

Problems Using Aggregate Data to Infer Individual Behavior: Evidence from Law, Finance, and Ownership Concentration

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ABSTRACT

Cross-country comparisons in finance use two distinct approaches. Some analyze country averages; others analyze the underlying firm-level data. The influential finding of an inverse relation between the law and ownership concentration is shown to be spurious because country averages have produced misleading results. When data from existing studies is used on a firm basis, the relation between the Anti-Director Rights Index and ownership concentration changes sign, while those involving legal origins and the Anti-Self-Dealing Index lose all significance. The results change because country averages do not control for firm-specific influences, such as firm size, and because firms from tiny countries are over weighted. The use of country averages instead of the underlying firm data is unnecessary and requires implausible assumptions. Other individual and firm-level inferences will also be unreliable when the supporting tests are based on country aggregation.

Keywords: Aggregation bias, Law and finance, Ownership concentration.

JEL Codes: C18, G15, G32, G34.

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Many influential studies in finance and beyond compare firms and markets across countries. Much of this research can be traced to the seminal work of La Porta, Lopez-de-Silanes, Shleifer, and Vishny (LLSV) (1998). LLSV showed that investors' legal protections can be measured and that the laws of different nations often share common characteristics. These common characteristics, in turn, help explain important similarities and differences in firms and markets around the world.

The voluminous literature that followed can be divided into two parts. One part studies why countries have different laws. An example would be Djankov *et al.*'s (2008a) study of the debt enforcement laws and procedures of 88 countries. The other and larger literature compares firms across countries. An example would be LLSV's (2000) study of dividend policies or Faccio's (2006) study of political connections around the world.

There is a rarely discussed—indeed hardly noticed—split in how researchers seek to explain differences in firms or individuals across countries. Some papers form country averages of a particular characteristic, such as the use of internal rather than external financing. These country averages are then used as the dependent variable in any empirical analysis. Other papers use the underlying firm observations as the unit of analysis. Table 1 summarizes this split in the literature. None of these papers discuss their decision to go one route or the other. Yet, my paper shows that these differences are not innocuous but are often critical to their results.

I illustrate the fundamental differences between individual data analysis and aggregate data analysis with an influential finding from the law-and-finance literature, the inverse relation between legal protections for public market investors and the ownership concentration of public corporations. Understanding why ownership concentration varies around the world is central to the paper that launched the law-and-finance literature, LLSV (1998), and also to La Porta, Lopez-de-Silanes, and Shleifer (LLS)

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Country Averages	Both Averages and Individual Observations	Individual Observations
La Porta <i>et al.</i> (1998) (ownership concentration; also the nine other papers on the same topic noted in Table 2)	Nenova (2003) (dual class stock)	La Porta <i>et al.</i> (2000) (dividend policy)
La Porta <i>et al.</i> (2002b) (government ownership of banks)	Dittmar <i>et al.</i> (2003) (corporate cash holdings)	La Porta <i>et al.</i> (2002b) (market-to-book ratio)
Kumar <i>et al.</i> (2001) (firm size)	McLean <i>et al.</i> (2012) (firm investment and financing)	Rajan and Zingales (1995) (capital structure)
Rajan and Zingales (2003) (stock market development)	Dyck and Zingales (2004) (block premiums)	Durnev and Kim (2005) (corporate governance and disclosure practices)
Griffin <i>et al.</i> (2007) (stock trading)		Doidge <i>et al.</i> (2007) (corporate governance) Fan <i>et al.</i> (2012) (capital structure)
Booth <i>et al.</i> (2001) (capital structure)		Esty and Megginson (2003) (loan syndicates)
Demirguc-Kunt and Maksimovic (1998) (internal versus external financing)		Kalcheva and Lins (2007) (corporate cash holdings)
Demirguc-Kunt and Maksimovic (1999) (debt maturity)		Qian and Strahan (2007) (bank loans)
Wurgler (2000) (firm capital investments)		Dahya <i>et al.</i> (2008) (corporate governance and firm value)
Faccio (2006) (political connections)		Khorana <i>et al.</i> (2009) (mutual fund fees)

Table 1: Split in the Literature on the Choice of Dependent Variables.

Description: Summary of the type of dependent variables used in a broad but non-exhaustive array of papers. When averages are used as the dependent variable, individual data are used to calculate the averages.

Interpretation: Researchers use two fundamentally different methodologies to study individual-level topics. There is little, if any, discussion in these papers of this methodological choice.

(1999, 2006, 2008), Beny (2005), Stulz (2005) (Presidential Address to the American Finance Association), Li *et al.* (2006), Roe (2006), Djankov *et al.* (2008b), and Mueller and Philippon (2011). These papers, which are summarized in Table 2, all use country averages to find an inverse relation between investors' legal protections and ownership concentration. The papers provide the empirical foundation for the now-influential proposition

	Analyses of Country Averages Only	Firm-Level Controls in Regressions	Conclusion
La Porta <i>et al.</i> , 1998	Yes	None	Ownership concentration is lower in common law countries and when shareholders have strong legal rights to sue corporate directors (Anti-Director Rights Index, Original).
La Porta <i>et al.</i> , 1999	Yes	No Regressions*	Same as above.
Beny, 2005	Yes	None	Concentration is lower in countries with strong legal prohibitions on insider trading.
Stulz, 2005	Yes	None	Concentration is lower when the threat of expropriation by the government is lower and when shareholders have strong legal rights to sue corporate directors (Anti-Director Rights Index, Original).
La Porta <i>et al.</i> , 2006	Yes	None	Concentration is marginally lower with disclosure requirements of securities laws; after controlling for disclosure, the Anti-Director Rights Index, Original is found to be unrelated to ownership concentration.
Li <i>et al.</i> , 2006	Yes	None	Financial institutions own more stock as Anti-Director Rights Index, Original increases.
Roe, 2006	Yes	None*	Ownership concentration is lower when shareholders have strong rights to sue corporate directors (Anti-Director Rights Index, Original) and when the country was at peace during the 20 th century.
Djankov <i>et al.</i> , 2008b	Yes	None	Concentration is lower with ex-post private controls on self-dealing by corporate insiders; this Anti-Self-Dealing Index is seen as superior to the Anti-Director Rights Index, Revised.
La Porta <i>et al.</i> , 2008	Yes	None	Ownership concentration is lower with the Anti-Self-Dealing Index.
Mueller and Philippon, 2011	Yes	None	Families own less stock when national labor relations are good and when the Anti-Director Rights Index, Revised increases.

Table 2: Summary of the Literature on Ownership Concentration around the World.

Note: *Some analyses are conducted only with medium-sized firms.

Description: Published papers that analyze the relation between investors' legal protections and the ownership concentration of public corporations.

Interpretation: There is a homogeneity to the published papers in that all analyze country averages of ownership (not firm observations) and all, consequently, fail to include any firm-level controls in regressions.

that large-percentage shareholders are a response to weak legal protections for public market investors.

My paper shows that inferences change when the unit of analysis is the underlying individual-firm observations. There are three good reasons not

to aggregate:

1. Country averages cannot control for firm-level determinants.
2. Country averages weight firms differently depending on the composition of the database used.
3. Country averages distort standard errors by eliminating all within-country variation in ownership, creating a misleading impression with artificial clustering.

My paper illustrates how country averages and the underlying individual observations can produce very different results. It analyzes three measures of investors' protection that are central to a broad literature (not just the law-and-ownership literature): (A) the rights of shareholders to sue corporate directors (the Anti-Director Rights Index of LLSV); (B) a common-law legal origin; and (C) legal prohibitions on self-dealing by corporate insiders (the Anti-Self-Dealing Index of DLLS). I confirm the existing-literature finding that there is a statistically significant inverse relation between each of these legal protections and country-averaged ownership concentration. But when the same data is used on an individual-firm basis, the Anti-Director Rights Index reverses sign, and both Legal Origins and the Anti-Self-Dealing Index become completely insignificant. These analyses use the same ownership data and regression specifications that were originally used in the literature to establish the claimed inverse relation between investors' legal protections and ownership concentration.

In some sense, the wide use of country averages is surprising because there have been many warnings by statisticians over the years that aggregate data analysis can produce misleading inferences about individual units. These warnings started as early as Pearson *et al.* (1899) and Yule (Notes on the theory of association of attributes in statistics) and have continued through Freedman (2006a) and beyond; they triggered a decline in the use of averages as the unit of analysis in many other fields. In contrast, in finance the analysis of country averages accelerated with the publication of one of the most-cited papers in many years, LLSV (1998).¹ My paper shows that country-average analysis is based on assumptions that are not only implausible but also unnecessary when firm-level data is available.

¹LLSV (1998) is the most cited paper in all of the economics and finance literature published since 1994, according to Kim *et al.* (2006)

Finally, the analyses in my paper also call into question the findings of other individual-firm hypotheses that have been studied with country averages. Among these topics are capital-structure choice, earnings management, and stock-price movements. The findings from these many diverse studies may not be wrong. They do, however, require re-analysis with individual-firm data.

1 The Fundamental Question of Interest

The main problem is easily illustrated with a simple example. Assume there are two public corporations: In Firm A, the largest shareholder owns 15% of the common stock. In Firm B the largest shareholder owns 45% of the common stock. The fundamental question of interest in the law-and-ownership literature is “why is there this difference in the ownership concentration of these two firms, 15% versus 45%?”² The broader law-and-finance literature asks similar fundamental questions of other firm attributes: Why does one firm pay half of its earnings in dividends, while another firm pays no dividends? Why does one firm have half of its capital structure in debt, while another firm has only 10%? My paper uses ownership concentration to illustrate my points, but the analyses are also applicable to other firm- or individual-level characteristics. For instance, some research on international development (effectively) investigates why an individual from a developed country earns (say) \$50,000 a year, while an individual from an underdeveloped country earns only \$10,000.

At one time, academics seldom compared firms across countries. Some researchers still hold this view. For most, however, the situation changed fundamentally with LLSV (1998). LLSV showed that investors’ legal protections can be measured and that the laws of different nations often share common characteristics. They and subsequent researchers then showed that differences in these shared legal protections help explain similarities and differences in firms and markets around the world. This fundamentally new perspective is why LLSV (1998) is widely, and in my view correctly, considered a seminal paper.

One testable theory is that Firm B has more concentrated ownership because it is subject to the civil law while Firm A is subject to the common

²This literature is not attempting to determine if the difference between 15% and 45% matters, say, for firm value or anything else. Other literatures address these issues.

law. In its simplest form, this theory implies that another firm that is also subject to the civil law—even if it is from a different country—should have the same ownership concentration as Firm B. Some commentators remark that law and finance is a concept that focuses on countries. This is not fully accurate. Law and finance does focus on laws that are determined at the national level (or on laws that impact all firms within a given country equally), but the essential point is that the key characteristics of these laws in effect extend across national boundaries. The fundamental theory this part of the law-and-finance literature addresses is whether these shared across-country legal approaches influence specific characteristics of firms located in different countries.

2 Two Fundamentally Different Methodological Approaches

When firm observations cover a number of countries, some of which share certain legal approaches, it becomes possible to test whether those shared legal approaches are associated with differences in ownership concentration. (The law-and-finance literature typically does not address the always-difficult issue of causation. Credible instrumental variables are hard to find, and quasi-natural experiments are rare.)

As already noted in Table 1, researchers take one of two fundamentally different methodological approaches. Some use individual firm-level observations as the unit of analysis. Others take the firm observations, compute the average for each country, and then use those country averages as the unit of analysis. All of the published papers on law and ownership concentration take the latter approach (Table 2). In this paper I am not trying to determine why there is the difference in ownership of 15% versus 45% in our earlier hypothetical. I am addressing whether researchers investigating this topic should use country averages or the underlying firm data.

There are three reasons why empirical results differ between country-averaged and the underlying individual-firm data. These reasons ultimately go to implicit but seldom-articulated assumptions about the underlying model, which in our example case is about the causes of firm ownership concentration.

1. **Firm-Level Influences.** The first reason why results can change is the classic omitted-variable problem.

Consider the following hypothetical:

Firm Size	Country A Common Law		Country B Civil Law	
	Ownership Concentration	Number of Firms	Ownership Concentration	Number of Firms
\$100 M	40%	5	30%	75
\$500 M	30%	15	25%	15
\$1 B	10%	80	5%	10
	14.5% (Average)	100 (Total)	26.75% (Average)	100 (Total)

Does this data support the hypothesis that ownership concentration is inversely related to investors' legal protections?

Consistent with conventional wisdom, overall ownership is more concentrated among firms having weaker legal protections, the civil-law firms (26.75% versus 14.5%). Yet, inconsistent with conventional wisdom, at each level of firm size, ownership is more concentrated in the common-law firms.

Whether this hypothetical supports or rejects the theory that ownership concentration is inversely related to investors' legal protections comes down to a question of comparison and comparison ultimately comes down to a question of causation (Pearl, 2009, pp. 78–83). In the background is the question of whether legal origin, firm size, or both have an impact on ownership concentration. Is firm size an omitted variable?

Is a \$100-million firm equivalent to a \$1-billion firm as far as ownership concentration is concerned? In other words, does firm size have a causal influence on ownership independent of any impact that legal origin has? If there is no causal relation between firm size and firm ownership concentration (if the association in the preceding hypothetical is due to chance), one should ignore firm size when comparing firms' ownership concentration. But if there is a causal relation, one needs to control for firm size to obtain homogeneous comparisons. Without such a control, it is not possible to distinguish

whether the difference in ownership is due to differences in firm size or differences in legal origins.

Without a controlled experiment, there is no definitive way to determine if firm size causally impacts ownership concentration. With individual observations, a researcher at least has the flexibility of reporting specifications both with and without potential firm-level determinants. Both results can be reported, and readers can draw their own conclusions. With country averages, however, this flexibility is lost because aggregation causes a loss of information; all within-country information is reduced to a single point, namely the average ownership concentration for firms from that country. This presumably is why the existing law-and-ownership papers (Table 2) do not control for any firm-level determinants of ownership concentration, including size.

- 2. **Weighting of Firm Observations.** The second reason why results can change from country averages to the underlying individual observations is related to the weighting of individual-firm observations. With analyses of individual observations, each observation (each firm in our case) receives equal weight. In analyses of country averages, each country receives equal weight. If there are different numbers of observations in different countries—which is true of all of the existing studies of law and ownership—the coefficients change. The more unbalanced the panel, the greater the change. Consider the following hypothetical:

Country	Common Law		Civil Law	
	A	B	C	D
Ownership Concentration	20%	30%	90%	10%
Number of Firms	40	60	1	99
Country Average	25%		50%	
Firm Average	26%		11%	

Based on country averages, ownership is more concentrated in the civil-law firms (50% versus 25%). But based on firm observations, ownership is more concentrated in the common-law firms (26% versus 11%). The major reason for the difference is that the single firm

from Country C is given more weight than any other firm. It carries 99 times the weight of each firm from the other civil-law country, Country D. Of course, the theory being tested holds that a civil-law legal origin has the same impact on firm ownership concentration even when firms are located in different countries. Although this weighting might seem extreme, some of the existing law-and-ownership studies place even more extreme weights on firms from (usually tiny) countries.

3. **Different Standard Errors.** The third reason why results can change is that the standard errors change. Unlike the two previous considerations, this is an issue not of bias but of power. Although the calculation of standard errors often involves several factors depending on the type of standard error (nominal, robust, country-clustered, and so forth), a common thread is that all standard errors vary with the standard deviation and number of observations. Country averages eliminate the within-country spread in individual ownership and replace it with the spread around the country averages. In addition, with country averages the number of observations is the number of countries, but with individual observations it is the number of firms. Consider the following hypothetical:

Country	Common Law		Civil Law	
	E	F	G	H
Firm A	93%	95%	94%	91%
Firm B	83%	85%	93%	88%
Firm C	53%	65%	90%	72%
Firm D	11%	19%	39%	63%
Firm E	10%	13%	19%	44%
Firm F	9%	8%	18%	17%
Firm G	8%	5%	18%	16%
Firm H	5%	4%	17%	14%
Firm I	4%	3%	16%	13%
Firm J	4%	3%	16%	12%
Average	28%	30%	42%	43%

By design, the averages are the same aggregated and disaggregated

because each country has the same number of firms. Common-law countries have a mean concentration of 29%, while civil-law countries have a mean of 42.5%. The standard deviations are, however, quite different. With 20 individual firms for each legal origin, we have the following situation:

	Common Law	Civil Law
Mean (N = 20)	29%	42.5%
SD (N = 20)	35%	33%
Std. Err.	7.8%	7.4%
<i>p</i> -value of no difference	0.21	

This means that under a conventional two-sample difference-in-means test using the underlying individual-firm observations, the test statistic cannot reject the null hypothesis that the underlying population means are the same (*p*-value 0.21).

In contrast, if the firms are first averaged by country and then grouped by legal origin, then we have the following situation:

	Common Law	Civil Law
Mean (N = 2)	29%	42.5%
SD (N = 2)	0.7%	1.4%
Std. Err.	0.5%	1.2%
<i>p</i> -value of no difference	0.02	

Now the test statistic, which is based on the country averages, indicates that the difference in ownership between common law and civil law firms is unlikely to be due to chance (*p*-value 0.02). There is little variation between the averages of the Common Law Countries E and F, as well as between the Civil Law Countries G and H.

The reason for this difference in results is that there is a considerable spread for both common-law and civil-law firms. Country averages eliminate this spread and thus create a false impression of tight clustering. In this example, the reduction in spread more than counterbalances the increase in the number of observations that results from moving from country averages to firm observations.

Thus, although nominal standard errors are typically smaller with individual observations because there are more observations, it is not inevitable. Again, the fundamental point is that standard errors are different between individual analyses and aggregate analyses.³

3 Revisiting Aggregate Findings with Individual Data

I now illustrate how individual data and country averages can produce fundamentally different results and that one approach is not inherently more conservative. First, I estimate the relation between each of three key measures of investors' legal protection and ownership concentration using country averages. To make this realistic and relevant, I use the two ownership databases and regression specifications that underlay the Table 2 papers. That is, I mimic the papers that find an inverse relation between investors' legal protections and ownership concentration.

Next, I re-estimate the same relation using the exact same data but on a firm basis. I use the estimation technique used in most of the Table 1 papers that take a firm or individual approach, pooled ordinary least squares (OLS) with country-clustered standard errors. Because I am using firm observations, I am able to control for firm-level attributes (although some of my analyses have no firm-level controls). For illustrative purposes, I consider the two firm-level factors that existing research suggests are most clearly related to ownership concentration, firm size and firm age.⁴ I conduct these analyses using the standard cross-sectional model:

$$y_i = \alpha + \beta^1 \cdot x_i + \delta^1 \cdot c_i + \varepsilon_i \quad (1)$$

where y_i is firm i 's ownership concentration; x_i is a set of firm-level variables for firm i (such as firm size); c_i is a set of country-level variables applicable

³With other types of standard errors, such as country-clustered standard errors, the situation becomes more complicated, but the basic point remains: standard errors of any type are different between country-averaged observations and underlying individual-firm data observations.

⁴A very incomplete list of papers that study variation in ownership concentration and control for firm size include Shleifer and Vishny (1986); Stulz (1988, 1990); Holderness (2016); Karpoff *et al.* (1996); Field and Karpoff (2002); Franks *et al.* (2009); and Himmelberg *et al.* (1999). Boone *et al.* (2007) document that Chief Executive Officer (CEO) ownership and board of director ownership declines significantly in the ten years after a firm goes public. Anderson and Reeb (2003) document that family block ownership is higher for younger firms.

to firm i , some of which are legal (such as shareholders' rights to sue directors) and others of which are non-legal (such as the log of a country's GDP per capita); and ε_i is an error term.

It is important to point out what the analyses in the remainder of this paper attempt to do and what they do not attempt to do. My analyses do not attempt to determine or even to describe the relation between investors' legal protections and ownership concentration. There have been many criticisms of the law-and-ownership literature over the years, ranging from the accuracy of the ownership databases, to the coding of investors' legal protections, to the appropriate country-level controls. (I do, however, address these criticisms in a companion paper that reexamines the relation between investors' legal protections and ownership concentration (Holderness, 2016)). Because my focus here is on a much broader and simpler issue—the implications of using aggregate data to understand individual phenomenon—my paper does not address any of these important criticisms of the law-and-ownership literature. The analyses in this paper illustrate how aggregate data analysis can lead to substantially different inferences than individual data analysis. This would also apply to other individual and firm-level research that relies on cross-country comparisons and not just the law-and-ownership research.

3.1 Anti-Director Rights Index

One of the enduring contributions of the law-and-finance literature has been to quantify the legal protections for public market investors around the world. This has made possible the impressive body of empirical research into cross-country differences in financial markets. Among the various indices of investors' statutory protections, the most widely used is the Anti-Director Rights Index. It was introduced by the paper that launched the law-and-finance literature (LLSV, 1998) and has been used in well over 100 published papers (Spamann, 2010). The index is a composite of six rights shareholders have to bring legal actions against corporate directors: (1) vote by mail; (2) shares not blocked or deposited; (3) cumulative voting; (4) oppressed minority; (5) pre-emptive rights; and (6) percentage of share capital required to call an extraordinary shareholders' meeting. (All data and variables used in my paper are defined in the Appendix.)

Table 3 reports the association between ownership concentration from World-scope and the Anti-Director Rights Index. Although the Worldscope

	Country Averages		Firm Observations		
	R1	R2	R3	R4	R5
Anti-Director Rights Index	-3.70 (0.01)	-3.65 (0.05)	+2.13 (0.53)	+2.32 (0.51)	+4.54 (0.11)
Per Capita GDP	-1.65 (0.50)	-1.62 (0.49)	-10.11 (0.00)	-6.64 (0.06)	-6.75 (0.03)
Judicial Enforcement		0.14 (0.96)		5.91 (0.14)	6.00 (0.08)
Firm Size					-2.42 (0.00)
Firm Age					-3.56 (0.00)
Missing Firm Age					-0.09 (0.99)
Constant	77.21 (0.00)	76.01 (0.01)	131.08 (0.00)	70.13 (0.19)	78.28 (0.08)
Adjusted R2	0.06	0.10	0.05	0.07	0.14
Observations	45	45	14,839	14,839	14,839

Table 3: Anti-Director Rights Index Regressions with Country Averages and Firm Observations.

Description: Regressions of ownership concentration on the rights of shareholders to sue corporate directors as measured by the Anti-Director Rights Index. The ownership data are the same in all regressions and come from Worldscope. Regressions 1–2 use country averages of ownership concentration and are estimated using OLS with Huber-White robust standard errors. Regressions 3–5 use the underlying, firm observations and are estimated using OLS with standard errors that are clustered by country. The data and variables are defined in the Appendix. (*p*-values based on *t*-statistics are reported in parentheses.)

Interpretation: There is no negative association between the Anti-Director Rights Index and ownership concentration once we disaggregate. If anything, the relation may be positive. The difference between Regressions 1 and 2, on the one hand, and Regressions 3 and 4, on the other hand, comes solely from the overweighting in the first two regressions of firm observations from certain (usually tiny) countries.

ownership database is not used in LLSV, it is used in two of the Table 2 ownership papers (Stulz (2005) and Li *et al.* (2006)), as well as in several of the Table 1 papers (to study other topics). When country averages of ownership concentration are regressed on the Anti-Director Rights Index (Regressions 1 and 2), the coefficient on the Index is negative and significant. This confirms the existing literature finding.

The same regression specification *but based on the underlying firm-level data* suggests that the coefficient on the Anti-Director Rights Index changes sign and is no longer statistically significant. The difference in coefficients between Regression 1 (or 2) and Regression 3 (or 4) is due solely to differences in the weighting of firm observations. There are no firm-level controls in any of these four regressions. If all countries had the same number of observations, these coefficients would not change.⁵

The Worldscope weights given to Venezuelan firms (Table 6) illustrate why the regression results change. With country-average observations, the high ownership concentration and low Anti-Director Rights of Venezuela is 1 observation out of 45. With individual-firm observations, only 2 out of 14,839 observations are Venezuelan. Thus, the two Venezuelan firms are given approximately 165 times the weight in the country-average regressions as opposed to the firm-level regressions.⁶ There are differences in the weighting of firms from other countries, but this (admittedly pronounced) difference illustrates why coefficients can change between aggregate and individual data even when there are no firm-level controls.

Regression 5 in Table 3 shows that the results change further with firm-level controls. These changes occur because the firm-level controls are correlated both with ownership concentration and the Anti-Director Rights Index. With firm size and firm age in Regression 5, the coefficient on the Anti-Director Rights Index increases and approaches marginal significance

⁵Specifically, regression coefficients remain the same between individual and aggregate regressions when each country within a shared legal group has the same number of firm observations. Countries in different groups can have different numbers of observations if there are no other controls. An OLS regression line essentially estimates the average value of the dependent value (ownership) corresponding to each value of the independent variable (legal protections). Thus, assume that only two countries have a value of 1 for the Anti-Director Rights Index. Assume further that one country has an average ownership of 20%, and the other has an average ownership of 60%. The country average, therefore, is 40%. If there are the same numbers of observations for each country, the average of the individual observations is also 40%. If there are different numbers of observations for the two countries, however, the average of the individual observations will be different. For instance, assume that the first country has 10 firms, but the second country has only five firms. In this case, the individual firm observations average 33.3% (not 40%), and the estimated regression line changes accordingly.

⁶When Venezuela is deleted from the firm-level regressions, the results change only modestly. For instance, the *p*-value on the Anti-Director Rights Index in Regression 5 of Table 4 goes from 0.113 to 0.111. When I delete Venezuela from the country-average regressions, on the other hand, the *p*-value in Regression 1 increases from 0.01 to 0.04; in Regression 2 it increases from 0.05 to 0.09.

(p -value 0.11). This is dangerously close to the inference that the Anti-Director Rights Index is associated with more (not less) concentrated ownership. In sum, the individual data simply cannot reject the null hypothesis.

The preceding raises the possibility that the results may be unduly influenced by countries with many firms. This appears not to be the case. When standard errors are clustered by country, the adjustment to the standard errors increases with the number of firms in a country. Furthermore, in untabulated robustness tests, I limit the number of observations from every country to 300 randomly chosen firms. (This adjustment affects eight countries.) The equivalent coefficient on the Anti-Director Rights Index in Regression 5 then falls to 0.28 (p -value 0.91). Because this cutoff is somewhat arbitrary, I also use other cutoffs, ranging from 50 to 1,000. In all instances, it is impossible to reject the hypothesis that ownership concentration is unrelated to the rights of shareholders to sue corporate directors.

The coefficient estimates in Table 3 should not be taken to imply that coefficients always reverse sign between aggregate and individual data. Typically, they do not. But they do change sign sufficiently often that a term has been coined for this phenomenon, *Simpson's Paradox*.⁷

3.2 Legal Origins

The difference between a common-law and a civil-law legal origin is central to a broad literature. The common law had its origins in the English common law courts. It relies on individual judges to adjudicate disputes. As these precedents accumulate, they begin to carry the force of law. The use of common law expanded around the world with the British Empire. It is the legal foundation not only for the United Kingdom, but also for countries such as Australia, India, and the United States (with the exception of Louisiana, which follows the Napoleonic Code). The civil law is older, having its origins in Roman law. In contrast to the common law, this law is heavily codified and makes extensive use of legal experts to formulate rules. The civil law is most frequently associated with Napoleon, who imposed a version of it (the Napoleonic Code) on France in 1804 after the chaos of the French Revolution and then throughout much of continental Europe with his military conquests. Derivative versions of the civil law developed subsequently in Germany and Scandinavia.

⁷See https://en.wikipedia.org/wiki/Simpson%27s_paradox.

Common-law countries typically offer more legal protections and better enforcement than do civil-law countries (LLSV, 1998; LLS, 2008). Therefore, one simple test of the theory that large shareholders are a response to weak legal protections for investors is to determine whether ownership is less concentrated in firms from common-law countries. An advantage of this inquiry is that most countries adopted their legal origins—or had them imposed through colonization or military conquest—long before the advent of the modern public corporation. Thus, blockholders could have had little, if any, influence over the choice of a country's legal origins. Reverse causation, therefore, should not be a problem.

To investigate the impact of a common-law legal origin, LLSV hand-collected ownership data for the ten largest non-financial firms from 49 countries. The authors have graciously made the firm-level data available to me. Again, all variables are defined in the Appendix. In Regression 1 of Table 4, based upon country averages, common-law countries appear to have less-concentrated ownership than civil-law countries. This replicates the existing literature finding.

By moving from regressions with country averages (Regression 1 and 2) to regressions of individual-firm observations (Regressions 3 through 5), the coefficient on the common-law dummy changes. The change is not as dramatic as in the previous example with the Anti-Director Rights Index and Worldscope data. The reason is that the LLSV sample is more balanced. Most countries have ten observations, but eleven countries have fewer observations. If the sample were perfectly balanced, the coefficient estimates in Regressions 3 and 4 would now be the same as those in regressions 1 and 2, respectively, because there would be no differences in the weighting of individual firm observations. The addition of firm-level controls in Regression 5 further weakens the relation between legal origins and ownership concentration. Overall, the coefficient on the common-law dummy declines from the -6.91 with a p -value of 0.06 in Regression 1, to -2.99 with a p -value of 0.36 in Regression 5. It is now not possible to reject the hypothesis that common-law firms have the same ownership concentration as civil-law firms.

3.3 *Anti-Self-Dealing Index*

Readers should be aware that the regressions in Tables 3 and 4 are not exact replications of regressions from the literature. Rather, they illustrate how

	Country Averages		Firm Observations		
	R1	R2	R3	R4	R5
Common Law Legal Origin	-6.91 (0.06)	-4.90 (0.19)	-5.31 (0.15)	-3.35 (0.37)	-2.99 (0.36)
Per Capita GDP	-6.30 (0.00)	-4.93 (0.01)	-6.64 (0.00)	-5.21 (0.01)	-2.00 (0.29)
Judicial Enforcement		5.38 (0.04)		5.04 (0.05)	3.05 (0.20)
Firm Size					-2.21 (0.00)
Missing Firm Size					-10.32 (0.08)
Missing Firm Size					-2.22 (0.21)
Firm Age					-3.39 (0.72)
Missing Firm Age					72.15 (0.00)
Constant	107.07 (0.00)	65.88 (0.01)	109.24 (0.00)	69.32 (0.00)	72.15 (0.00)
Adjusted R ²	0.17	0.22	0.07	0.09	0.13
Observations	49	49	446	446	446

Table 4: Common Law Legal Origin Regressions with Country Averages and Firm Observations.

Description: Regressions of ownership concentration on a dummy variable that takes the value of one if a country has a common law legal origin and zero otherwise. The ownership data are the same in all regressions and come from LLSV (which is why the number of observations is lower than in the preceding Table). Regressions 1–2 use country averages of ownership concentration and are estimated using OLS with Huber-White robust standard errors. Regressions 3–5 use the underlying, firm observations and are estimated using OLS with standard errors that are clustered by country. The data and variables are defined in the Appendix. (*p*-values based on *t*-statistics are reported in parentheses.)

Interpretation: Once we disaggregate, there is no reliable negative association between legal origins and firm ownership concentration.

aggregate data produce different results than the underlying individual data. I conclude by exactly replicating a published regression involving investors' legal protections and ownership concentration.

LLS (2008) review the law-and-finance literature. In so doing, they use the Anti-Self-Dealing Index of DLLS (2008) to document an inverse

relation between the law and ownership concentration. It is the *only* legal measure they use in the context of ownership concentration. The Anti-Self-Dealing Index incorporates both ex-ante controls and ex-post penalties on self-dealing transactions by corporate insiders, especially by controlling shareholders. DLLS [2008, p. 461] argue this index is “better grounded in theory” than the Anti-Director Rights Index.

Regression 1 of Table 5 exactly replicates the LLS ownership regression. Judicial enforcement is not included for this reason. The coefficient on the Anti-Self-Dealing Index is negative and marginally significant (p -value 0.08). Yet in Regression 2, the same specification but with the underlying individual-firm data, the coefficient on the Anti-Self-Dealing Index declines and loses any statistical significance (p -value 0.15). The more modest change in the Anti-Self-Dealing coefficient reflects that the LLSV database, although more balanced than Worldscope, is not perfectly balanced. Again, if there were the same number of observations for each country, this coefficient would not change at all.

After controlling for firm size and age, the coefficient on the Anti-Self-Dealing Index declines further (Regression 3). This occurs because size and age are correlated both with ownership concentration and the Index.

The change in results becomes even more pronounced if we control for the quality of judicial enforcement. When this variable is added, the coefficient on the Anti-Self-Dealing Index in the most-complete specification falls to -2.92 (p -value 0.65) (untabulated). In all cases with individual data, one cannot reject the hypothesis that ownership concentration is unrelated to the legal prohibitions on self-dealing by corporate insiders. The individual data for the third time simply cannot reject the null hypothesis.

3.4 Summary

Tables 3–5 illustrate that aggregate and individual data can produce very different inferences. The tables also identify why results based on country averages do not necessarily hold with the underlying individual data. This does not imply that all relations identified with aggregate data necessarily turn insignificant or change sign with individual data. A relation identified with aggregate data can also become stronger with individual data. The point is that aggregate data have the potential to produce misleading inferences even for prominent findings in the literature.

	Country Averages	Firm Observations	
	R1	R2	R3
Anti-Self-Dealing Index	-12.77 (0.08)	-10.02 (0.15)	-5.84 (0.33)
Per Capita GDP	-4.95 (0.02)	-5.61 (0.00)	-1.84 (0.34)
Firm Size			-2.51 (0.00)
Missing Firm Size			-12.40 (0.04)
Firm Age			-2.26 (0.20)
Missing Firm Age			-3.96 (0.67)
Constant	98.44 (0.00)	102.94 (0.00)	90.54 (0.00)
Adjusted R ²	0.17	0.07	0.12
Observations	49	446	446

Table 5: Anti-Self-Dealing Index Regressions with Country Averages and Firm Observations.

Description: Regressions of ownership concentration on legal prohibitions on self-dealing by corporate insiders as measured by the Anti-Self-Dealing Index. The ownership data are the same in all regressions and come from LLSV. Regression 1 uses country averages of ownership concentration and is estimated using OLS with Huber-White robust standard errors. Regression 1 replicates the ownership regression reported in LLS (2008, p. 295, Panel B). Regressions 2–3 use the underlying, firm observations and are estimated using OLS with standard errors that are clustered by country. The data and variables are defined in the Appendix. (*p*-values based on *t*-statistics are reported in parentheses.)

Interpretation: Once we disaggregate, there is no reliable negative association between the Anti-Self-Dealing Index and firm ownership concentration.

4 Underlying Assumptions with the Choice of Methodology

Other papers have shown that individual data analysis and aggregate data analysis can produce very different results. Robinson's (1950) influen-

tial article is one such example.⁸ It does not mean that one approach is universally superior to the other just because results are different. It does mean, however, that the two approaches have different underlying assumptions that need to be contemplated. These assumptions relate to the three reasons why results change between individual and aggregate data analysis and ultimately to the choice between individual and aggregate data analysis. This section discusses these assumptions.

4.1 How to Control for Firm-Level Determinants?

Returning to our original hypothetical Firm A and Firm B from Section 1, a reasonable hypothesis is that Firm A has less concentrated ownership because it is larger and older, not because it is subject to the common law. With firm-level observations, it is possible to investigate this possibility. With country averages, it is not. Aggregation destroys all within-country variation in ownership concentration. Only a single statistic remains: the average ownership concentration for the country.

There are three situations in which one does not need to control for firm-level characteristics in across-country comparisons:

1. There is no bias when there are no firm-level determinants of the firm-level characteristic of interest.
2. There is no bias when the country-level coefficient of interest and all firm-level determinants are uncorrelated.
3. One may not want to control for firm-level determinants when those determinants themselves are entirely due to the variable of interest. For example, if investor-protection laws are associated with (or cause) both firm size and firm-ownership concentration, then controlling for firm size would bias down the coefficient of interest on legal protection. In the extreme case of perfect collinearity, it would be impossible to disentangle the effects of firm size and legal protection. The deliberate exclusion of a firm-size control would then attribute the *entire* association of firm size with ownership concentration to the hypothesized variable (investor protection). Naturally, it would require extreme priors to *assume* that the explanatory power of firm

⁸Robinson (1950) focuses on correlation coefficients, while the previous section focuses on regression coefficients.

size be attributed fully to investor protection. Alternatively, one could interpret the evidence produced in such a test to be about whether firm size explains ownership concentration, rather than about whether legal protection matters. Empirical tests, however, could not disentangle the two.

Using country averages as the unit of analysis implicitly assumes that one of these three conditions pertains. Otherwise a classic omitted-variable bias arises. Whether any of these three conditions are present depends on the question of interest. To frame a discussion of law and ownership, Figure 1 summarizes the ownership concentration data from Worldscope. When I regress ownership concentration on country dummies in one individual-firm regression (not tabulated), the adjusted R^2 is 0.24. This represents the maximum amount of variation in ownership concentration that can possibly be explained by all country-level factors, not just investor protection laws.⁹ In other words, the within-country variation with ownership concentration is considerably greater than the across-country variation.

The first justification for using country averages in the context of law and ownership is that there are no firm-level determinants of ownership. But if there are no firm-level determinants and only country-level determinants, all firms in the same country should have the same ownership concentration. Figure 1 and many published studies show this is not the case. A response could be that all within-country variation in ownership is noise. If this were true, then a large body of theoretical and empirical research addressing within-country variation in ownership concentration would ultimately be studies of randomness. This seems unlikely.¹⁰

The second justification for country averages is that there are firm-level determinants of ownership concentration (hence the many within-country

⁹An alternative measure is the intra-class correlation from a variance-component model. This decomposes regression residuals into random country-level effects and within-country effects. This analysis reveals that approximately 0.26 of the total variance in ownership concentration results from across-country as opposed to within-country factors. This figure would be zero if all countries had the same average ownership concentration, and it would be one if all firms within each country had the same ownership concentration.

¹⁰Under this view, among the many papers that would become studies of randomness would be Morck *et al.* (1988), Stulz (1988), and Holderness and Sheehan (1988). All of these papers study within-country (specifically, within the United States) variation in ownership concentration.

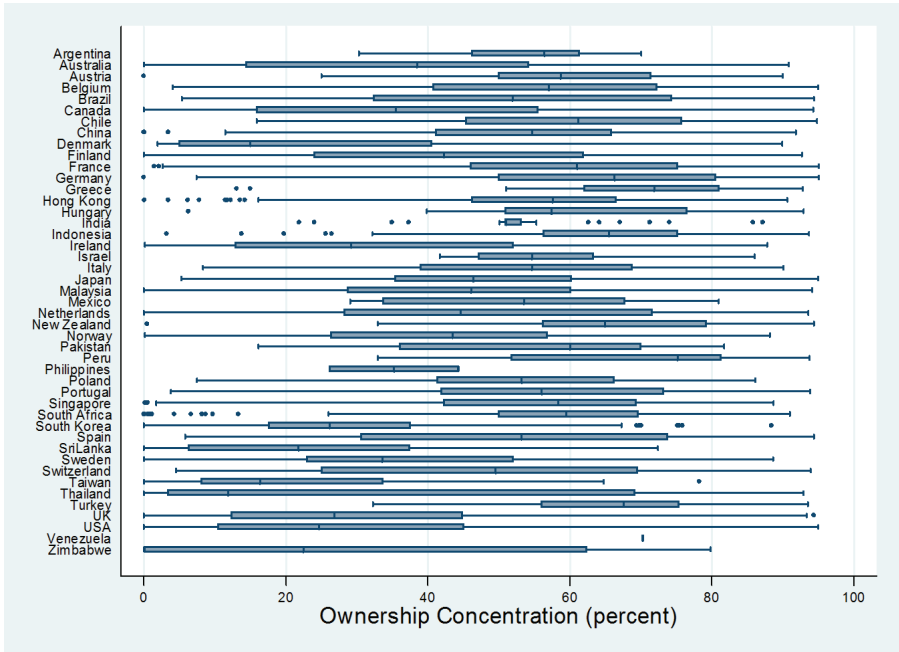


Figure 1: Ownership Concentration at Firms from 45 Countries.

Description: Ownership concentration at public firms from 45 countries. Data come from Worldscope for 1996 and are defined in the Appendix. Countries are included if data on the rights of shareholders to sue corporate directors are available (Anti-Director Rights Index). The box represents the 25th and 75th percentiles. The ends of the whiskers extend to the minimum and maximum values or to 1.5 times the inter-quartile range, whichever is closer to the box. Values outside of this range are represented by dots.

Interpretation: There is substantial variation in ownership concentration in virtually all countries. Country averages eliminate all such variation and thus create a misleading impression of tight clustering.

analyses of ownership are not studies of randomness), but these firm-level influences are randomized around the world. Such randomness, however, is unlikely in any observational study. Moreover, there is evidence that firm size varies systematically across countries (Kumar *et al.*, 2001), and there is evidence and theory that ownership concentration varies systematically with firm size. (Demsetz and Lehn (1985) was the first of many papers to develop this point).

The third justification for using country averages instead of individual data is the opposite of the preceding justifications: There are firm-level influences on ownership concentration, but they are perfectly correlated with the country-level laws of interest. This could arise either because the laws fully determine the firm-level influences or because a third factor fully determines both the laws and the firm-level influences. The problem with this possibility, at least in our context, is that it predicts that all firms in the same country will have identical ownership concentration and identical characteristics that might also influence ownership, such as size and age. The evidence is strongly inconsistent with both propositions. Again, a possible response is that all within-country variation in both ownership and the relevant firm characteristics (say, firm size) is noise. But this conflicts with the fundamental premise of the numerous theoretical and empirical papers studying within-country variation in ownership concentration and other firm characteristics.

4.2 What is the Rationale for Weighting Individual Firms Differently?

The second reason why results change between individual and aggregate data analysis is the difference in the weighting of individual observations. As the earlier examples showed, especially the one involving the Anti-Director Rights Index and Worldscope (Table 3), this has the potential to be important.

Any comparison, whether within a country or across countries, is premised on the assumption that the compared units are homogeneous with respect to all causal influences other than the one of interest on the outcome of interest (Pearl, 2009). If they are homogenous, one can pool the individual observations because each individual observation tells us the same thing about the underlying population. Presumably, this is why most analyses in finance and economics weight individual firms (or people) equally.

Because we do not have a randomized experiment on the relation between the law and firm ownership concentration, we must try to control both for firm-level determinants and for country-level determinants (such as gross domestic product (GDP) per capita). If these factors have been properly controlled for—in other words, if the model is properly specified—then the comparisons are by definition homogeneous. In this case, for

example, one common-law firm provides the same amount of information about the underlying population of common-law firms as another common-law firm. This is true regardless of whether the firms are from the same country or from two different common-law countries. The population parameter that the law-and-ownership literature seeks to estimate is not the average ownership concentration from a given country but the average ownership concentration of all firms subject to a specific shared level of investors' legal protection. Crucially, this legal protection extends across countries. Once the legal origin of a firm has been identified, the firm's country becomes irrelevant if the model is properly specified. This is why a panel that has different numbers of observations from different countries is not necessarily a problem.

A country-average approach weights individual firms differently whenever there are different numbers of observations from different countries. (At the same time—and somewhat inconsistently—a country-average approach weights firms equally within a country.) Table 6 reports the implicit cross-country weights of the existing studies of law-and-ownership studies. In some instances, a firm from one country is given the same weight as a firm from another country. In other instances, a firm from, say, the Philippines or Venezuela is given over 3,000 times the weight of a firm from another country, say, the United States, even if investors from the two countries might have the same legal protections. Again, the underlying (and path-breaking) premise of law and finance is that the law has the same impact on individual firms even when they are from different countries.¹¹

There is nothing inherently wrong with weighting different observations differently. Several well-accepted statistical techniques do so. For example, one might justify unequal weights when the model is not properly specified at the country level. But if the misspecification does not bias the coefficients, then the clustering of standard errors by country will correct the problem (Moulton, 1990; Petersen, 2008). If the unmeasured country effect biases the coefficients, however, then clustering of standard errors will not correct the problem. As Freedman (2006b) and King and Roberts (2014) point out, large differences between classical standard errors and robust or clustered standard errors typically suggest that the model is misspecified, but the adjusted standard errors do not correct for the misspecification.

¹¹A coefficient estimate can be interpreted as an average of the true underlying coefficient only under special circumstances—principally in the absence of omitted variables.

Country	Legal	Weights		
		Anti-Director	LLSV	Worldscope
Argentina	Civil	2.00	1.00	475.15
Australia	Common	4.00	1.00	20.45
Austria	Civil	2.50	1.11	137.27
Belgium	Civil	3.00	1.00	56.15
Brazil	Civil	5.00	1.00	102.95
Canada	Common	4.00	1.00	66.42
Chile	Civil	4.00	1.00	87.00
China		1.00		74.42
Colombia	Civil		1.00	
Denmark	Civil	4.00	1.00	50.22
Ecuador	Civil		1.00	
Egypt	Civil		5.00	
Finland	Civil	3.50	1.00	70.19
France	Civil	3.50	1.00	13.00
Germany	Civil	3.50	1.00	14.92
Greece	Civil	2.00	1.00	205.90
Hong Kong	Common	5.00	1.00	16.30
Hungary		2.00		386.06
India	Common	1.43	5.00	187.18
Indonesia	Civil	4.00	1.00	39.85
Ireland	Common	5.00	1.00	106.50
Israel	Common	4.00	1.00	441.21
Italy	Civil	2.00	1.00	71.00
Japan	Civil	4.50	1.00	2.59
Kenya	Common	1.00		
Malaysia	Common	5.00	1.00	15.80
Jordan	Civil		2.50	
Mexico	Civil	3.00	1.00	514.75
Netherlands	Civil	2.50	1.00	45.09
New Zealand	Common	4.00	1.00	114.39
Norway	Civil	3.50	1.00	57.19

Table 6: Unequal Weighting of Firm Observations in Country Average Analyses.

Country	Legal	Anti-Director	Weights	
			LLSV	Worldscope
Nigeria	Common		1.11	
Pakistan	Common	4.00	1.43	411.80
Peru	Civil	3.50	1.00	772.13
Philippines	Civil	4.00	1.43	3,088.50
Poland		2.00		213.00
Portugal	Civil	2.50	1.00	118.79
Singapore	Common	5.00	1.00	28.33
South Africa	Common	5.00	1.00	35.91
South Korea	Civil	4.50	1.00	21.08
Spain	Civil	5.00	1.00	54.18
Sri Lanka	Common	4.00	1.00	386.06
Sweden	Civil	3.50	1.00	35.91
Switzerland	Civil	3.00	1.00	47.52
Taiwan	Civil	3.00	1.00	162.55
Thailand	Common	4.00	1.00	123.54
Turkey	Civil	3.00	1.25	140.39
UK	Common	5.00	1.00	3.94
USA	Common	3.00	1.00	1.00
Uruguay	Civil		3.33	
Venezuela	Civil	1.00	1.43	3,088.50
Zimbabwe	Common	4.00	3.33	1,029.50

Table 6: *Continued.*

Description: Weighting of individual firm observations implicit in analyses of country averages based on the LLSV and the Worldscope ownership databases. The weights given to individual firm observations are relative to the weight placed on a United States firm (United States firm = 1.00).

Interpretation: Country average analyses typically place different weights on individual firms depending on the composition of the database. Firms from small countries are often over-weighted both in comparison with firms from large countries and in comparison with firms from other countries where investors have the same legal protections. No rationale is offered in the literature for these differences in weighting.

Unfortunately, the only way to correct a misspecification is to control for the omitted factor (that is, to specify the model properly), to make the

comparisons homogeneous, and then to pool the individual observations and treat each observation equally. Weighting schemes cannot correct for model misspecifications.

In summary, the existing law-and-finance literature has yet to explain why it uses weighting assumptions that demonstrably turn out not to be innocuous. The burden of proof is on those who use country averages to explain:

- What is the rationale for weighting individual firms differently?
- Why, for example, should firms from Venezuela be weighted 3,000 times as heavily as firms from the United States?
- Why are the weights that happen to emerge from the composition of a database the correct weights?
- Why should firms be weighted equally within country if they are not weighted equally across countries?

4.3 *Why Calculate Standard Errors Using Countries Instead of Firms?*

The third and final reason why results change between individual and aggregate analysis is that statistical significance changes with the movement from individual observations to country averages. Statistical significance makes sense only in the context of an underlying-chance process. In the case at hand, the implicit chance process to justify the use of individual observations would have to be that there are (say) two boxes of firms, one containing the population of firms subject to the civil law and the other containing the population of firms subject to the common law. One draws random samples from each box and computes the average ownership concentration. One can then use accepted statistical techniques to determine how likely the difference between the two averages is due to chance as opposed to the different legal origins.

It is not clear what the underlying-chance process is with the use of country averages. For instance, if researchers believe that all firm-level determinants are determined at the country level and that firms from different countries should receive different weights to correct any misspecification of the model at the country level, they could simply control for no firm-level determinants and weight the individual firm observations in the way

they believe corrects the misspecification. There is no need to resort to country averages and thereby discard potentially informative data on the variation of ownership and number of observations both within countries and within shared legal clusters. Variation in firm ownership concentration is ultimately what we seek to understand.

4.4 When to Use Country Averages

No one to date has made the theoretical case for using country averages when the within-country data is available.

There is one instance, however, when it can make sense to use country averages as the unit of analysis—when all firms within a given country are identical with respect to the characteristic of interest, in our case ownership concentration. This is not the same as the statement that the shared legal treatment, say, a common-law legal origin, affects all firms equally. If this were the case, as it is with controlled experiments, one would still use individual observations to ascertain whether differences in outcome are due to the treatment or due to the chance occurrence of the other, randomized causal influences. To justify country averages, one would have to go further and assert that the *only* determinant of ownership concentration is the shared legal treatment. If this were the case, then all firms within a country would be identical, at least with respect to the characteristic of interest. In this case, it would not be useful to control for firm-level determinants of ownership—*because there are none*. Weighting of individual observations would also be inappropriate, because by assumption, each observation provides as much information as multiple observations. Finally, it would be appropriate to ignore the within-country variation in ownership because, again by assumption, there is no within-country variation.

Moreover, if there are no other country effects, then one would not use country averages but the average of all firms within a shared legal cluster, say all common-law firms. If there are other country effects, such as GDP per capita, then one could use the country averages in a regression analysis that controls for GDP per capita. In this case, the chance model would be that the sample countries are randomly selected from the population of countries with the same legal protections.

On the other hand, if firms are not identical within countries or within the shared legal cluster, then country averages (or some other aggregate measure) are inappropriate. As Bowers and Drake (2005, pp. 305–306)

explain, using averages as the unit of analysis “implies that [individual units] are identical within [clusters], and thus the mean provides as much information about y and x as the individual observations do. If this decision is not correct, then the analyst has needlessly thrown away a lot of information—and, more important, no longer has a model of an individual-level process. In the end, analysts must worry that the results of such a model reflect the process of aggregation more than, or instead of, an individual-level process.”

Whether all units within a country or some other cluster are identical depends on the question of interest. With ownership concentration, it would seem that all firms within a country are not identical for both the empirical and theoretical reasons already discussed: the wide dispersion in firms' ownership concentration within most countries and the many theoretical and empirical studies of within-country ownership concentration. To justify country averages one must assume that all firms within a country have the same ownership concentration. The implicit reasoning behind country average analyses must, therefore, be that the observed spread in within-country ownership concentration is somehow false, perhaps reflecting measurement error. This level of measurement error seems unlikely as ownership concentration can be directly observed, and large shareholders are legally required to report their ownership accurately. In short, the use of country averages as the unit of analysis in the literature requires assumptions that are implausible with firm ownership concentration and implausible with most other firm-level characteristics.

4.5 *The Demise of Aggregate Data Analysis*

Remarkably, the question of whether one should use individual or aggregate data analysis did not arise with the law-and-finance literature. It has been present from the early days of empirical inquiry. This is why there have been many warnings over the years by statisticians—named *Simpson's Paradox* and investigated as early as Pearson *et al.* (1899) and Yule (Notes on the theory of association of attributes in statistics)—about the potential of aggregate data analysis to produce misleading inferences about individual units. Consequently, methodological overviews of the analysis of grouped data summarily reject the use of averages as the unit of analysis when individual observations are available (e.g., Bowers and Drake, 2005, pp. 305–306; Gelman and Hill, 2007, p. 240; Osborne, 2008, pp. 445–450).

Because of the problems that arise with aggregate data analysis when the within-cluster units are not identical, aggregate data analysis declined markedly in the post-war period.¹² Aggregate data analysis has persisted only in those areas where individual data are unavailable, which is not the case with the literature addressed in this paper and in most other law-and-finance topics.¹³

We would therefore do well to heed the warning by the distinguished statistician David Freedman (2006a, p. 4028) that “it is all too easy to draw incorrect conclusions from aggregate data.”

5 Conclusion

There is an unrecognized but fundamental split in the law-and-finance literature between papers using firm-level data and papers using country-level data. The difference in methodologies can lead to pronounced differences in inference. My paper illustrates this in the context of cross-country differences in firm-ownership concentration. A celebrated result in this literature is a negative relationship between country averages of ownership and investors' legal protections. This relation, however, at base is a theory about individual firms, not a theory about countries.

My paper shows that when one uses data from individual firms, the coefficient on each of three key legal measures either changes sign or loses statistical significance based on similar specifications and the same underlying ownership data. These changes occur because country averages cannot

¹²As Achen and Shively (1995, p. 5) observe: “The Second World War marks a great divide in the social sciences in many ways, but perhaps in no other way is that divide more sharp than in the collapse of aggregate data analysis after the war and its replacement by individual survey analysis as the dominant method of quantitative social research.”

¹³Firebaugh (1978) reviews the post-WWII decline in aggregate data analysis and notes those areas where it has persisted due to the unavailability of individual-level data, for instance in criminology or epidemiology. Freedman *et al.* (1998 and 1999) and King (1999) engaged in a spirited debate over statistical techniques that supposedly enable researchers to draw reliable conclusions about individual behavior from group data. Freedman's fundamental criticism is that King's math is correct, but the assumptions needed for his techniques to be appropriate are seldom satisfied in real world situations. Although they continued to disagree, King (1999, p. 352) acknowledges that his critics “are right about one point: if one can avoid making inferences about individuals from aggregate data, then one should do so. And of course, valid survey data [individual data] make ecological inferences superfluous.”

control for firm-level determinants of ownership and because country averages overweight firms from small countries. Individual firm data for each of the three investor protection measures simply cannot reject the null hypothesis that legal protection and ownership concentration are unrelated at conventional statistical significance levels.

The basic point of my paper goes beyond the ownership-concentration literature. Country averages are the appropriate unit of analysis only when all firms within a country are identical on the characteristic of interest. For many firm-level topics, including firm-ownership concentration, this is implausible. In these instances, by averaging units within a country or some other cluster, valuable information is lost and incorrect inferences become likely.

A Appendix

Ownership Concentration (LLSV):

Description: “Average percentage of common shares owned by the top three shareholders in the ten largest non-financial, privately-owned domestic firms in a given country. A firm is considered privately-owned if the State is not a known shareholder in it.” Shareholders are not required to own any minimum percentage stock to be included in this measure.

Source: LLS (2006). The country averages come from Andrei Shleifer’s website accessed on March 4, 2009. The underlying firm-level data come directly from the authors. The data come from the period 1995–1996, with the exception of Ecuador (2000), Uruguay (1998–2000) and Jordan (1999). (Private communications with the authors.) The only change to the firm-level data involves the Austrian firm Jenbacher Werke. It was included twice with an ownership concentration of 51%. One of these duplicate observations was deleted.

Ownership Concentration:

Description: (Worldscope) Worldscope item WC05475. “It represents shares held by insiders. For Japanese companies closely held represents the holdings of the ten largest shareholders. For companies with more than one class of common stock, closely held shares for each class are added together. It includes but is not restricted to: shares held by officers, directors, and

their immediate families; shares held in trust; shares of the company held by any other corporation; shares held by pension/benefit plans; shares held by individuals who hold 5% or more of the outstanding shares. It excludes: shares under option exercisable within 60 days; shares held in a fiduciary capacity; preferred stock or debentures that are convertible into common shares.” To correct obvious data errors and to exclude firms that are effectively privately held, firms for which this data item is greater than 95% are dropped.

Source: Thomson Financial Datastream. Data is from December 31, 1996.

Firm Size:

Description: The natural log of the market value of the firm’s equity. Datastream item WC07210. “The total market value of the company based on year end price and number of shares outstanding converted to U.S. dollars using the year end exchange rate. For companies with more than one type of common/ordinary share, market capitalization represents the total market value of the company.” If data item WC07210 is unavailable, the alternative data items MVC and MVCU are used, in that order.

Source: Thomson Financial Datastream. The data are as close to December 31, 1996 as possible. If the data do not come from 1996, they are converted to 1996 dollars with the gross national product (GNP) Deflator. If Firm Size is missing (see below), a value of zero is assigned.

Missing Firm Size:

Description: Takes a value of one if Firm Size is missing and zero otherwise.

Source: If Firm Size is unavailable for all years between 1992 and 2000, it is recorded as missing.

Firm Age:

Description: The natural log of the number of years since incorporation as of 1996. Datastream item WC18273. “Date of Incorporation represents the date the company was incorporated.”

Source: Thomson Financial Datastream. The data are as close to December 31, 1996 as possible. For LLSV firms with missing Datastream data, I searched company websites for information on the date of incorporation. If Firm Age is missing (see below), a value of zero is assigned.

Missing Firm Age:

Description: Takes a value of one if Firm Age is missing and zero otherwise.

Source: If Firm Age is unavailable for all years between 1992 and 2000 or if it is unavailable after Internet research, it is recorded as missing. Indices of Country-Level Legal Protections for Investors.

*Country-Level***Anti-Director Rights Index:**

Description: The “aggregate index of shareholder rights.” The index is formed by summing: (1) vote by mail; (2) shares not blocked or deposited; (3) cumulative voting; (4) oppressed minority; (5) pre-emptive rights; and (6) percentage of share capital required to call an extraordinary shareholders’ meeting. The Anti-Director Rights Index was first proposed in (LLSV) 1998. The revised and most current version of the Index, DLLS (2008), is used.

Source: DLLS (2008). These data come from Andrei Shleifer’s website accessed on March 4, 2009.

Common-Law Legal Origin:

Description: Takes a value of one if a country has a common law legal tradition and zero otherwise.

Source: LLSV (1998). These data come from Andrei Shleifer’s website accessed on March 4, 2009.

Anti-Self-Dealing Index:

Description: The “average of ex-ante and ex-post private control of self-dealing.”

Source: DLLS (2008). These data come from Andrei Shleifer’s website accessed on March 4, 2009.

*Ancillary Country-Level Control Variables***Per-Capita GDP:**

Description: The natural logarithm of “GDP per capita in Purchasing Power terms” from the 1994 World Development Indicators.

Source: LLS (2008). These data come from Andrei Shleifer’s website accessed on March 4, 2009. I selected this particular measure of per capita GDP to be able to replicate the regression of ownership concentration on the Anti-Self-Dealing Index reported in LLS (2008, p. 295, Panel B).

Judicial Enforcement:

Description: “Logarithm of the length (in calendar days) of the judicial procedure to collect on a bounced check.”

Source: DLLS (2008). These data come from Andrei Shleifer’s website accessed on March 4, 2009.

References

- Achen, C. H. and W. P. Shively. 1995. *Cross-Level Inference*. University of Chicago Press.
- Anderson, R. C. and D. M. Reeb. 2003. “Founding-family ownership and firm performance: Evidence from the S&P 500”. *Journal of Finance*. 58: 1301–1328.
- Beny, L. N. 2005. “Do insider trading laws matter? Some preliminary comparative evidence”. *American Law and Economics Review*. 7: 144–183.
- Boone, A. L., L. C. Field, J. M. Karpoff, and C. G. Raheja. 2007. “The determinants of corporate board size and composition: Empirical evidence”. *Journal of Financial Economics*. 85: 66–101.
- Booth, L., V. Aivazian, A. Demircug-Kunt, and V. Maksimovic. 2001. “Capital structures in developing countries”. *Journal of Finance*. 56: 87–130.
- Bowers, J. and K. W. Drake. 2005. “EDA for HLM: Visualization when probabilistic inference fails,” *Political Analysis*. 13: 301–326.
- Dahya, J., O. Dimitrov, and J. J. McConnell. 2008. “Dominant shareholders, corporate boards and corporate value: A cross-country analysis”. *Journal of Financial Economics*. 87: 73–100.
- Demircug-Kunt, A. and V. Maksimovic. 1998. “Law, finance, and firm growth”. *Journal of Finance*. 53: 2107–2137.
- Demircug-Kunt, A. and V. Maksimovic. 1999. “Institutions, financial markets, and firm debt maturity”. *Journal of Financial Economics*. 54: 295–336.

- Demsetz, H. and K. Lehn. 1985. "The structure of corporate ownership: Causes and consequences". *Journal of Political Economy*. 93: 1155–1177.
- Dittmar, A., J. Mahrt-Smith, and H. Servaes. 2003. "International corporate governance and corporate cash holdings". *Journal of Financial and Quantitative Analysis*. 38: 111–133.
- Djankov, S., O. Hart, C. McLiesh, and A. Shleifer. 2008a. "Debt enforcement around the world". *Journal of Political Economy*. 116: 1105–1149.
- Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer. 2008b. "The law and economics of self-dealing". *Journal of Financial Economics*. 88: 430–465.
- Doidge, C., G. A. Karolyi, and R. M. Stulz. 2007. "Why do countries matter so much for corporate governance?" *Journal of Financial Economics*. 86: 1–39.
- Durnev, A. and E. H. Kim. 2005. "To steal or not to steal: Firm attributes, legal environment, and valuation". *Journal of Finance*. 60: 1461–1493.
- Dyck, A. and L. Zingales. 2004. "Private benefits of control: An international comparison". *Journal of Finance*. 59: 537–600.
- Esty, B. C. and W. L. Megginson. 2003. "Creditor rights, enforcement, and debt ownership structure: Evidence from the global syndicated loan market". *Journal of Financial and Quantitative Analysis*. 38: 37–59.
- Faccio, M. 2006. "Politically connected firms". *American Economic Review*. 96: 369–386.
- Fan, J. P. H., S. Titman, and G. Twite. 2012. "An international comparison of capital structure and debt maturity choices". *Journal of Financial and Quantitative Analysis*. 47: 23–56.
- Field, L. C. and J. M. Karpoff. 2002. "Takeover defenses of IPO firms". *Journal of Finance*. 57: 1857–1889.
- Firebaugh, G. 1978. "A rule for inferring individual-level relationships from aggregate data". *American Sociological Review*. 43: 557–572.
- Franks, J., C. Mayer, and S. Rossi. 2009. "Ownership: Evolution and regulation". *Review of Financial Studies*. 22: 4009–4056.
- Freedman, D. A. 2006a. "Ecological inferences and the ecological fallacy". *International Encyclopedia of the Social and Behavioral Sciences*: 4027–4030.
- Freedman, D. A. 2006b. "On the so-called "Huber Sandwich Estimator" and "Robust Standard Errors,"" *The American Statistician*. 60: 299–302.

- Freedman, D. A., S. P. Klein, M. Ostland, and M. R. Roberts. 1998 and 1999. "Review of 'A Solution to the Ecological Inference Problem'". *Journal of the American Statistical Association*. 93: 1518–22. with discussion 94, 352–357.
- Gelman, A. and J. Hill. 2007. *Data Analysis Using Regression and Multi-level/Hierarchical Models*. New York: Cambridge University Press.
- Griffin, J. M., F. Nardari, and R. M. Stulz. 2007. "Do investors trade more when stocks have performed well? Evidence from 46 countries". *Review of Financial Studies*. 30: 905–951.
- Himmelberg, C. P., R. G. Hubbard, and D. Palia. 1999. "Understanding the determinants of managerial ownership and the link between ownership and performance". *Journal of Financial Economics*. 53: 353–384.
- Holderness, C. G. 2016. "Law and Ownership Reexamined". *Critical Finance Review*. 5(1): xx–xx.
- Holderness, C. G., R. S. Kroszner, and D. P. Sheehan. 1999. "Were the good old days that good? Changes in managerial stock ownership since the Great Depression". *Journal of Finance*. 54: 435–469.
- Holderness, C. G. and D. P. Sheehan. 1988. "The Role of Majority Shareholders in Publicly Held Corporations". *Journal of Financial Economics*. 20: 317–346.
- Jin, L. and S. C. Myers. 2006. "R2 around the world: New theory and new tests". *Journal of Financial Economics*. 79: 257–292.
- Kalcheva, I. and K. V. Lins. 2007. "International evidence on cash holdings and expected managerial agency problems". *Review of Financial Studies*. 20: 1087–1112.
- Karpoff, J., P. H. Malatesta, and R. A. Walkling. 1996. "Corporate governance and shareholder initiatives: Empirical evidence". *Journal of Financial Economics*. 42: 365–395.
- Khorana, A., H. Servaes, and P. Tufano. 2009. "Mutual fund fees around the world". *Review of Financial Studies*. 22: 1279–1310.
- Kim, E. H., A. Morse, and L. Zingales. 2006. "What has mattered to economics since 1970". *Journal of Economic Perspectives*. 20: 189–202.
- King, G. 1999. "The future of ecological inference research: A comment on Freedman et al." *Journal of the American Statistical Association*. 94: 352–355.
- King, G. and M. Roberts. 2014. "How robust standard errors expose methodological problems they do not fix". *Political Analysis*: 1–21.

- Kumar, K. B., R. G. Rajan, and L. Zingales. 2001. *What determines firm size? unpublished working paper*. Chicago, IL: University of Chicago.
- La Porta, R., F. Lopez-de-Silanes, and A. Shleifer. 1999. "Corporate ownership around the world". *Journal of Finance*. 54: 471–517.
- La Porta, R., F. Lopez-de-Silanes, and A. Shleifer. 2002a. "Government ownership of banks". *Journal of Finance*. 57: 265–301.
- La Porta, R., F. Lopez-de-Silanes, and A. Shleifer. 2006. "What works in securities laws?" *Journal of Finance*. 61: 1–32.
- La Porta, R., F. Lopez-de-Silanes, and A. Shleifer. 2008. "The economic consequences of legal origins". *Journal of Economic Literature*. 46: 285–332.
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. W. Vishny. 1998. "Law and finance". *Journal of Political Economy*. 106: 1113–1155.
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. W. Vishny. 2000. "Agency problems and dividend policies around the world". *Journal of Finance*. 55: 1–33.
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. W. Vishny. 2002b. "Investor protection and corporate valuation". *Journal of Finance*. 57: 1113–1155.
- Leuva, C., D. Nanda, and P. D. Wysocki. 2003. "Earnings management and investor protection: An international comparison". *Journal of Financial Economics*. 69: 505–527.
- Li, D., F. Moshirian, P. K. Pham, and J. Zein. 2006. "When financial institutions are large shareholders: The role of macro corporate governance environments". *Journal of Finance*. 61: 2975–3007.
- McLean, D., T. Zhang, and M. Zhao. 2012. "Why does the law matter? Investor protection and its effects on investment finance and growth". *Journal of Finance*. 67: 313–350.
- Morck, R., A. Shleifer, and R. W. Vishny. 1988. "Management ownership and market valuation: An empirical analysis". *Journal of Financial Economics*. 20: 293–315.
- Morck, R., B. Yeung, and W. Yu. 2000. "The information content of stock markets: Why do emerging markets have synchronous stock price movements?" *Journal of Financial Economics*. 58: 215–260.
- Moulton, B. R. 1990. "An illustration of a pitfall in estimating the effects of aggregate variables on micro units". *Review of Economics and Statistics*. 72: 334–338.

- Mueller, H. M. and T. Philippon. 2011. "Family firms and labor relations". *American Economic Journal: Macroeconomics*. 3: 218–245.
- Nenova, T. 2003. "The value of corporate voting rights and control: A cross-country study". *Journal of Financial Economics*. 68: 325–351.
- Osborne, J. W. 2008. "A brief introduction to hierarchical linear modeling". In: *Best Practices in Quantitative Methods*. Ed. by J. W. Osborne. Los Angeles: Sage Publications.
- Pearl, J. 2009. *Causality: Models, Reasoning, and Inference*. New York: Cambridge University Press.
- Pearson, K., A. Lee, and L. Bramley-Moore. 1899. "Genetic (reproductive) selection: Inheritance of fertility in man". *Philosophical Transactions of the Royal Society A*. 173: 534–539.
- Petersen, M. A. 2008. "Estimating standard errors in finance panel data sets: Comparing approaches". *Review of Financial Studies*. 22: 435–480.
- Qian, J. and P. E. Strahan. 2007. "How laws and institutions shape financial contracts: The case of bank loans". *Journal of Finance*. 61: 867–892.
- Rajan, R. G. and L. Zingales. 1995. "What do we know about capital structure? Some evidence from international data". *Journal of Finance*. 50: 1421–1460.
- Rajan, R. G. and L. Zingales. 2003. "The great reversals: The politics of financial development in the Twentieth Century". *Journal of Financial Economics*. 69: 5–50.
- Robinson, W. S. 1950. "Ecological correlations and the behavior of individuals". *American Sociological Review*. 15: 351–357.
- Roe, M. J. 2006. "Legal origins, politics, and modern stock markets". *Harvard Law Review*. 120: 460–527.
- Shleifer, A. and R. W. Vishny. 1986. "Large shareholders and corporate control". *Journal of Political Economy*. 94: 461–488.
- Spamann, H. 2010. "The "Antidirector Rights Index" revisited". *Review of Financial Studies*. 23: 467–486.
- Stulz, R. M. 1988. "Managerial control of voting rights: Financing policies and the market for corporate control". *Journal of Financial Economics*. 20: 25–54.
- Stulz, R. M. 1990. "Managerial discretion and optimal financing policies". *Journal of Financial Economics*. 26: 3–27.
- Stulz, R. M. 2005. "The limits of financial globalization". *Journal of Finance*. 60: 1595–1638.

- Wurgler, J. 2000. "Financial markets and the allocation of capital". *Journal of Financial Economics*. 58: 187–214.
- Yule, G. U. Notes on the theory of association of attributes in statistics. *Biometrika*. 2: 121–134.