-.109
	(0.10)	(0.07)	(.034)
constant	1.26	3.39	1.86
	(1.00)	(0.66)	0.36
R^2	.01	.49	.310
N	13	11	33

Table 6: **Meeting Frequency Estimates Using Uncensored Data for French Provinces** OLS estimates with heteroskedastic consistent standard errors. The "countries and French provinces" estimate adds French provinces while removing the French Estates General.

	Meeting frequency				Expenditure prerogative			
$\ln(\text{area})_t$	-.044	-.043					-1.86	-3.09
	(.033)	(.032)					(0.65)	(0.76)
$\ln(\text{area})_{t+1}$	.019	.024					0.58	1.07
	(.037)	(.038)					(0.68)	(0.61)
polity scale_t			-.047	-.062	-.613	-.673		
			(.024)	(.033)	(.265)	(.316)		
polity scale_{t+1}			.031	.034	-.120	-.100		
			(.023)	(.025)	(.351)	(.370)		
ln(urban population)		-.004		.037		-.088		1.21
		(.025)		(.041)		(.339)		(0.73)
ln(regional urbanization)		.232		.144		1.35		1.16
		(.188)		(.197)		(0.86)		(1.03)
ln(urban potential)		.066		.055		-0.31		-3.93
		(.128)		(.145)		(1.11)		(1.68)
Smallest quartile included?	yes	yes	yes	yes	yes	yes	yes	yes
Largest quartile included?	yes	yes	yes	yes	yes	yes	yes	yes
City-states included?	yes	yes	yes	yes	yes	yes	yes	yes
observations	165	165	165	165	189	189	189	189

Table 7: **Tests of the Conditional Correlation Between Political Regime and Future Geographic Scale** Meeting frequency estimates are first difference estimates using OLS and including period dummies. Spending prerogative estimates are logit models including a cubic function of time. All standard errors clustered by country..