Online Appendix to *The Distortion Gap*[*]

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This appendix serves to complement Moore and Giovinazzo (2012). Section 1 discusses the relaxation of assumptions of our model (with special attention to the independence assumption) and demonstrates that our primary findings hold under these relaxations. Section 2 presents a 3-D surface plot and a 2-D contour plot that offer more detailed visualizations of the quantities we summarize in our paper's Figure 1. These Figures enable the reader to examine *how much* state or national policymaking is preferred under certain conditions.

1 Relaxing Assumptions

Independence

This section demonstrates the robustness of our finding to deviation from the assumption of independence between P, whether a state's median voter prefers policy A, and S, whether the state has an interest group strong enough to force adoption of B. Making no independence assumption about P and S, we can write the proportion of states satisfied under state policymaking as $Z_{st} = 1 - \frac{\sum_j P_j S_j}{J}$, where j indexes the J total states. Note that calculating this quantity requires knowing the full joint distribution of P and S. Our core model assumes independence, thus that the joint distribution is the product of the marginal distributions. We present an example suggesting that the shape of the region we discover and highlight in

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P	S	Policy Choice	State Satisfied
1	1	B	No
1	1	B	No
0	1	B	Yes
0	0	B	Yes
0	0	B	Yes
0	0	B	Yes
			4/6

P	S	Policy Choice	State Satisfied
1	0	A	Yes
1	0	A	Yes
0	0	B	Yes
0	1	B	Yes
0	1	B	Yes
0	1	B	Yes
			6/6

P	S	Policy Choice	State Satisfied
1	1	B	No
1	0	A	Yes
0	1	B	Yes
0	1	B	Yes
0	0	B	Yes
0	0	B	Yes
			5/6

Table 1: Three cases with different correlations between P and S yielding different proportions of satisfied states, given state policymaking with six states, $\bar{P} = 1/3$, $\bar{S} = 1/2$.

our paper's Figure 1 (and Figures 2 and 3 below) may depend on this assumption. However, we then demonstrate that the region of national policymaking superiority exists and carries the same substantive interpretation, even when this assumption is relaxed.

To suggest the relevance of the independence assumption, let $J = 6$, $\bar{P} = \frac{1}{3}$, and $\bar{S} = \frac{1}{2}$. Table 1 displays three (P, S) profiles consistent with these values of $\bar{P}$ and $\bar{S}$, but only in the last does $1 - \bar{P}\bar{S}$ represent the proportion of satisfied states. (Recall that a state is satisfied if its median voter's preference is enforced, either because the interest group is weak, $S = 0$, or the median voter agrees with the interest group, $P = 0$.) Only in the third case, where $P \perp\!\!\!\perp S$, does $1 - \bar{P}\bar{S} = 1 - \frac{1}{3} \cdot \frac{1}{2} = \frac{5}{6}$ represent the proportion of satisfied states[1]. Thus, one can take interest either in simply calculating Z_{st} as in this example, or in $E(Z_{st})$, the expected proportion of satisfied states, which equals $1 - \bar{P}\bar{S}$ in this case.

We use exhaustive simulations to demonstrate that our findings are robust to deviations from the independence assumption, despite the different counts of satisfied states in the three tables above. This strategy is appropriate, since writing the proportion of satisfied states requires taking the marginal distributions of P and S implied by $\bar{P}$ and $\bar{S}$ and calculating the distribution of the product PS. Finding the full distribution of the product of two random variables is a difficult general problem. Glen, Leemis and Drew (2004) provide some details.

[1]Proof of whether $P \perp\!\!\!\perp S$ holds for the three cases follows. Case 1: $P(P = 1|S = 1) = .\bar{6}$, but $P(P = 1|S = 0) = 0$. Case 2: $P(P = 1|S = 1) = 0$, but $P(P = 1|S = 0) = .\bar{6}$. Case 3: $P(P = 1|S = 1) = P(P = 1|S = 0) = .\bar{3}$, and $P(P = 0|S = 1) = P(P = 0|S = 0) = .\bar{6}$

We first select a number of states to simulate, presenting results for $J = 10$ below. Then for each value of $\bar{P}$, we consider a representative vector of values of P (such as $\begin{pmatrix} 1 & 0 & 0 \end{pmatrix}$ for $J = 3$ and $\bar{P} = \frac{1}{3}$), and enumerate every possible vector of S for every possible combination of $\bar{P}$ and $\bar{S}$. For $J = J^*$, this implies $(J^* + 1)2^{J^*}$ unique joint distributions. For $J = 20$, for example, this involves over 22 million calculations. Thus, we use a server with significant computational power, and calculate $Z_{nat} - Z_{st}$, the difference between the proportion of states satisfied under national versus state policymaking, for every joint distribution. After examining patterns for every possible correlation between P and S, we found that summarizing the correlations by their signs did not obscure any meaningful deviations from the results we present here. Figure 1 groups these calculations into three bins based on whether the correlation between P and S is positive, negative, or exactly zero. Replication code and similar results for values of $J < 10$ are available from the authors.

Figure 1 summarizes our simulations. We find that the correlation between P and S does not substantively impact our finding: for positive, negative, and zero correlations, the region of national policymaking preference is similarly located and sized. We highlight two implications from these results. First, when preference conflict and interest group prevalence are positively correlated, the indifference region is much larger. This suggests that state-level policymaking should not be considered the default alternative when strong interest groups coalesce in states where most of the public disagrees with them. For example, safety-conscious Californians may widely prefer bans on text messaging while driving, but California also is home to mobile technology firms that want their products used as widely as possible. Second, relative to a positive correlation, a negative correlation between the quantities reduces the size of the indifference region, but increases the size of the region preferring national policymaking. Thus, when mass publics and opposed interest groups tend to cluster in different places, national policymaking is more likely to be preferred. For example, Americans in most states may strongly favor fuel efficient vehicles, but within automaker-dense Michigan concentrated interests oppose such measures.

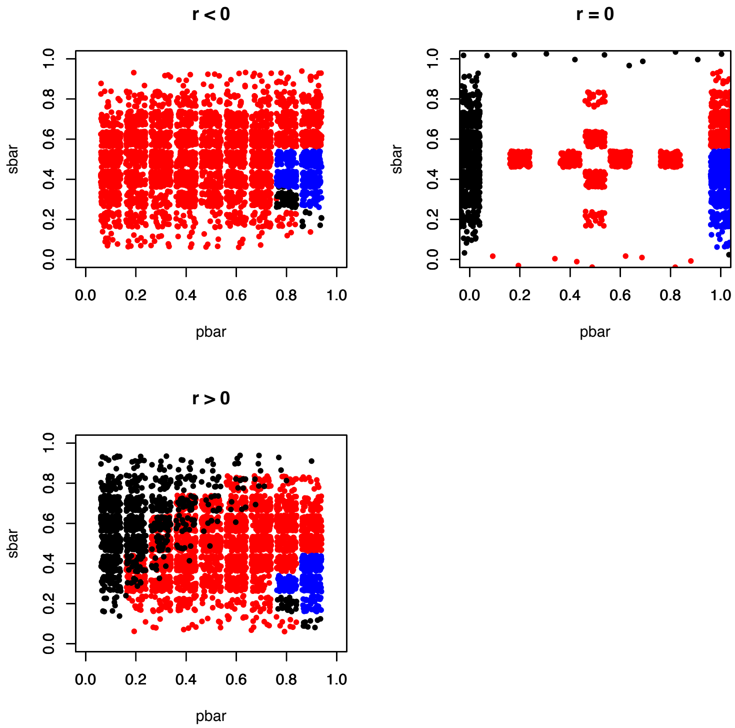

Figure 1: Findings are robust to correlation between P and S: for positive, negative, and zero correlations, the region of national policymaking superiority is similar in location and size to the blue region of Figure 3. National policymaking preferred in blue, State policymaking in red, indifference in black. "pbar" is proportion preferring policy A, "sbar" is proportion with strong group forcing adoption of B. All combinations of P and S for a 10-state federation are represented. Correlations grouped for display (disaggregated plots show similar pattern).

State Size and Power

Relaxing the assumption of equal state size, we show an example under which national policymaking is superior to state-level policymaking. Let there be one large state with $n_1 =$ 40 million, and several smaller states with $n_2 = n_3 = \ldots = n_{51} = 5.2$ million. Suppose every median voter wants A, so $\bar{P} = 1$, and an interest group dominates in $\bar{S} = \frac{1}{4}$ of the states. Let P and S be statistically independent. If the large state has the powerful group, then state-level policymaking will produce a proportion of satisfied voters $\bar{U}_{st} = \frac{5.2\text{m}\times 50\times 0.75}{300\text{m}} = 0.65$, while national policymaking will do better: $\bar{U}_{nat} = 1$.

Relaxing only the assumption of equal state power in the national legislature also yields straightforward examples of the superiority of national policymaking. Suppose $\bar{P} = 1$ and $\bar{S} = \frac{1}{4}$ again, and that $\forall j,\ n_j = n$. Let one state get 5 votes in the national legislature, while the other 50 each get 1 vote. Then, if the powerful state lacks the powerful interest group, the powerful state and the 37 others lacking the interest group will win with 42 votes in a majoritarian legislature. Fewer of the voters are satisfied under state policymaking, $\bar{U}_{st} = \frac{38n}{51n} \approx 0.74$, while all are satisfied under national policymaking: $\bar{U}_{nat} = 1$.

Relaxing both assumptions, we provide an example of the superiority of national policymaking that echoes the American House of Representatives. Let the fifty-one state sizes be the same as above; regarding state power, let state 1 have 5 votes in the national legislature, while the other states have 1. Again let $\bar{P} = 1$, $\bar{S} = \frac{1}{4}$. Then, if the large state has the powerful group, it will still be outvoted in the national legislature, 17-38, and $\bar{U}_{nat} = 1$. Meanwhile, $\bar{U}_{st} = \frac{5.2\text{m} \times 50 \times 0.75}{300\text{m}} = 0.65$ just as above.

Thus, while the model of Moore and Giovinazzo (2012) assumes states of equal population and equal voting strength in the national legislature, our conclusions do not depend on these assumptions, and obtain even where states are of different populations and voting strengths. Conditions remain under which national policymaking is preferred.

References

Glen, Andrew G., Lawrence M. Leemis and John H. Drew. 2004. "Computing the Distribution of the Product of Two Continuous Random Variables." *Computational Statistics & Data Analysis* 44(3):451–464.

Moore, Ryan T. and Christopher T. Giovinazzo. 2012. "The Distortion Gap: Policymaking Under Federalism and Interest Group Capture." *Publius: The Journal of Federalism* 42(2):189–210.

2 Supplementary Figures

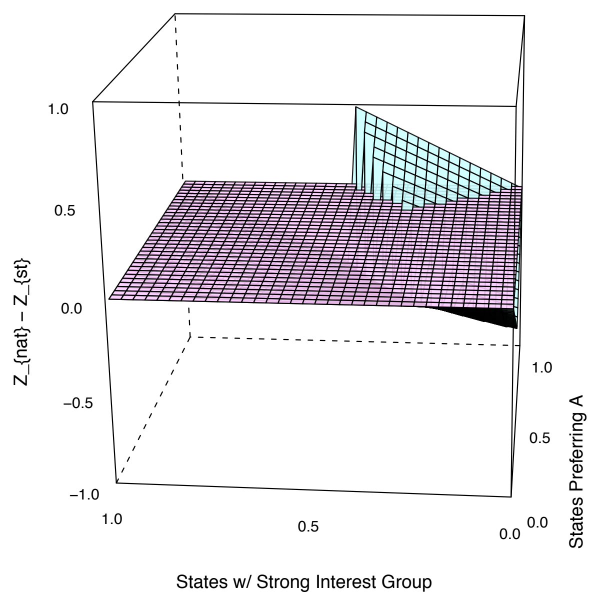

Figure 2: Aggregate Welfare under National vs. State Regimes, Surface Plot. Partially-visible cyan surface represents $Z_{nat} - Z_{st}$; points above the horizontal magenta $z = 0$ plane define the region where national policymaking is preferred. See Figure 3 for contour plot.

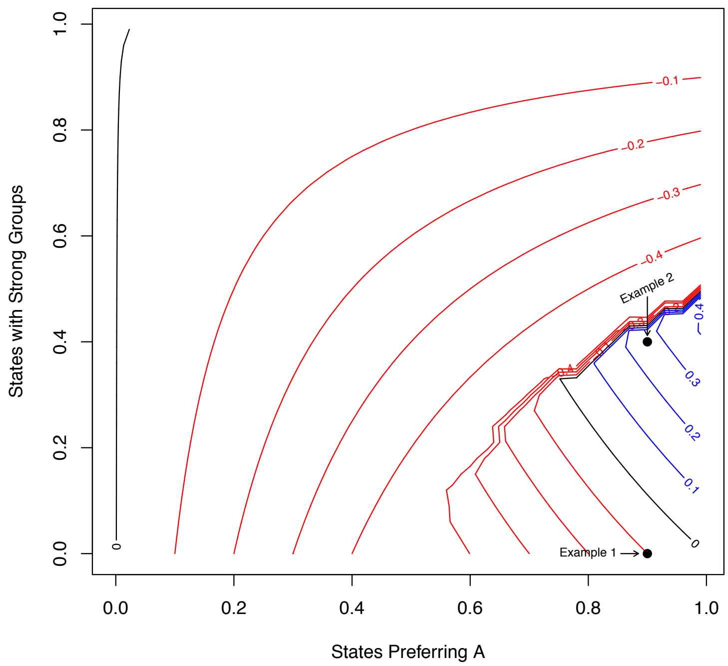

Figure 3: Aggregate Welfare under National vs. State Regimes, Contour Plot. Blue contours show where national policymaking is preferred; red contours show where state policymaking is preferred; black contours show indifference curves, $(Z_{nat} - Z_{st} = 0)$. See Figure 2 for surface plot. Example calculations from published paper, second Section are labeled.