THE GEOGRAPHIC DISTRIBUTION OF US EXECUTIONS

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ABSTRACT

We review statistical patterns of the geographic distribution of US executions, compare them to homicides, and demonstrate extremely high degrees of concentration of executions in the modern period compared to previous historical periods. We further show that this unprecedented level of concentration has been increasing over the past 20 years. We demonstrate that it is virtually uncorrelated with factors related to homicides. Finally, we show that it corresponds to a statistical distribution associated with "self-reinforcing" processes: a power-law or exponential distribution.

These findings stand whether we look at individual counties within death-penalty states, across the 50 states of the United States, or look at the international distribution of executions across countries in recent years. The substantive conclusion from the statistical patterns observed is that these cannot be explained merely by random variation around some general average. Rather, localities start down a path, then are reinforced in their pathways. There appears to be little to no logic about why certain counties are the high-use counties, whereas the vast majority have never executed a single individual in 40 years of experience with the modern death penalty, often in spite of thousands of homicides. Our research indicates that a main determinant of

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whether an individual will be executed is not the crime they commit, but the jurisdiction's experience with executing others. This is not acceptable—legally, morally, or constitutionally.

INTRODUCTION

A small number of jurisdictions in the US generate most of the executions.[1] This high level of geographic concentration is not explained by the number or the rate of homicides. Many of the jurisdictions with the greatest number, or the greatest rates of homicide per population, are not among the highest executing ones.[2] The extreme concentration of jurisdictions[3] using the death penalty can be seen whether we compare the 50 states, over 3,000 counties across the country, counties within states, or even the countries of the world. The high level of concentration we observe in the modern[4] death penalty has been growing in the past 15 years, as the death penalty has been in decline.[5] Indeed, it is higher in the modern period than it was in any period in US history from colonial times.[6] Not only has the geography of execution become more focused, but it has taken on a "southern" character which it did not previously exhibit in other historical periods. Finally, the level of geographic concentration is so great that it satisfies the statistical requirements to be classified as a "power-law" distribution, suggesting a self-reinforcing process in which the best predictor of the next execution in a jurisdiction is not the number of homicides, but the number of previous executions already carried out.[7]

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1. *See infra* Table 2. 52% of the executions since 1976 have come from just 57 counties. *See also infra* Figure 4.

2. *See infra* Table 2. The 57 counties generating 52% of the executions have just 24% of the homicides occurring in death-penalty states.

3. *See infra* Figures 1–3.

4. We use the term "modern" to refer to the post-*Furman* (1972) death penalty. Furman v. Georgia, 408 U.S. 238 (1972). Executions were halted by this 1972 decision and went forward again under more restrictive rules after the 1976 *Gregg* decision. *Gregg v. Georgia*, 428 U.S. 153 (1976). Over 1,400 executions have now occurred in the 40 years following the *Gregg* decision. Because the Court mandated different standards in *Gregg* than those rejected as insufficient in *Furman*, we focus on the "modern" or post-1976 executions throughout this article.

5. *See infra* Figure 8.

6. *See infra* Figure 7.

7. We will explore the concept of a power-law distribution in greater detail below. *See generally* PETER BAK, HOW NATURE WORKS: THE SCIENCE OF SELF-ORGANIZED CRITICALITY (Copernicus 1996) (discussing the power-law distribution); DUNCAN J. WATTS, SMALL WORLDS: THE DYNAMICS OF NETWORKS BETWEEN ORDER AND RANDOMNESS. (Princeton Univ. Press 1999) (same) [hereinafter *Small Worlds*]; DUNCAN J. WATTS, SIX DEGREES: THE SCIENCE OF A CONNECTED AGE (Norton 2003) (same) [hereinafter *Six Degrees*]; ALBERT-LASZLO BARABASI, LINKED: THE NEW SCIENCE OF NETWORKS (Penguin 2005) (same).

The US has "self-organized" into a large majority of jurisdictions that do not execute in spite of high numbers of homicides, and a small number which execute at rates many times greater than others, but which are not particularly affected by high homicide rates. The differences that we document below are not small local fluctuations around an average value and attributable to random fluctuations. Rather, they have the characteristics of completely different systems of justice based on local norms developing independently and building on their own historical momentum to generate radically different outcomes which call into question the equal protection of the law.

In Part II, we explain the sources of our data. In Part III, we document the distribution across states and counties where executions have occurred in the modern period. Part IV compares these data with homicides, showing a low correlation between homicides and executions, even in death-penalty states. Part V demonstrates that this pattern of high concentration is true across counties within states just as it is across states. Part VI compares the modern period with previous historical periods, displaying increased concentration and a greater focus on the US South in the modern period. Part VII discusses the "power-law" aspects of the data. We conclude in Part VII with a discussion of the implications of these findings, which are all presented in simple graphical, mapping, and tabular forms, except for the power-law demonstration, which by its nature requires some algebra, but which we explain in simple terms as well.

We focus here on executions, not death sentences, for several reasons. First, we have a comprehensive database on executions for the entire modern period, which can be compared to an existing database for the earlier historical period. No such database exists for the question of death sentences. Second, a recent report has shown that death sentences and executions show similar levels of concentration.[8] In both cases, just two percent of the counties produce a majority of the cases. Our focus on executions allows us to assess those cases where the death penalty has been fully carried out, and also allows a comprehensive assessment of the entire record of the death penalty since its modern re-establishment.

8. Richard Dieter, *The 2% Death Penalty: How a Minority of Counties Produce Most Death Cases At Enormous Costs to All*, DEATH PENALTY INFORMATION CENTER (Oct. 2013), http://www.deathpenaltyinfo.org/documents/TwoPercentReport.pdf.

I. DATA SOURCES

We use the following sources of data throughout this analysis.

Executions

Modern Period

We use a comprehensive database of US executions coded by the county of conviction generated by Frank R. Baumgartner and consistent with the widely used Death Penalty Information Center (DPIC) database.[9] For this analysis, we use the date of execution and the county of conviction, covering the period from the beginning of the modern death penalty in 1977, through December 31, 2015.[10] This database consists of 1,422 executions from 474 counties across 34 states and the federal government. For the purpose of most of our analyses here, we exclude the 3 federal executions, as those are not associated with a particular county.

Historical Period

We use the widely available "Espy File" listing all known judicial executions in the US from colonial times through the modern period.[11] These data are also coded by the county of conviction, making it fully compatible with our database on modern executions.

Homicides

The US Department of Justice provides county-level counts of homicides in its annual Uniform Crime Reports.[12] We compiled these annual reports from 1984 through 2012, all the datasets currently available, merging the annual counts for each county. When the number of homicides was missing for an individual county for a particular year,

9. *See generally Searchable Execution Database*, *in* DEATH PENALTY INFORMATION CENTER, http://www.deathpenaltyinfo.org/views-executions (last visited 10 June 2016)

10. Some inmates have been sentenced to death for multiple crimes, sometimes in more than one county. We use only the county of conviction for the first death sentence imposed on each inmate. Very small variations therefore may distinguish our results here from some local studies which sometimes count the total number of death sentences, including multiple sentences for the same inmate. None of these small differences would affect the general pattern of our results.

11. *See* M. WATT EPSY & JOHN ORTIZ SMYKLA, *Executions in the United States, 1608-2002: The Espy File*, *in* INTER-UNIVERSITY CONSORTIUM FOR POLITICAL AND SOCIAL RESEARCH (4th ICSPR ed. 2005) (database) [hereinafter *Espy File*].

12. *See generally Uniform Crime Reports*, FEDERAL BUREAU OF INVESTIGATION, https://www.fbi.gov/about-us/cjis/ucr/ucr (last visited June 10, 2016).

we used the average number of homicides in the two previous and two subsequent years. If that was not possible, we used the average of the closest five years. Six counties in Arkansas were missing throughout the study period, and were excluded from the analysis. We adjusted for a small number of counties (such as Miami-Dade), which changed census identification codes during the study period, producing a dataset consistent with the 2010 census codes. These steps generated a database with actual homicide counts or estimates (in a very small number of cases) for each of the 3,137 US counties. For the most part, counties with high homicide numbers in one year also have high numbers in other years. This is largely because the counties differ greatly by population size. Most US counties have small populations, but a few have over 1,000,000. With this pattern in population size across the counties, homicide numbers in many counties are consistently fewer than 5 per year, whereas others (such as Los Angeles) may have hundreds per year. The relative numbers of homicides in any given year across the different counties are relatively consistent because of this. The small number of missing cases for homicides, as well as most of the estimates, were in small counties. None of the counties with missing homicide data had any executions.[13]

Population

We use 2010 population numbers by state and by country from the U.S. Census.

II. THE DEGREE OF GEOGRAPHIC CONCENTRATION IN THE MODERN US DEATH PENALTY

A. Concentration by Country, by State, and by County

Table 1 shows the US states sorted by their cumulative numbers of executions in the modern period, the number of homicides in the 1984-2012 period, their 2010 population, and the rates of homicide per population, and execution per homicide. For states with no executions, cumulative homicide totals and rates per population are listed in the last row. Non-executing and executing states differ only slightly by homicide rates (1.53 per 1,000 population for the states with no

13. The homicide database was originally collected by Gram. *See* Wallace Gram, *A Power-Law Analysis of the Uneven Geographic Distribution of Executions in the Furman era of the Death Penalty* (2015) (unpublished Senior Thesis, University of North Carolina) (on file with Department of Political Science).

executions compared to 1.68 overall). However, the table illustrates that individual states that have executions show great variation in homicide rates per population. Similarly, executions per 100 homicides range widely around the national average of 0.27. Delaware, Texas, and Oklahoma are the only states that surpass a rate of 1 execution per 100 homicides, and just four more states (Virginia, Missouri, Alabama, and Montana[14]) have rates above 0.50 executions per 100. Clearly, executions are not a widely used punishment for homicide, as the overall rate of application is on the order of one quarter of one percent. Note that the table lists over 500,000 homicides in the US over the period of study. So, while homicides are extremely common across all the states, there is little difference in the rate of homicide per population across executing and non-executing states. Also, among executing states, the rates of homicides per 1,000 population and the rates of executions per 100 homicides show great variability. Executions are extremely rare compared to homicides, and appear to follow no pattern related to homicides.

14. Note that for Montana, with just 538 homicides over the period of study, has had only 3 executions and so while its rate of execution per 100 homicides is high, the absolute numbers of each are very low compared to more populous states.

Table 1. States with Executions by Population and Homicides[15]

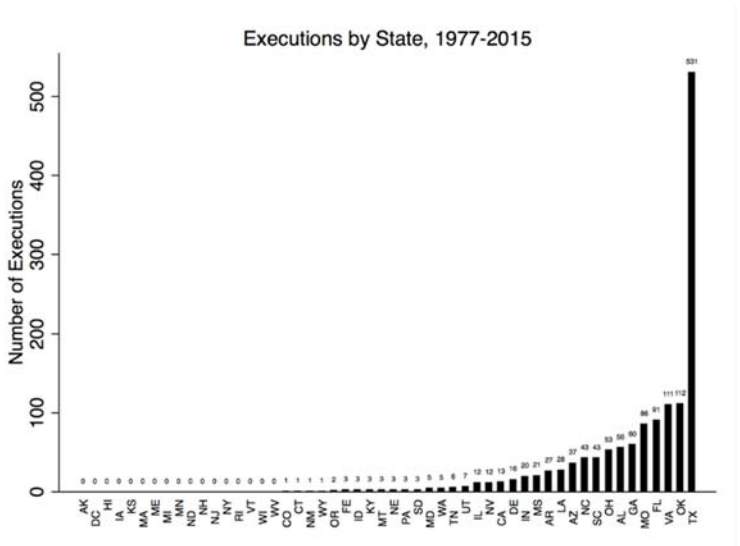
State	Population (2010)	Homicides (1984-2012)	Executions (1976-2015)	Homicides Per 1,000 Population	Executions Per 100 Homicides
Texas	25,145,561	47,918	531	1.91	1.11
Oklahoma	3,751,351	6,532	112	1.74	1.71
Virginia	8,053,257	12,773	111	1.59	0.87
Florida	18,801,310	29,877	91	1.59	0.30
Missouri	5,988,927	11,489	86	1.92	0.75
Alabama	4,779,736	10,489	56	2.19	0.53
Georgia	9,687,653	18,465	60	1.91	0.32
Ohio	11,536,504	14,924	53	1.29	0.36
North Carolina	9,535,483	16,488	43	1.73	0.26
South Carolina	4,625,364	9,320	43	2.01	0.46
Arizona	6,392,017	10,283	37	1.61	0.36
Louisiana	4,533,372	16,538	28	3.65	0.17
Arkansas	2,915,918	5,708	27	1.96	0.47
Mississippi	2,967,297	5,512	21	1.86	0.38
Indiana	6,483,802	9,391	20	1.45	0.21
Delaware	897,934	950	16	1.06	1.68
California	37,253,956	77,292	13	2.07	0.02
Illinois	12,830,632	23,561	12	1.84	0.05
Nevada	2,700,551	4,327	12	1.60	0.28
Utah	2,763,885	1,557	7	0.56	0.45
Tennessee	6,346,105	12,119	6	1.91	0.05
Maryland	5,773,552	14,132	5	2.45	0.04
Washington	6,724,540	6,123	5	0.91	0.08
Idaho	1,567,582	868	3	0.55	0.35
Kentucky	4,339,367	5,127	3	1.18	0.06
Montana	989,415	538	3	0.54	0.56
Nebraska	1,826,341	1,488	3	0.81	0.20
Pennsylvania	12,702,379	19,503	3	1.54	0.02
South Dakota	814,180	333	3	0.41	0.90
Oregon	3,831,074	3,117	2	0.81	0.06
Colorado	5,029,196	4,984	1	0.99	0.02
Connecticut	3,574,097	3,837	1	1.07	0.03

15. Seventeen states and the District of Colombia had no executions. Their combined population and homicide numbers are shown here. Three executions were carried out by the federal government and are not included here.

New Mexico	2,059,179	3,547	1	1.72	0.03
Wyoming	563,626	415	1	0.74	0.24
States with no Executions	71,012,628	108,904	-	1.53	-
Total	308,797,771	518,429	1,419	1.68	0.27

Figure 1 shows the distribution of executions by state. As can be seen in Table 1 as well, the distribution is extremely skewed, with Texas hosting over one third of the national total, and the top three states (Texas, Oklahoma, and Virginia) producing over half of the national total of executions over the entire modern period. As we will see below, this level of geographic concentration is unprecedented in US history.

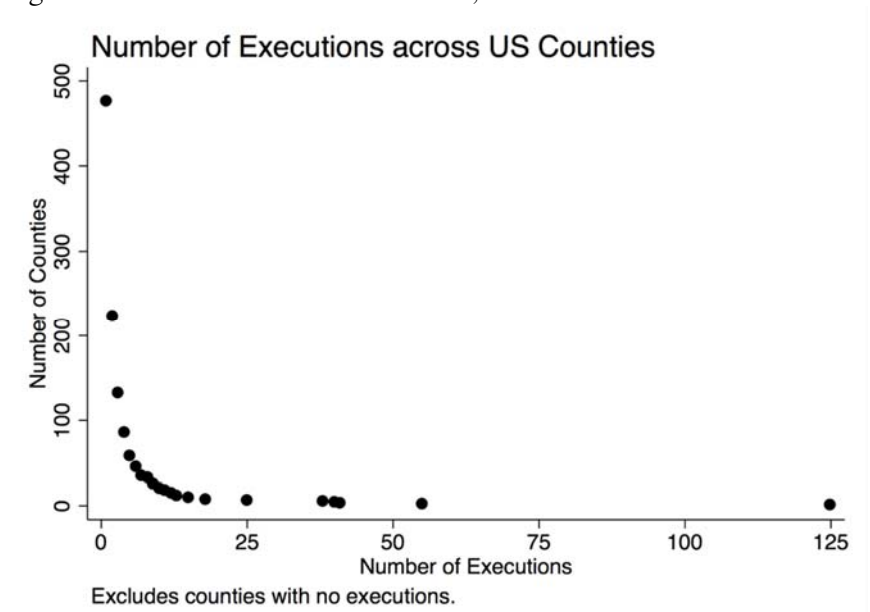
Figure 1. Executions across States, 1977-2015.



The skewed distribution apparent in Figure 1 is even sharper when we look across counties, rather than states. There are 3,139 counties in the US, but only 474 have had even a single execution in the modern era. Figure 2 shows these data, restricted only to those counties with an execution. On the horizontal (x) axis is the number of executions in a county, from 1 to 125. The vertical (y) axis shows the number of counties that have had at least that number of executions. 474 counties have 1 execution or more; 223 have 2 or more; 6 have 25 or more, and 1 has 125. Just a few counties account for the bulk of executions. While the vast majority of US counties have not seen a single execution over

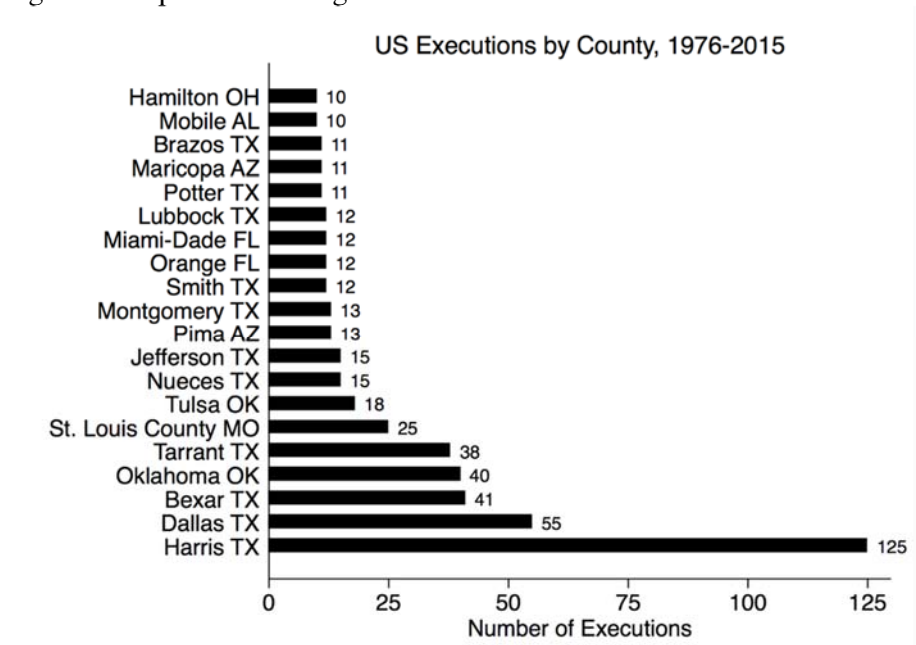
40 years, 2 have seen over 50 and one (Harris County, TX) has had more than 100.

Figure 2. Executions across Counties, 1977-2015.



The top executing counties are listed in Figure 3. Just twenty counties have executed 10 or more inmates in the 40 years of the modern death penalty, clearly documenting the high degree of concentration by geography.

Figure 3. Top 20 Executing Counties in the United States



Several points stand out starkly here. First is the high concentration of executions. If Harris County, TX, were a state, it would be second only to the rest of Texas in terms of executions.[16] Second, in over 40 years of modern experience with the death penalty, just 20 jurisdictions have executed as many as 10 individuals. Even in the top-use jurisdictions, spread over 40 years (and sometimes more than 10,000 accumulated homicides), executions are rare, unusual, and extraordinary events. Third, it is primarily a southern phenomenon; Cincinnati OH (Hamilton County) is the only place on the list outside of the south. In the next section, we consider whether these high-use execution jurisdictions are also distinctive by high rates or numbers of homicides.

B. A Few Counties, Many Executions

Table 2 shows the number of executions and homicides for counties with high and low numbers of executions. The table is limited only to counties in death-penalty states.[17] Almost 40 percent of the homicides,

16. *See supra* Figure 1. Oklahoma and Virginia have 112 and 111 executions, respectively.

17. There were no changes in the number of death-penalty states between 1984 and 2005, and the three states (RI, DC, MA) that abolished the death penalty relatively quickly after *Gregg*

and 50 percent of the US population, are in counties that have not executed a single individual in the past 40 years. The 20 counties that have executed 10 or more individuals, by contrast, have generated 35 percent of the executions, but account for just 12 percent of the homicides and nine percent of the population.

Table 2. Homicides, Executions, and Population by Number of Executions[18]

Counties with at least *x* executions (1977-2015)	Cumulative Number of Counties	Cumulative % of Total Executions (1977-2015)	Cumulative % of Homicides in states with DP (1984-2012)	Cumulative % of Population in states with DP (2010)
125 Executions	1	8.81	2.65	1.52
38 Executions	5	21.07	6.56	3.96
10 Executions	20	35.17	12.04	8.82
5 Executions	57	52.00	24.04	17.36
3 Executions	130	69.34	34.45	25.33
2 Executions	221	82.17	48.43	36.00
1 Execution	474	100.00	62.61	50.17
0 Executions	2,271	100.00	100.00	100.00

IV. COMPARING EXECUTIONS WITH HOMICIDES

In Figure Four, we present four identically formatted maps of the US. For each map, circles identify the counties with the highest counts, and the circles are proportionate in size to the underlying variable. Black dots show lower levels of each variable. States that had the death penalty available throughout most of the period are shaded with light gray; states that were abolitionist throughout the bulk of the period are shaded darker.[19] In the upper-left we show cumulative homicides from 1984 through 2012. Counties with fewer than 100 homicides are left blank; small dots represent those with 100 to 2,000 homicides; larger black dots identify counties with 2,001 to 4,000 homicides, and above that the circles are proportionate to the number of homicides.

v. Georgia, 428 U.S. 153 (1976) had no executions. Therefore, for the purpose of Table 2 (and Figure 4 below), we count as abolitionist those states that did not have the death penalty over the bulk of the modern period. Six states abolished between 2005 and 2015, and they are included among the retentionist states here.

18. Percent of total executions is calculated using the total number of executions between 1977 and 2015 excluding three federal executions.

19. This simply means that Illinois, New Jersey, New York, Connecticut, New Mexico, and Nebraska, which abolished after 2005, are listed as retentionist here.

Homicides are clearly centered in Los Angeles, Chicago, Detroit, and the Philadelphia-New York corridor.

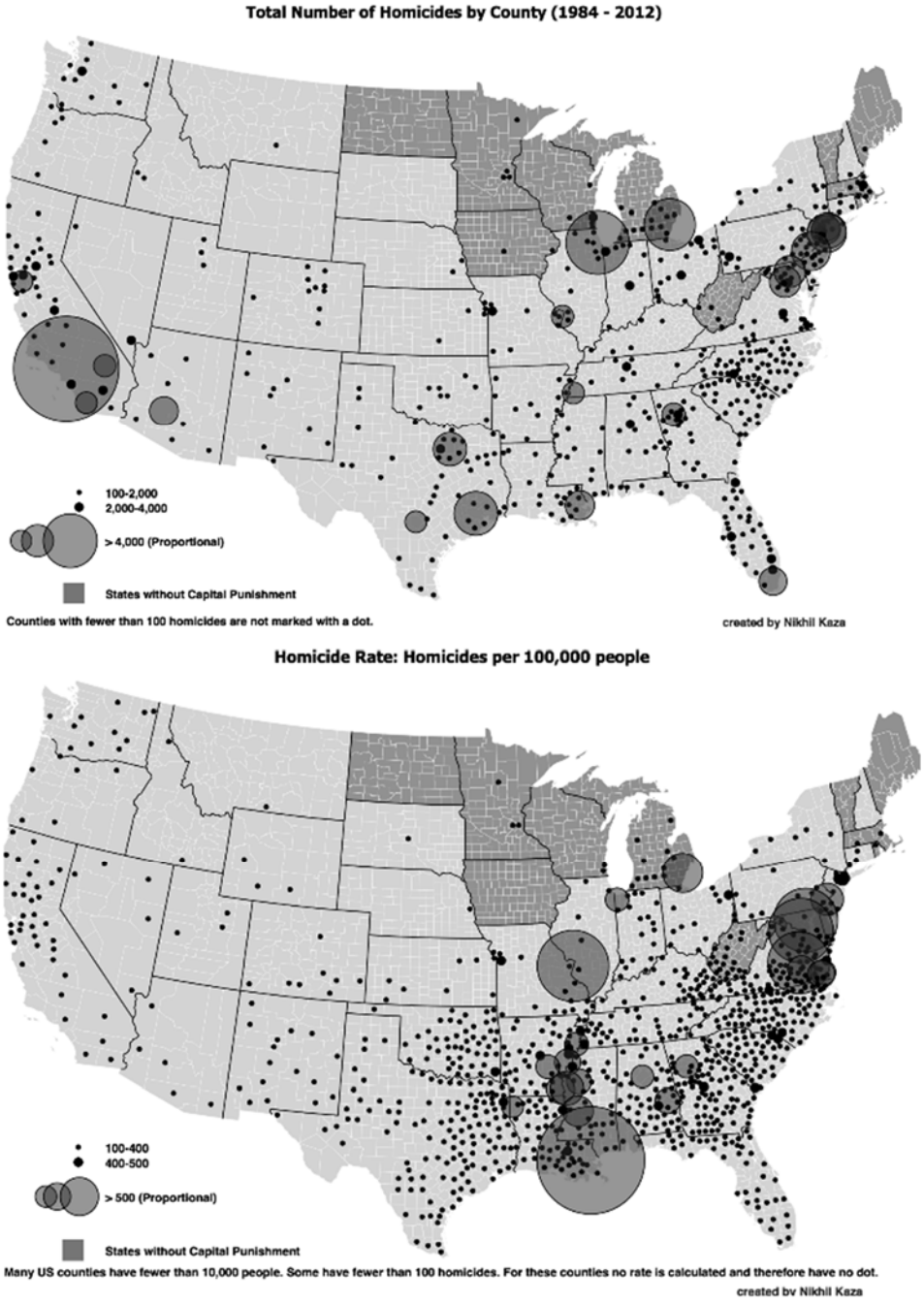
The next pane shows homicide rates per population. Here, we see New Orleans, St. Louis (city,), a corridor from Richmond, VA through Washington, DC, Baltimore, Philadelphia, to Newark, with Detroit and Chicago also identified. In the lower panes we see execution data. At the left, the number of executions per 1,000 homicides; here, we exclude counties with fewer than 100 homicides throughout the study period.[20] Execution rates are concentrated in two general areas: Texas / Oklahoma / St. Louis, and the Mid-Atlantic States. Finally, in the lower-right pane, we see the total number of executions, similar to what we presented in Figure 3 above. Texas, Oklahoma, Arizona, and Florida lead, with St. Louis, Mobile Alabama, and Cincinnati, also identified.

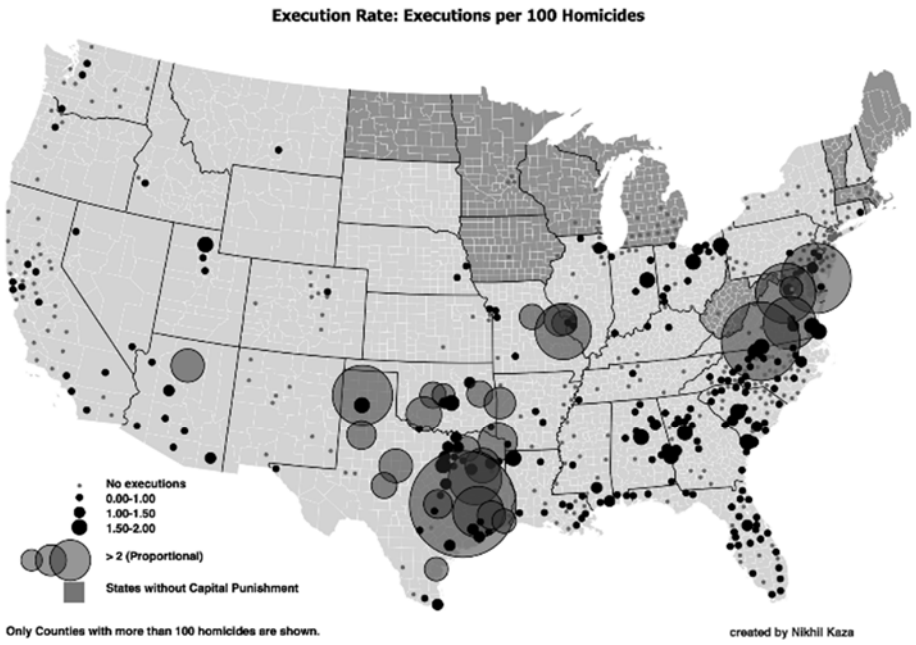
The maps in Figure 4 indicate a lack of correlation among the four variables displayed. As we have already shown,[21] executions are concentrated in a few places. But these places are not the same places where the most homicides have occurred.

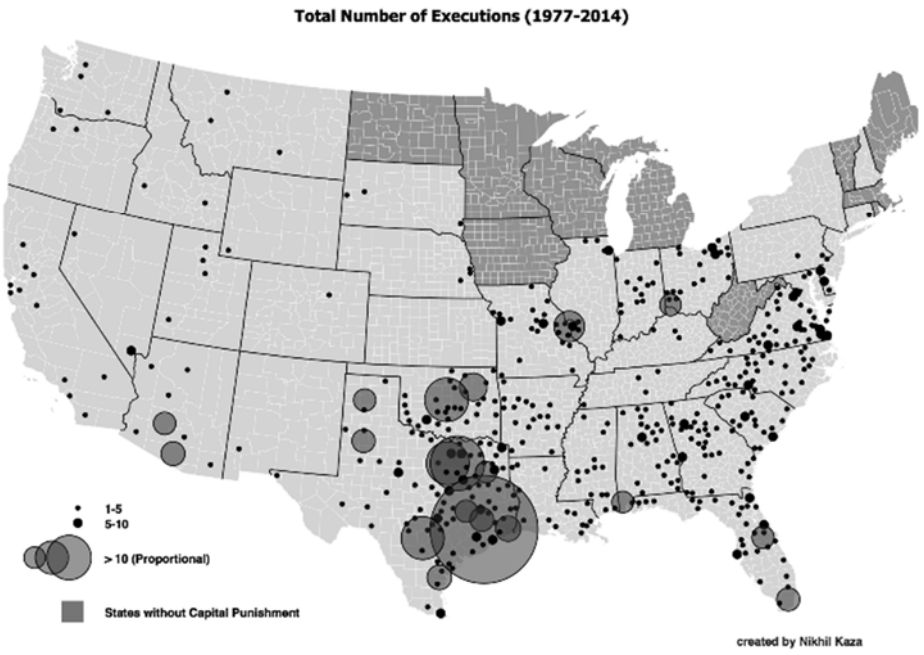
20. This omits a small number of executions that occurred in small jurisdictions. Calculating rates of execution per homicide in those units with fewer than, say, five homicides, generates extremely high values that make it difficult to compare with other cases, which are based on a larger baseline.

21. *See supra* Figures 1–3.

Figure 4. Homicides, Homicide Rates, Execution Rates, and Executions.




Execution Rate: Executions per 100 Homicides
No executions
0.00-1.00
1.00-1.50
1.50-2.00
> 2 (Proportional)
States without Capital Punishment
Only Counties with more than 100 homicides are shown.
created by Nikhil Kaza


Total Number of Executions (1977-2014)
1-5
5-10
> 10 (Proportional)
States without Capital Punishment
created by Nikhil Kaza

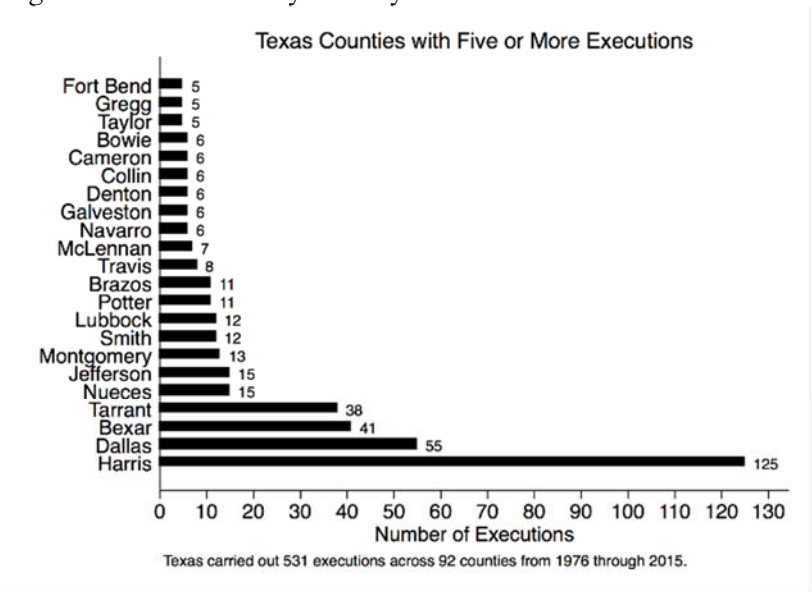
The maps presented in Figure 4 present a series of puzzles in the relation between homicides and executions. No county in Texas appears in the map showing areas with high rates of homicide, but the state is home to the greatest number of counties with the high execution levels. New Orleans, the parish with by far the nation's greatest homicide rate, is not in the list of high execution counties. In fact, no Louisiana parish is, though the state is part of the same Federal Circuit which has overseen the high number of Texas executions. The correlations among the four variables mapped are low: homicides to executions, 0.31; homicide rates to executions, 0.06; homicide rates to execution rates, -0.26. Clearly, there are no strong causal or statistical links tying homicides to executions, even in death states.

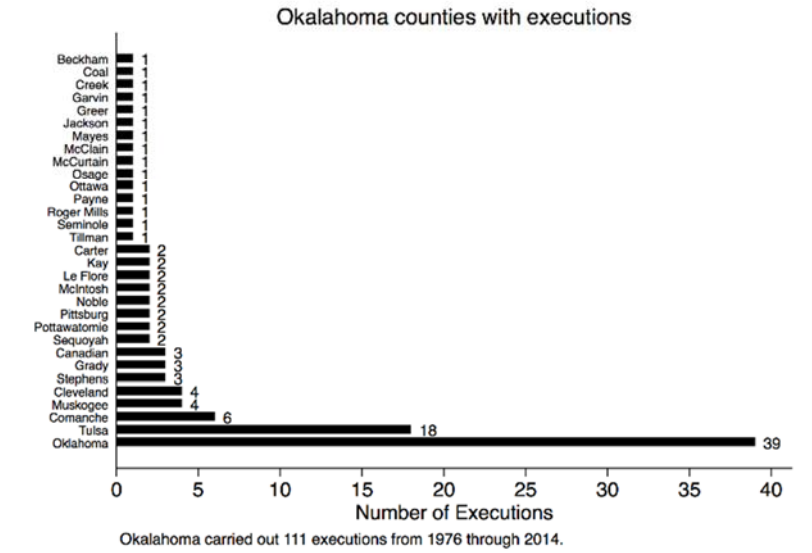
V. CONCENTRATION IS HIGH, EVEN WITHIN INDIVIDUAL STATES

The degree of concentration across counties that we observed in Figure 2 is apparent even within death-penalty states. Space prohibits a full listing for each state, but Figure 5 shows the distribution of executions across the 246 counties of Texas and the 77 of Oklahoma. Other states show remarkably similar distributions.[22]

22. A full set of distributions by county for each major executing state is available from the authors.

Figure 5. Executions by County in Texas and Oklahoma[23]





In no state with large numbers of executions is the distribution of executions closely connected to homicide numbers or homicide rates. Rather, a small set of jurisdictions within the state "go for death," while

23. 162 counties in Texas had no executions, 63 counties had fewer than 5 and 21 had 5 or more. In Oklahoma, 46 counties had no executions, with 31 counties having one or more.

many others do not. We can illustrate this with a few particular comparisons. Table 3 shows the same data as in Table 1 above for selected comparisons: St. Louis City and County, Orleans and Jefferson Parish, and Baltimore City and County.

Table 3. Paired Comparisons of Homicides and Executions in Six Jurisdictions

County	Population (2010)	Homicides (1984-2012)	Executions (1976-2015)	Homicides per 1,000 population	Executions Per 100 Homicides
St. Louis County	998,954	1,008	25	1.01	2.480
St. Louis City	319,294	4,462	8	13.97	0.179
Orleans Parish	343,829	7,040	4	20.48	0.057
Jefferson Parish	432,552	1,340	4	3.10	0.299
Baltimore County	805,029	864	4	1.07	0.463
Baltimore City	620,961	7,846	0	12.64	0.000

St. Louis City, like Baltimore City, has a high homicide rate, particularly compared to its surrounding outlying county. In fact, there were more than four times as many homicides in the city of St. Louis than in the county. However, the county had twenty three executions, whereas the city had eight. Similarly, Baltimore City has had almost ten times the number of homicides as the county, but has had no executions compared to four for the county. In Louisiana, both Orleans and Jefferson Parish have had the same number of executions, but Orleans Parish has almost seven times the homicide rate, and indeed has the highest homicide rate in the nation. If the executions do not follow the homicides, even within states that use the death penalty, it raises the question of what is driving them.

Donohue[24] has shown geographic disparities in the use of the death penalty in his comprehensive study of Connecticut, and similar findings have come from other scholars and are cited throughout the legal

24. John J. Donohue III, *An Empirical Evaluation of the Connecticut Death Penalty System Since 1973: Are There Unlawful Racial, Gender, and Geographic Disparities?*, 11 J. OF EMPIRICAL LEGAL STUDIES 637 (2014).

literature.[25] Scheidegger[26] and others (including Justice Thomas), have suggested that "local control" is exactly what the framers desired, and that much of the difference between the cities of St. Louis or Baltimore and their surrounding counties, might be related to public opinion or race.[27] Why Houston, Texas is the nation's leader in executions is clearly not explained by this logic. Public opinion polls in Houston suggest that support there is lower than the state-wide average for Texas. According to a *Houston Chronicle* poll from 2002, in response to the question, "Do you support or oppose the death penalty?" Harris county residents responded "oppose" at a rate of 30.8, compared to 21.9 of Texas residents, and 28.2 percent of US respondents.[28] In other words, Harris county public opinion was statistically indistinguishable from the national average, and significantly below the rest of the state. Yet, their use of the punishment is the highest within both Texas and the entire US. While scholars such as Scheidegger and Justice Thomas suggest that local variation is a desirable, a planned result of the jury

25. *See generally* David C. Baldus et al., Equal Justice and the Death Penalty: A Legal and Empirical Analysis (Northeastern Univ. Press 1990); Raymond Paternoster et al., An Empirical Analysis of Maryland's Death Sentencing System with Respect to the Influence of Race and Legal Jurisdiction, Final Report (2003), http://www.aclumd.org/uploaded_files/0000/0377/md_death_penalty_race_study.pdf; Raymond Paternoster et al., *Justice by Geography and Race: The Administration of the Death Penalty in Maryland, 1978-1999*, 4 U. Md. L.J. Race Religion Gender & Class 1 (2004); McCleskey v. Kemp, 481 U.S. 279 (1987).

26. *See generally* KENT S. SCHEIDEGGER, MEND IT DON'T END IT: A REPORT TO THE CONNECTICUT GENERAL ASSEMBLY ON CAPITAL PUNISHMENT (2011), http://www.cjlf.org/deathpenalty/ConnDPReport2011.pdf; KENT S. SCHEIDEGGER, MARYLAND STUDY, WHEN PROPERLY ANALYZED, SUPPORTS DEATH PENALTY (2003), *available a*t http://www.cjlf.org/deathpenalty/MdMoratorium.htm.

27. Justice Thomas's concurrence in *Glossip* disputed the validity of the Donohue study, in particular its assessment of egregiousness of the underlying crimes, and argued that only juries can make such a determination. *Glossip v. Gross*, 135 S.Ct. 2726, 2752–53 (2015) (Thomas J., concurring). His defense of the jury as the ultimate arbiter of death worthiness suggests no limits to geographical variation allowed. *Id.* He writes that geographical variation cannot be used as evidence of arbitrariness because the constitutional provisions that "place such decisions in the hands of jurors and trial courts located where 'the crime shall have been committed,' seem deliberately designed to introduce that factor" (e.g., that of geographical variation in outcomes). *Id.* In a critique of Paternoster's analysis of the Maryland death penalty (2003, 2004), which focused on geographical disparities, Scheidegger wrote: "The study calls the variation by county 'geographic disparity.' I call it local government." SCHEIDEGGER, *supra* note 26, at http://www.cjlf.org/deathpenalty/MdMoratorium.htm. Scheidegger continues, this time with regards to race: "If the numbers are correct, they indicate that the death penalty is not being invoked often enough in the predominately African-American areas of Maryland, to the detriment of crime victims in those areas." *Id.* His point in general is that white and black communities elect district attorneys who may have different degrees of enthusiasm for the death penalty, and that this local variation is a desirable reflection of local political values rather than a threat to equal enforcement of the law. *Id.*

28. *Chronicle Poll*, HOUSTON CHRONICLE (December 31, 2002), http://www.deathpenaltyinfo.org/ harrissupportdp.pdf.

system, and that by which district attorneys are elected in local elections, the degree to which the use of the death penalty corresponds to local desires has not been demonstrated. Houston, Texas does not have levels of support for the death penalty hundreds of time higher than other cities around the country. Therefore, its high number of executions cannot logically be explained by local preference.

VI. CONCENTRATION IN THE MODERN PERIOD IS HIGHER THAN IN PREVIOUS PERIODS OF HISTORY

A. Comparisons to Previous Periods in History

In previous historical periods, the death penalty was not as concentrated in any particular state, nor was it particularly a southern phenomenon. In the modern era, the geography of the death penalty has become highly focalized in particular places, and increasingly southern. We can see this with some simple graphics showing the distribution of executions by state for different historical periods. The Espy File provides comprehensive data on all judicial executions since 1608.[29] Figure 6 shows the distribution by state of all 14,489 executions carried out by judicial authorities through 1976. Part B of the figure shows the total numbers for the ten states with the highest totals.[30]

29. *See Espy File*, *supra* note 11.

30. The data for previous historical periods identify the executions by the legal jurisdiction that carried them out, using the Espy File, *id.*, variables for state as well as for the jurisdiction. All territorial, state, and Indian jurisdictions are listed by the state in which the execution took place. *See infra* Figure 6 (Listing "Federal" (343 executions) and "Other-Military" (1,206 executions) with the acronyms "FE" and "MIL"); Figure 7 (excluding these non-state jurisdictions).

Figure 6. All US executions, 1608 through 1976.

A. All States

B. Top executing states only

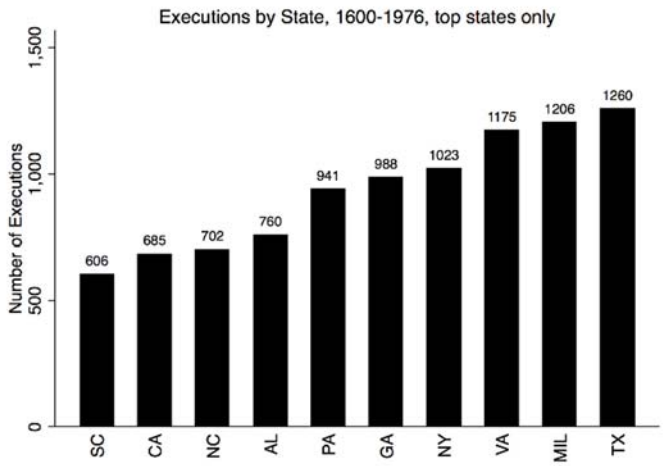
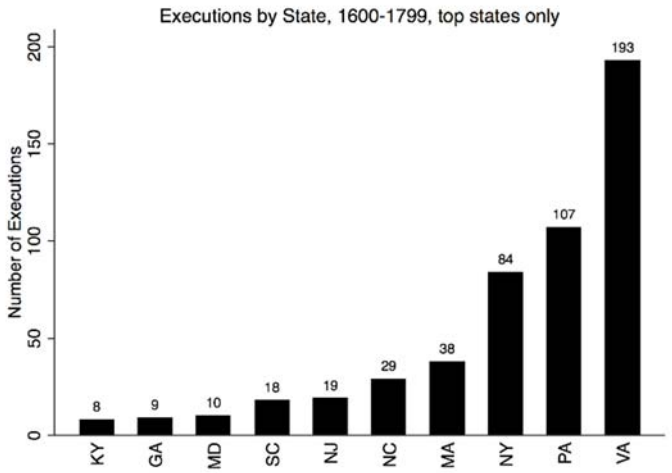


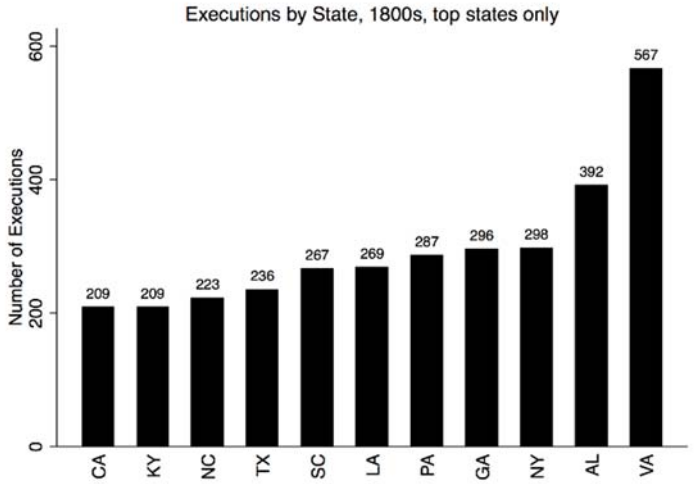
Figure 7 shows identically formatted figures to Part B. of Figure 6, above, for each of four different historical periods: the earliest period available, before 1800, the 1800s, the 1900s through Furman, and the modern period.

Figure 7. Top executing states in different historical periods.

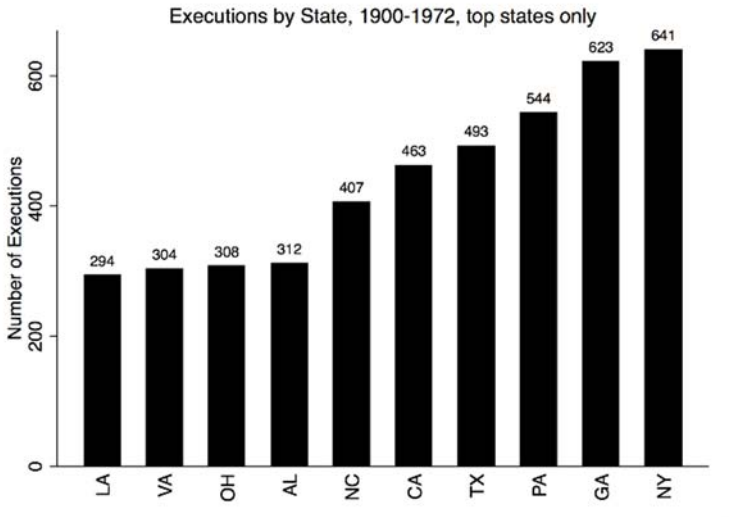
A. 1608-1799



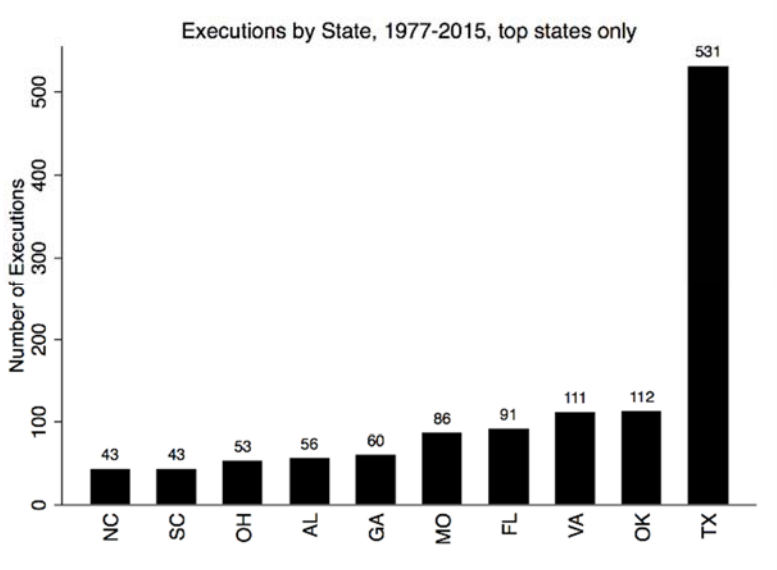
B. 1800s



C. 1900 through 1976.



D. Modern period (1977-2015)



In no period in American history has the death penalty been as highly concentrated as in the modern period. Table 4 compares the early twentieth century (through the *Furman* decision) with the modern death penalty. It also calculates a commonly used indicator of "market concentration," the Herfindahl-Hirschman Index, reflecting the degree of concentration of the observations in a single or a few categories as opposed to a more equal spread across many.[31] The index moves from a value of 0.046 to 0.168, a dramatic increase in the "market concentration" of executions in just a single state: Texas. Figure 7-C and Table 4 make clear that the death penalty was once spread across many jurisdictions, but this is no longer the case.

31. *See generally* Amber E. Boydstun et al., *The Importance of Attention Diversity and How to Measure it*, 42 POL'Y STUD. J. 173 (2014) (explaining measures of concentration).

Table 4. Executions by State, 1900 through 1972 compared to the modern period[32]

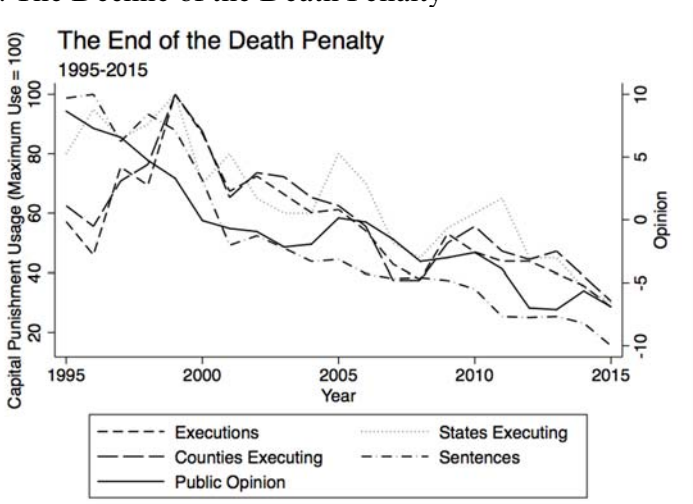
State	1900-1972	1977-2015	State	1900-1972	1977-2015
AL	312	56	NE	20	3
AK	8	0	NV	41	12
AZ	74	37	NH	3	0
AR	247	27	NJ	187	0
CA	463	13	NM	34	1
CO	65	1	NY	641	0
CT	65	1	NC	407	43
DE	25	16	ND	5	0
DC	0	0	OH	308	53
FL	266	91	OK	92	112
GA	623	60	OR	68	2
HI	42	0	PA	544	3
ID	9	3	RI	0	0
IL	203	12	SC	278	43
IN	70	20	SD	4	3
IA	28	0	TN	178	6
KS	15	0	TX	493	531
KY	202	3	UT	31	7
LA	294	28	VT	8	0
ME	0	0	VA	304	111
MD	111	5	WA	82	5
MA	65	0	WV	91	0
MI	0	0	WI	0	0
MN	7	0	WY	15	1
MS	244	21	FE	111	3
MO	107	86	MIL	26	0
MT	39	3			
Total	7,555	1,422			
HHI	0.046	0.168			

32. FE = Federal. MIL = "Other or Military" as listed in Espy and Smylka (2005). HHI is the Herfindahl-Hirschman Index, a common measure of "market concentration" based on the simple formula of the sum of squared proportions of observations across categories. All observations from the same category would have a value of 1.00; observations spread throughout 53 categories would have a value of 0.0189. In the early part of the twentieth century, the data show that executions were much more spread out across many jurisdictions as compared to the modern period, as reflected in the index values of 0.046 compared to 0.168.

B. Concentration has increased even more sharply since 1995

In the period of the decline of the death penalty (roughly since the mid- to late-1990s), its geographical concentration has only increased. In 1999, 98 executions were carried out by 72 counties across 20 states.[33] By 2015, these numbers had declined to 28, 22, and 6.[34] Figure 8 demonstrates the increased concentration of the death penalty in the past 20 years. The capital punishment usage series are all scaled to be compared to their maximum historical value during the 1977-2015 period, which is assigned a value of 100. The public opinion index is in relation to its value (scored as zero) in 1976. All the usage series decline to 20-40 percent of their maximum values.

Figure 8. The Decline of the Death Penalty



C. The focus on the South is greater now than in earlier periods

The modern death penalty is almost purely a southern phenomenon, whereas states such as Pennsylvania, Massachusetts, New York, California, Florida, and Illinois were among the top users in some previous historical periods.[35] Stuart Banner (2002) and David Garland (2012) make clear many of the reasons for this, including (for Banner) the different types of crimes punishable by death in the north

33. *See generally Searchable Execution Database*, DEATH PENALTY INFORMATION CENTER, http://www.deathpenaltyinfo.org/views-executions.

34. *See id.*

35. See *supra* Figure 7.

and south and (for Garland) the visceral reaction in southern state legislatures to the 1972 *Furman* decision, coming as it did on the heels of other landmark Supreme Court decisions threatening "traditional values."[36] Figures six and seven show that the modern death penalty has ceased to be an "American" punishment and is now almost purely a southern one.[37] Prominent northern states such as New York and Massachusetts no longer have the death penalty, and Pennsylvania rarely executes (though it sentences many to death). This leaves only Ohio among northern states with high numbers of executions. Whether the northern states have formally abolished (a group which includes previously high-use states such as Massachusetts, New York, and Illinois), or whether they have simply allowed their death penalty systems to become moribund (as in Pennsylvania, which has executed only three volunteers since 1976), the northeastern part of the country has virtually abandoned executions in the modern period.

VII. THE POWER-LAW OF DEATH

A "power-law" distribution is one with a great number of observations far in the tails, and can be contrasted with the more familiar "bell curve" or "normal" distribution. The Central Limit Theorem can be used to show that for any reasonably large number of factors, the combination of several of them will have a normal or bell-curved shape.[38] In the context of the geographical distribution of executions, a simple application of this would be to imagine that several things must come together, in sequence, for an execution to occur. Let us think of these as stages or steps in a process. The steps can be simplified as: 1) A death-eligible homicide occurs and an offender is arrested. 2) The district attorney seeks death. 3) Defense attorneys are assigned and do their work. 4) A judge and 5) a jury are assigned or selected to hear the case and do so. Finally, 6) appellate courts may uphold or overturn a death sentence previously imposed.

If we imagine that each geographical unit in the US judicial system could randomly have variation in how many death-eligible homicides occur, in how likely the D.A. is to seek death, in the qualifications and compensation scheme used for defense attorneys, in the predilections

36. *See* DAVID GARLAND, PECULIAR INSTITUTION: AMERICA'S DEATH PENALTY IN AN AGE OF ABOLITION 231–55 (Cambridge: Harv. Univ. Press 2012).

37. See *supra* Figure 7 and Table 4.

38. The Central Limit Theorem is one of the most widely used concepts in probability theory. *See, e.g.*, HUBERT M. BLALOCK JR., SOCIAL STATISTICS 183 (McGraw-Hill rev. 2d. ed. 1979).

and biases by juries and judges, and in the likelihood that appellate courts will uphold a death sentence, then we would expect a normal distribution in the variability in executions across space. The Central Limit Theorem would dictate that a combination of many elements, each occurring randomly, would generate a normal distribution. But in fact, we do not see this; rather, we see a power-law distribution in executions across space.

What process could generate a power-law rather than a normal distribution? Rather than being independent from each other, and randomly selected, what if each element in the stages referred to above were correlated with each other? That is, what if D.A.'s sought death not randomly, but only if they thought they could win? A power-law distribution can be generated by a process of self-reinforcement, but never by a series of independent factors working in isolation and coming together by random combination, (by the Central Limit Theorem, as explained in the previous paragraph).

Compare the distribution of height in society with the distribution of wealth.[39] Some people are taller than others, and some are wealthier. But we know intuitively that height is distributed as a bell curve, whereas wealth is not. In fact, wealth is a power-law distribution. If height were a power-law, we would not be surprised to see individuals who were 15 feet tall, and it would not be completely unheard of to see individuals who were 150 feet tall. Of course, this is absurd, but we know that wealth is indeed distributed in a manner unlike height. While most people fall within some range close to the overall average, there are particular individuals who possess thousands of times more money than average. Such is the difference between a process described by a bell-curve and a power-law.

Power-law distributions are not uncommon, but they must stem from a process that creates a "rich-get-richer" effect.[40] Sometimes, this is referred to as "preferential attachment." For example, the distribution of links across the World Wide Web have been shown to be a power-law: very few sites link to the vast majority of sites, but some sites have thousands or millions of incoming links.[41] If one is

39. Italian economist Vilfredo Pareto was perhaps the first, in 1896, to document that the distribution of wealth in societies tends to follow a power-law distribution. This is sometimes referred to as a Pareto-distribution for this reason. VILFREDO PARETO, LA COURBE DE LA REPARTITION DE LA RICHESSE 1–5 (G. Busino ed. & trans., Libairie Droz 1975).

40. *See* BAK, *supra* note 7; *Small Worlds*, *supra* note 7; *Six Degrees*, *supra* note 7; BARABASI, *supra* note 7.

41. *See* DAVID EASLEY & JON KLEINBERG, NETWORKS, CROWDS, AND MARKETS:

thinking of designing a web site and wants to link to other useful sites, one is likely to link to sites that are already popular. Thus, one will preferentially choose to link (attach) to those sites that are already bigger.[42] A preferential attachment process, working successively over time, generates a power-law distribution. [43] If individuals randomly selected where to link (that is, with no regard to how helpful, well-known, or useful the links might be), then the resulting distribution would be the familiar bell-curve: some would have randomly more and some randomly fewer, but no large differences would result.[44]

One could understand that across counties, executions, or executions per homicide, would not follow a clear mathematical formula linking them to homicides. Some homicides are more heinous than others, some jurisdictions might have randomly had a few more egregious ones, some juries may inexplicably have reached a verdict of death in a case that might surprise, or some may have done the opposite. All these are reasons to expect that any relation between homicides and executions should not be a perfect one.

If the distribution of executions across jurisdictions follows a power-law, it suggests that there must be some kind of self-reinforcing, "rich-get-richer process" generating the distribution. Such a distribution simply cannot occur as a result of a process of uncorrelated decision-making. On the other hand, it could easily be the case if local legal cultures develop separately, each focusing on their own history, rather than how they relate to surrounding or other jurisdictions, even within the same state.

Imagine the prosecutor's decision-making process when faced with a horrific murder in a jurisdiction where 25 executions have already been carried out. A number of factors suggest seeking death again: previous homicides where executions occurred may not have been as horrendous as this one; he knows juries will support it; he knows he has

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REASONING ABOUT A HIGHLY CONNECTED WORLD 543 (Cambridge Univ. Press 2010).

42. *Id.*

43. *Id.*; Moshe Adler, *Stardom and Talent*, AM. ECON. REV. 208–12 (1985).

44. *See generally Small Worlds*, *supra* note 7; *Six Degrees*, *supra* note 7; BARABASI, *supra* note 7 (describing power-law distributions and what creates them); BRYAN D. JONES & FRANK R. BAUMGARTNER, THE POLITICS OF ATTENTION: HOW GOVERNMENT PRIORITIZES PROBLEMS (Univ. of Chicago Press 2005); Bryan D. Jones et al., *A General Empirical Law for Public Budgets: A Comparative Analysis,* AM. J. POL SCI., 855–73 (2009) (applying power-law distributions to government budgets); BAK, *supra* note 7 (discussing examples of power-law distributions in the physical world); Thomas A. Smith, *The Web of Law* (UCSD Law and Econ. Research Paper Series, Paper 8, 2005) http://digital.sandiego.edu/lwps_econ/art8 (discussing the distribution of legal citations, which also corresponds to a power-law, as there are many legal cases rarely cited, but only a few which generate thousands of citations).

the staff to follow through; and he knows judges and appellate courts will condone it. Compare this to the same homicide in a jurisdiction that has yet to carry out a single execution: was this the single most horrendous murder ever in the history of that jurisdiction? Will a jury return a verdict of death? Will a judge and appellate courts, for the first time in history, allow the verdict to stand? The two jurisdictions self-separate into high and low users of the death penalty. In any case, what we observe in the distribution of executions across jurisdictions is consistent with this "rich-get-richer" phenomenon of self-reinforcement.[45]

Figure 1 showed the extremely sharp gap between Texas and every other death-penalty state, and the high concentration of executions in just a few states. A power-law distribution fits the equation $N(s) = s^{-k}$ when N(s) is the cumulative frequency of an event with size *s*, and *k* is a constant to be estimated.[46] Taking the log of each side of that equation leaves $\log N(s) = -k \log(s)$.[47] If the relationship is a power-law, then the relation between the *log* of the cumulative frequency of the event will be a linear function of the *log* of the size of the event. Thus, a simple test of a power-law distribution is to plot the size of the event against the cumulative frequency of events of that size, using a logarithmic scale for both the x and the y axis in the figure.[48] A log-log plot of cumulative frequency of events of different sizes constitutes a simple test of a power-law distribution, and the test is to see if the data array on a straight line.

Figure 9 presents a log-log presentation of the same distribution that was presented in Figure 1; executions across the 50 states. The fact the states array on a straight line when both the frequency and the value of the execution variable are logged demonstrates the relationship a power-law. Figure 10 shows the same across the counties of the US. Figure 11 shows similar data within the top two death states, Texas and Oklahoma. Finally, Figure 12 shows that this phenomenon also occurs when looking at the international distribution of executions across the countries of the world. In every case, the vast majority of jurisdictions abstain completely, but a few generate very high values indeed.

45. In work in progress, Lee Kovarsky of the University of Maryland Law School refers to this as the "muscle memory" of a local legal community. *See* Lee Kovarsky, *The Local Concentration of Capital Punishment*, 66 DUKE L. J. __ (forthcoming 2016).

46. *See* BAK, *supra* note 7.

47. *See id.*

48. *See id.* at 1–32.

Figure 9. The Distribution of Executions across US States, 1976-2015

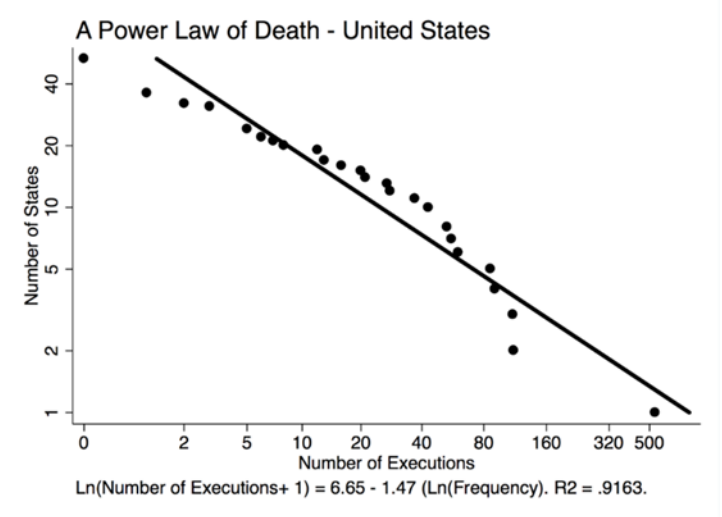


Figure 10. US Counties

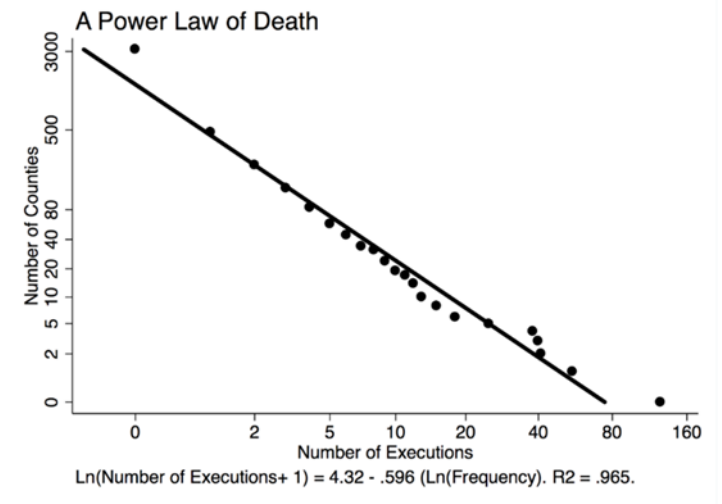
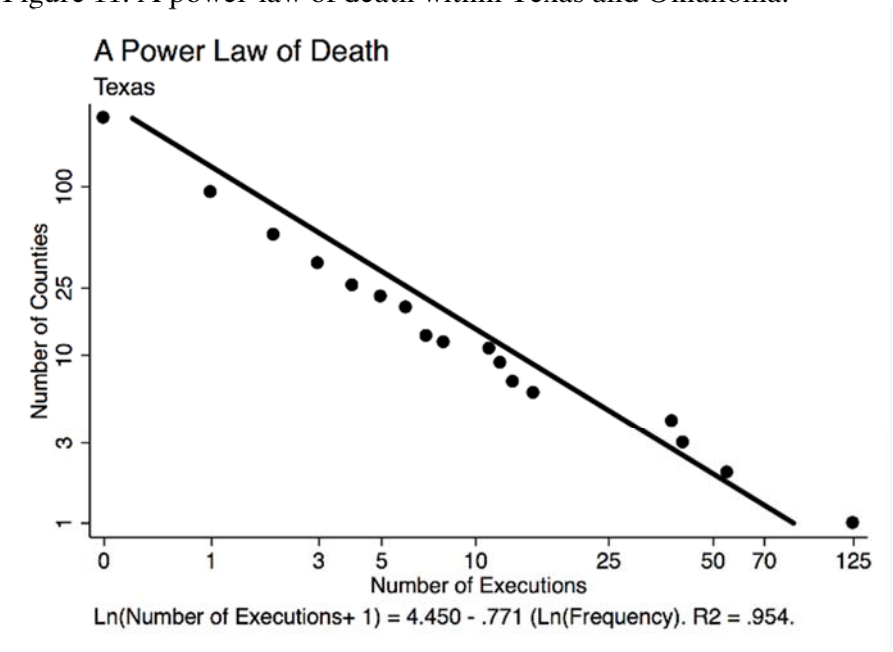


Figure 11. A power-law of death within Texas and Oklahoma.



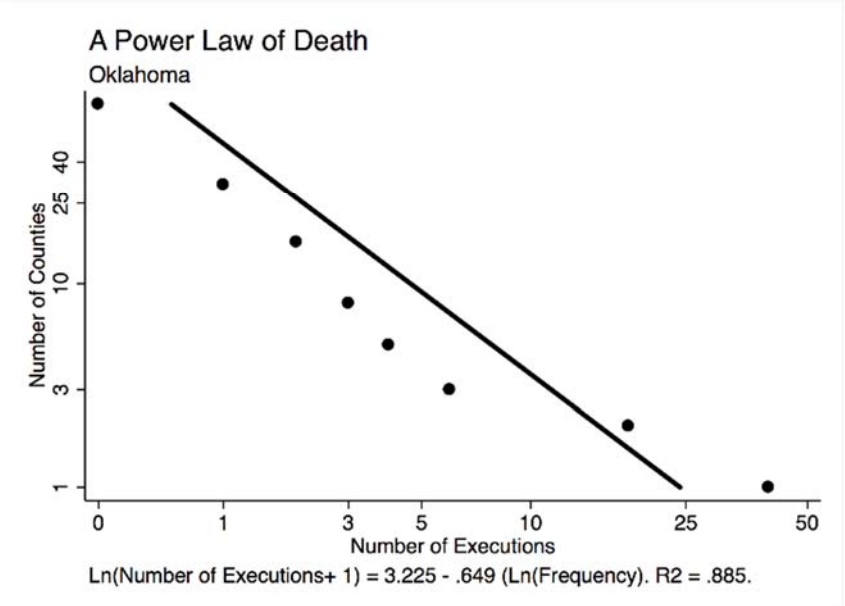
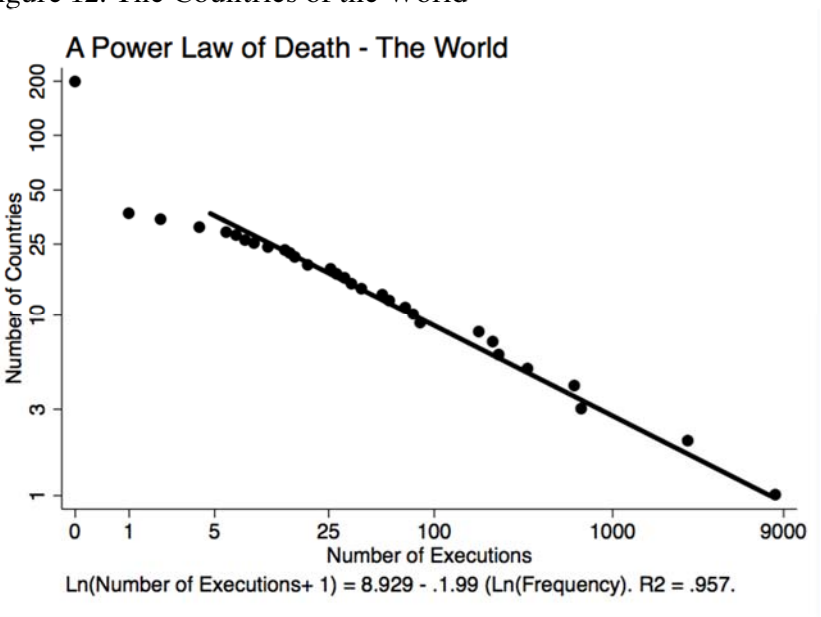


Figure 12. The Countries of the World[49]



We demonstrated in Part IV of this article that executions are not correlated with homicide rates, and only weakly correlated with homicides. Now, we have an understanding of why this could be the case. Over time, local jurisdictions have separated out into those areas which never execute, in spite of significant numbers of homicides, and those which much more often carry out executions. These differences are more related to the number of executions previously carried out in the same jurisdiction, leading to shared expectations by all the decision-makers involved, than they are related to the egregiousness of the underlying crime. Such a pattern is not consistent with equal justice.

CONCLUSION

Previous research has already documented that the geography of the death penalty is highly skewed.[50] Our analysis of the broader statistical patterns suggests not only is the concentration very high, but that it is an illustration of unconstitutional levels of arbitrariness. It corresponds to a pattern of purely random start and then self-

49. Country-level data come from annual Amnesty International reports and cover the period of 2007 to 2014, with 197 countries included, and 38 having one or more executions across the time period.

50. *See, e.g.*, Dieter, *supra* note 8; Donohue, *supra* note 24, at 637; Baldus et al, *supra* note 25; Paternoster et al., *supra* note 25.

reinforcement. The correlation between homicides and executions, even within states, is so low as to call into question any linkage between crime and punishment. Rather, we have a self-reinforcing and arbitrary development of legal norms developing independently of those in other jurisdictions. Any system with self-correcting or even statistically uncorrelated actors deciding based on their own independent assessments of "the merits" would produce a distribution of executions across geographic units with something closer to a normal distribution than what we observe. Because we see a power-law distribution of executions across localities, and because this is so consistent no matter at what scale we consider the data (e.g., by state, by county, or across the countries of the world), we must then question what could possibly generate such an extremely skewed distribution. As this question has been extensively researched in other areas of knowledge, we can look to the common elements of what they have found: it must involve a system of self-reinforcement. What that means in the context of executions is troubling, however. If the location where the crime occurs is a better predictor of one's chances of execution than the heinousness of the underlying crime, this cannot be acceptable on constitutional or abstract moral grounds.