The Concept of Legal Uncertainty

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Abstract

There is a great deal of theoretical literature on the causes and consequences of legal uncertainty. However, there has been virtually no empirical analysis of these issues, perhaps on account of the absence of rigorously defined yet practical measures of legal uncertainty. This article defines several different kinds of legal uncertainty in ways that correspond to well-recognized concepts such as risk and ambiguity and shows how survey data can be used to construct measures of those forms of legal uncertainty.

1 Introduction

Certainty is generally considered to be a virtue in a legal system. Max Weber went so far as to attribute the development of the capitalist economy to legal certainty (Trubek 1972). Legal uncertainty, meanwhile, is regarded as a vice. It is routinely blamed for undermining both the rule of law in general and the law's ability to achieve specific objectives such as deterring anti-social conduct or encouraging trade and investment (see for example Kerhuel and Raynouard 2010). This blaming exercise in turn leads to a search for the causes of legal uncertainty. Ambiguous legal texts, arbitrary mechanisms for selecting judges, broad grants of discretion to law enforcement officials, and lack of

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transparency about the workings of the legal system are often identified as the culprits. There is, however, little hard evidence to support claims about either the causes of the consequences of legal uncertainty, mainly because there have been few efforts to construct measures of the critical variable. Accordingly, this paper identifies several potentially useful ways of defining and measuring the concept of legal uncertainty and shows how at least some of them can be operationalized using existing data.

A quick illustration reveals the variety of possible definitions of legal uncertainty. Suppose you describe the facts of a dispute to 10 different people and then ask them whether the plaintiff is likely to win or lose. For the sake of concreteness, assume that the case involves the victim of a car accident suing the driver in negligence. There are at least 5 distinct senses in which one might say that the applicable legal regime is uncertain:

1. If all 10 people say that the plaintiff has a 50 per cent chance of winning then we would say that the outcome is uncertain. If by contrast they all put the plaintiff's chance of winning at 10 per cent – or, for that matter, at 90 per cent – then the legal outcome seems more certain.
2. Suppose the people all respond with a range of probabilities. If they say, "between 40 and 60 percent" then we might say that the legal outcome is more uncertain than if they say "between 45 and 55 percent".
3. Regardless of the probabilities the people assign to the plaintiff's winning, the greater the difference between the payoffs associated with winning and losing the more uncertain, in a sense, the legal outcome might appear to be.

4. Suppose that the description of the dispute does not include the precise speed at which the defendant was driving and so people are asked to assign a probability of plaintiff victory for each speed between 40 and 60 miles per hour. If the probabilities people assign increase gradually with the defendant's speed then we might say that the law—as opposed to the outcome of any given dispute—is more uncertain than if the probabilities increase abruptly from zero to 100 per cent at 50 miles per hour.
5. Suppose each person provides a different answer to the above questions. For instance, in response to question 1: A says 10 per cent, B says 20 per cent, and so on. In this case there seems to be more legal uncertainty than if each person offered the same answer.

The forms of legal uncertainty illustrated by these scenarios are conceptually distinct and seem to merit different labels. In the first scenario, greater uncertainty means greater variation in the level of confidence that different outcomes will occur. We will say that it captures whether the legal outcome is more or less *unpredictable*. In the second scenario there is variation in the size of the range of probabilities associated with the outcome. We will refer to this as *ignorance*. In the third scenario what varies is uncertainty over the monetary payoffs associated with legal outcomes rather than over the outcomes themselves. These forms of uncertainty are commonly known as *risk* and *ambiguity*. In the fourth scenario, uncertainty varies across fact patterns. We will say it involves uncertainty about *laws* rather than about the narrower *legal propositions* that govern

specific disputes. The fifth scenario involves beliefs that vary across actors. In other words, it captures *disagreement* about legal propositions and laws.

This set of illustrations not only shows that it is feasible to define different forms of legal uncertainty, but also hints at how to measure them. The idea of surveying people subject to different legal regimes on their beliefs about the outcomes of hypothetical legal disputes is not a fanciful one; there are now at least three important cross-country datasets generated in this way. As a result, some of the forms of legal uncertainty defined above can be measured using existing data, and it would not be difficult to design new surveys that measure other forms.

Concepts such as unpredictability, ambiguity and risk have well-understood meanings in the social science literature. Defining and measuring legal uncertainty in these terms makes it possible to draw upon existing literature to develop and test theories of how various kinds of legal uncertainty influence political attitudes, decision-making and information processing. For example: Does unpredictability undermine perceptions of the legitimacy of a legal regime? Do risk and ambiguity induce settlement? Does disagreement discourage settlement? Does risk induce compliance with laws? Is information about unpredictable legal systems less accessible? It can also be interesting to explore the role that various objective factors such as ambiguities in legal texts or heterogeneity among decisionmakers play in causing people to perceive different forms of legal uncertainty.

The rest of this paper is organized as follows. Section 2 discusses existing literature on how to go about defining and measuring legal uncertainty. Section 3 draws a distinction between subjective and objective forms of uncertainty. Section 4 defines two

main forms of legal uncertainty, distinguishes uncertainty over legal outcomes from uncertainty over monetary payoffs, and then discusses the problems of aggregating across fact patterns and actors. Section 5 shows how crude measures of some forms of uncertainty can be constructed from existing survey data and suggests how more refined measures might be constructed. Section 6 discusses ways in which such measures might be used in studying either the causes or consequences of legal uncertainty. Section 7 concludes with suggestions for further research on the definition and measurement of legal uncertainty.

2 Related literature

In the theoretical literature, an early work discussing alternative conceptions of legal uncertainty is D'Amato (1983). He defines legal uncertainty in a way that corresponds to what this paper defines as unpredictability and distinguishes it from what he calls "lawyer's uncertainty," which corresponds to what I have labelled "legal disagreement." D'Amato also explores the causes and consequences of uncertainty in the U.S. legal system. However, he only considers the application of these concepts in simple settings in which cases have only two possible outcomes, win or lose.

Harel and Segal (2000, especially 291-293) provide rigorous subjective definitions of the concepts of risk and ambiguity as applied to outcomes of criminal cases. However, they do not discuss the meanings of those concepts in situations in which laws apply to many fact patterns or to multiple actors, nor do they discuss practical ways of measuring legal uncertainty.

There are many studies which analyze the effects of specific forms of legal uncertainty on various kinds of behavior. For instance, Craswell and Calfee (1986) (as well as other scholars of accident law) employ a definition of legal uncertainty that involves a particular form of aggregation across fact patterns and analyze how it influences the deterrent effect of laws. Craswell and Calfee restrict their formal analysis to cases with only two possible outcomes and do not consider the possibility of ambiguity or disagreement. A number of authors analyze the effects of disagreement on settlement of litigation (Gould 1973; Posner, 1973: 423-426) although the effects of disagreement upon deterrence have also been examined (Bebchuk and Kaplow, 1992). Bebchuk's (1984) model of settlement under conditions of asymmetric information effectively analyzes the combined effects of what this paper will call disagreement and ambiguity. Bebchuk and Kaplow (1992) show how the relationship between disagreement about the probability of apprehension and disagreement about expected sanctions can vary with the actual probability of apprehension and sanction.

Little work has been done on empirical measures of legal uncertainty. A notable exception is Farnsworth, Guzior and Malani (2010). They use surveys to measure the "ambiguity" surrounding hypothetical laws applied to hypothetical fact patterns. They define ambiguity in at least two different ways, neither of which corresponds precisely to any of the definitions of uncertainty formulated in this paper. The divergence in approach is likely due to the fact that their focus is on defining and measuring conceptions of legal ambiguity for use in legal analysis. For example, under US law the level of ambiguity of a statute can determine who, as between a court and an administrative agency, is entitled

to interpret it.[1] By contrast, the focus of the present paper is on defining and measuring legal uncertainty for the purposes of social scientific analyses of the effects of law.

There is a large literature on cross-country measures of the properties legal institutions, including both objective and subjective measures (see, e.g. Kaufmann and Kraay 2008; Voigt 2009), and the existence and significance of legal uncertainty has been noted (Davis and Kruse 2007, 1105-6; Kaufmann and Kraay 2008, 5-6; Raynouard and Kerhuel 2010). However, little attention has been paid to measures of legal uncertainty, especially of the subjective kind. There is also extensive literature on the measurement of institutional quality across countries. The measure of legal disagreement presented here is constructed from individual responses to survey data in the same way as Wei's (1997) measure of uncertainty about the level of corruption.

3 Subjective versus objective conceptions of legal uncertainty

It is impossible to define the concept of legal uncertainty without drawing a distinction between its *subjective* and *objective* forms. Defined objectively, legal uncertainty is a property of laws themselves – law *X* just *is* uncertain. The subjective approach by contrast assumes that uncertainty is a property of people's beliefs about the law – law *X* is uncertain *to person Y*.

Both kinds of legal uncertainty are important in understanding how law influences social and economic outcomes. This is especially clear when it comes to the analysis of how law influences behavior. Behavioral incentives created by any given law are a

[1] *See Chevron U.S.A. v. Natural Resources Defense Council, Inc.* , 467 U.S. 837 , 842-843 (1984) ("[I]f the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute").

function of people's beliefs about the law rather than what some objective observer would say about it. At the same time, it is typically reasonable to presume that beliefs about law are determined to some extent by its objective features. In general therefore, beliefs about law, including beliefs about legal uncertainty, are intervening factors in the causal relationship between objective features of a legal system and outcomes of interest. Since the aim here is to develop measures of legal uncertainty that can be used to explain social or economic outcomes *directly*, the focus will be on alternative measures of subjective legal uncertainty.

4 Forms of legal uncertainty

4.1 A model of how beliefs about law are formed

The definitions of legal uncertainty in the following sections are based on a particular model of how actors form beliefs about law. The guiding spirit of the model is Oliver Wendell Holmes' prediction theory of law: the idea that law is no more than a prediction of what a legal official—a judge in Holmes' version of the theory—will do. In this model legal uncertainty is nothing more than uncertainty about what legal officials will do.[2]

In more technical terms, the foundation of the model is an assumption that the universe of physically possible concatenations of facts, Ω, can be partitioned, more or less finely, into a finite number of *fact patterns* so that $\Omega = \{\omega_{i,},\ldots,\omega_{N,}\}$. For any given fact pattern, legal officials assign one element from a set of mutually exclusive *legal outcomes* $D = \{d_1,\ldots,d_J\}$. For example, in a case of theft the set of legal outcomes might

[2] Holmes (1897: 461) ("The prophecies of what the courts will do in fact, and nothing more pretentious, are what I mean by the law.")

be {conviction, acquittal}. In the case of a car accident the set of outcomes might be a range of damage awards. In many cases both criminal and civil sanctions, imposed either in isolation or in combination, are possible. In fact, for present purposes there is no need to limit the range of possible legal outcomes. So for instance, those who reject a court-centered view of law might focus on the actions of legal officials besides judges, such as the actions of police officers – for example, {release, search, arrest} – or, in societies governed by customary law, the actions of a chief or village elder.[3] Uncertainty enters the model to the extent that actors are uncertain about the legal outcomes that will be assigned to a particular fact pattern.[4]

A substantial body of literature, backed by empirical observation, suggests that in the presence of uncertainty it often is not valid to assume that actors' beliefs about the likelihood of events can be represented by a unique probability. Accordingly, the present model adopts the weaker assumption that actors believe any probability falling within some finite interval - such as 'between 40 and 60 percent' – to be possible. These kinds of beliefs can be conveniently summarized by a probability function $p(\cdot)$ where $p(d)$ is the minimum 'probability', from 0 to 1, that the actor assigns to d, and $1 - p(\text{not } d)$ is the maximum probability (see for example, Mukerji 1998 (citing Schmeidler 1989)). This kind of probability function is non-standard because it does not obey the axiom that $p(d) + 1 - p(\text{not } d) \leq 1$. We do, however, assume that it obeys the familiar axioms that $p(\emptyset) = 0$ and $p(D) = 1$.

[3] For a claim that the effects of legal uncertainty upon compliance may vary depending on the type of legal outcome being examined see Feldman and Teichman (2009).

[4] Farnsworth et al. (2010) take a very different approach. They do not appear to be interested in subjects' beliefs about the actions of legal officials other than the subjects themselves. They are interested in subjects' beliefs about whether a particular legal outcome is "plausible" or "better" to either the subject themselves or to "ordinary readers of English."

With these concepts in hand, we can then define the following terms:

Legal proposition: A mapping which associates probabilities with legal outcomes conditional on the actor and the fact pattern, or in formal terms: $L_k = \{(p(d_1|\omega_i), d_1), ..., (p(d_J|\omega_i), d_J)\}$.[5]

Law: A set of legal propositions defined over multiple fact patterns.

Legal system: A set of laws defined over the universe of possible fact patterns in a given jurisdiction.

The key idea here is that laws encompass multiple legal propositions and legal systems encompass several laws. Accordingly, for present purposes it is not necessary to explore how the boundaries of fact patterns or jurisdictions are defined.

It is worth stressing that these legal concepts are defined in actor-specific terms. This approach allows different actors to hold different beliefs about the probabilities of legal outcomes. Those actors may in turn have different preferences over the outcomes in question. For example, consider the set of legal outcomes that comprises {win, lose, award of nominal damages}. One actor may prefer the conclusiveness of either winning or losing to the inconclusiveness of an award of nominal damages; another actor may focus purely on the monetary value of the award and prefer an award of nominal damages to failure; yet another actor may be indifferent between success and nominal damages if the damages to be awarded in the event of success are uncertain.

We now turn to the question of what it means for a legal proposition to be uncertain.

[5] For the sake of convenience the references to actors and fact patterns will generally be omitted from the representations of legal propositions.

4.2 Uncertainty as unpredictability

It is occasionally useful to understand uncertainty simply as a measure of the dispersion of the probabilities associated with a set of outcomes. This kind of uncertainty is maximized when probabilities are uniformly distributed, as in the situation where plaintiff can only either win or lose a case and believes that each outcome has a probability of 50 percent. This concept captures the extent to which an actor expects to the realized outcome to deviate from their best guess. In other words, the extent to which they expect to be 'surprised.' For present purposes we will call this form of legal uncertainty *legal unpredictability*. Figure 1 shows legal propositions that display different levels of unpredictability; the red line represents a person who assigns more uniform probabilities to the set of legal outcomes.

[Figure 1 about here.]

The unpredictability of a standard probability distribution is best measured using its *entropy*. For $L = \{(p(d_1), d_1), ..., (p(d_J), d_J)\}$ entropy is defined as $H(L) = -\sum_{j=1}^{J} p(d_j) \log[p(d_j)]$ (Shannon 1948). Correspondingly, where actors assign unique probabilities to legal outcomes, legal unpredictability can usefully be defined as the entropy of a legal proposition. An alternative way of measuring the unpredictability of a legal proposition is to calculate the variance of the associated distribution of

outcomes, but since variance captures dispersion of outcomes rather than dispersion of probabilities it does not quite fit the concept of unpredictability.

The concept of unpredictability is not well-defined if actors do not assign unique probabilities to legal outcomes. If $p(\cdot)$ represents the minimum of a range of probabilities assigned and the size of the range of probabilities assigned to outcomes – i.e., what we have defined as "ignorance" – varies in the distributions being measured, then treating entropy as a measure of legal unpredictability will only be useful in the special case where the level of ignorance is constant across all the outcomes in all of the distributions being measured.

4.3 Uncertainty as ignorance

Another way of defining legal uncertainty is to treat it as a measure of the 'confidence,' for lack of a better term, that actors have in their ability to assign probabilities to legal outcomes and, correlatively, in their ability to rule out alternative beliefs.

The idea that people may have varying degrees of confidence in their ability to assign probabilities is motivated in part by the considerable body of evidence that people's willingness to bet on events is often influenced by the amount of supporting information they have (Camerer and Weber, 1992). The idea is that confidence increases with the amount of information that is relevant to determining a distribution of probabilities over the outcomes and, conversely, decreases with the amount of missing information. So, for example, a plaintiff's beliefs about the outcome of a trial—as manifested, for instance in their willingness to invest in litigation—may differ depending

upon whether an informed attorney says that the probability of success is '50 percent' or '40 or 60 percent, depending on which judge we draw' or 'between 40 and 60 percent' or 'impossible to estimate.' In each of these cases the plaintiff may form the opinion that the probability of success is 50 per cent, but that opinion is likely to be held more confidently in the first case than in the other cases. Unfortunately, there is no consensus on why this sort of variation in beliefs occurs or how to represent it formally. There is not even a consensus about what it ought to be called. We follow Huber (2010) in referring to this form of uncertainty as "*ignorance*". Other common labels are "Knightian uncertainty" and "ambiguity" (Camerer and Weber 1992).[6]

In the present model, actors whose beliefs reflect more ignorance assign probabilities that span larger intervals, e.g., 40 to 60 percent as opposed to 49 to 51 percent. In other words, the measure of ignorance for any given legal outcome is the size of the difference between the minimum and the maximum probabilities associated with that outcome: $I_j = 1 - p$ (not d_j) $- p$ (d_j). In Figure 2, the area between the two red lines represents a person who assigns a range of probabilities to each legal outcome, while the blue line represents a person who assigns a unique probability.

[Figure 2 about here.]

The ignorance of an entire legal proposition can be measured by calculating the average ignorance over all the possible outcomes: $I = \sum_j [1 - p \text{ (not } d_j) - p \ (d_j)] / J$. It might also be interesting to know how ignorance is distributed across possible outcomes.

[6] Others refer to this concept as simply "uncertainty" citing Keynes' famous distinction between uncertainty and risk.

For instance, people might be very confident in assigning very high or very low probabilities to legal outcomes. To continue with our example, people may be very confident that a reckless driver has zero probability of either escaping liability altogether or being ordered to pay $10 million dollars in damages, but less confident about his chances of being liable for $100,000. A summary way of describing the distribution of ignorance within a legal proposition would be to calculate the variance of ignorance across the possible outcomes: Var $(I) = \sum_j [I_j - I]^2 / J$.

4.4 Uncertainty over payoffs versus uncertainty over outcomes

The objective of defining legal uncertainty is often to analyze its effects on behavior. In these circumstances it becomes important to treat legal uncertainty as a property of probability distributions over monetary payoffs rather than distributions over legal outcomes. There is an important sense in which a legal proposition that assigns equal probabilities to damage awards of $0, $5000, and $10,000 is more uncertain than one for which the equally probable awards are $3000, $5000, and $7000, even though the two propositions entail the same amount of legal unpredictability. In other words, the greater the probabilities attached to legal outcomes with monetary payoffs that are relatively distant from one another, the greater the legal uncertainty.

The first step toward defining and measuring this kind of legal uncertainty is to transform a distribution of probabilities over legal outcomes into a distribution over monetary payoffs. We can call this distribution a *monetized legal proposition*, denoted by *ML*. If actors assign conventional probabilities to outcomes then the next step typically

will be to measure the *risk* associated with that monetized legal proposition. Riskiness is conventionally defined so that the more risky is a particular distribution of monetary payoffs the less valuable it will be to a risk-averse person, that is to say, someone whose utility is a concave function of their wealth. For any given actor, riskiness can be measured by calculating the *risk premium* associated with a monetized legal proposition.[7] The risk premium is simply the difference between the expected value of the proposition and the monetary value the relevant actor would assign to the proposition, in other words, the amount they would pay to obtain the expected outcome (in monetary terms) with certainty. In principle, the *ambiguity premium* associated with a monetized legal proposition can be calculated in a similar fashion, although it is not obvious how to calculate the expected outcome of a monetized legal proposition when actors do not assign unique probabilities to legal outcomes.[8]

4.5 Variation across fact patterns

Uncertainty can vary across fact patterns. For instance, the definitions of legal uncertainty offered so far shed light on what it means to say that a person is uncertain what legal outcomes will follow if a specific fact pattern occurs. In other words, they explain what it might mean to say, 'I am uncertain about the legal consequence of driving down this street at 90 km/h'. But what it would mean to say 'I am uncertain about the legal consequences of driving down this street'? This broader statement implies that there

[7] Since riskiness depends in part on actors' preferences over monetary outcomes there is no objective measure of riskiness. So for example, the variance of a distribution is not always a good proxy for its riskiness (Rothschild and Stiglitz, 1970). Only some distributions, namely those for which one is a mean-preserving spread of the other, can be ranked objectively in terms of riskiness (meaning that any risk-averse person would prefer one distribution over the other).

[8] One approach is to calculate the expected value using the minimum of the range of probabilities assigned. See Gilboa and Schmeidler (1989).

can be uncertainty about the legal outcomes associated with a *set* of fact patterns, such as driving down a specific street at a range of speeds. In other words, it is possible to speak of the uncertainty of not only legal propositions but also laws—such as the law that probabilistically assigns legal outcomes to all of the fact patterns that involve driving on a specific street—as well as, in principle, entire legal systems. For every form of legal uncertainty associated with legal propositions, i.e. unpredictability, risk, ambiguity or disagreement, there is a corresponding form of uncertainty for laws.

It is useful to analyze the distribution of uncertainty across fact patterns when actors can change the facts through their actions, as in a case where potential defendants can choose how fast to drive. It is also important to take into account the effects of uncertainty on multiple fact patterns when analyzing the impact of legal instruments that inevitably influence multiple fact patterns at once, such as state-wide traffic codes that require vehicles to be operated at a "reasonable and prudent" speed at all times.[9]

The most straightforward way to measure the uncertainty of laws is to calculate the average level of uncertainty of the component legal propositions. This would give a sense of how much legal uncertainty is associated with, say, driving between 80 and 100 km/h down a particular street.

It might be more interesting, however, to know how uncertainty is distributed across fact patterns. For instance, suppose someone says, "I am uncertain about the speed limit on this street?" This statement says something about how the magnitude of uncertainty varies with speed.[12] To simplify matters, it helps to assume that there are only

[9] See, e.g. Montana Code Annoted, 61-8-303(3).

[12] The formal representations of legal uncertainty developed by Craswell and Calfee (1986), as well as other tort law scholars such as Shavell (1987: chapter 4) and Kahan (1989), measure this kind of uncertainty of laws rather than legal propositions. For instance, Craswell and Calfee's motivating example

two possible legal outcomes, liability and no liability. Also, assume that the drivers in question assign a unique probability to each outcome, conditional on their speed. A driver who is uncertain about the speed limit believes that there is a range of speeds in which legal outcomes are uncertain, while outside of that range – i.e., at speeds that are believed with confidence to be above or below the limit – the outcomes are quite certain. In other words, her level of uncertainty varies significantly over the set of speeds. By contrast, a driver who is perfectly certain about the speed limit will be perfectly certain about legal outcomes at every speed – his level uncertainty will not vary. This contrast is captured in Figure 3: The red line represents a person who is highly uncertain about the speed limit and so assigns a gradually increasing probability of liability as speed increases. The blue line represents a person who is highly certain about the speed limit and so is perfectly certain of the outcome at all speeds.

[Figure 3 about here.]

This kind of variation in uncertainty across fact patterns can be called *indeterminacy*. It can be calculated in various ways, including by measuring the variance or the entropy in the amounts of unpredictability, risk or ambiguity associated with the set of legal propositions that make up a law or legal system.

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is a defendant who has to choose a level of care, measured along a single dimension, which may or may not be deemed to satisfy the legal standard. They define a function F(x) which represents the relationship between a defendant's level of care, x, and the probability of a fine or penalty being imposed. Craswell and Calfee interpret the standard deviation of F(x) as a measure of legal uncertainty. This is a way of capturing the idea that it can be more or less certain which fact patterns involve compliance with the legal standard with any given probability. The specific mathematical form of Craswell and Calfee's measure reflects the fact that the model from which it is derived makes the restrictive assumptions that there are only two possible legal outcomes {conviction, no-conviction}; actors assign fixed probabilities to legal outcomes (as opposed to ranges of probabilities); there is no disagreement; and, fact patterns vary along a single dimension.

4.6 Variation across actors

It is often interesting to analyze how legal uncertainty affects multiple actors, including their interactions with one another. A case in point would be an analysis of the relationship between legal uncertainty and bargaining over the settlement of a lawsuit. Another case might be an analysis of how legal uncertainty affects the market price of the securities of firms engaged in litigation. In these cases it is useful to capture the levels of uncertainty perceived by multiple actors, as well as how uncertainty is distributed across those actors.

As a starting point, it can be useful to calculate the average level of uncertainty across the relevant set of actors. It is often more interesting though to measure variation and in particular, *legal disagreement*, meaning, the extent to which actors disagree about the uncertainty of a particular legal proposition or law. So for example, suppose that for a given fact pattern, Anne, Bob and Charlotte assign probabilities of 50 percent, 60 percent and 70 percent respectively to a particular legal outcome, and have corresponding disagreements about the probabilities to be assigned to other mutually exclusive legal outcomes. In other words, they disagree about the unpredictability of the legal proposition that covers the fact pattern in question. (The illustration could be modified easily to show disagreements about ignorance, risk or ambiguity, or about laws rather than propositions.) Figure 4 shows two populations that exhibit different levels of disagreement. The red line represents a population with relatively dispersed probabilities, while the blue line represents a population with more tightly clustered beliefs.

[Figure 4 about here.]

There are several ways of measuring the extent of legal disagreement, the most straightforward being the variance in the individuals' levels of uncertainty. More sophisticated measures of how legal uncertainty is distributed across a group of actors might capture the extent to which their beliefs are common knowledge. In other words, to what extent do actors know that other actors know what they know, etc.?

4.7 Uncertainty versus value

It often is possible to vary the uncertainty of a legal proposition or law, in any of the senses used above, without varying the value that the relevant actors assign to it. Some analyses that claim to examine the effects of legal uncertainty blur the distinction between uncertainty and value by examining the consequences of varying both simultaneously. This is common in analyses that allow for only two possible legal outcomes. So for example, (D'Amato, 1983) describes a change in the probabilities of success of a lawsuit from 1 to 0.5 as an increase in the amount of legal uncertainty, notwithstanding the fact that the value of the lawsuit has also presumably changed. Similarly, Johnston (1995) and Croson and Johnston (2000) analyze the effects of alternative legal regimes on whether actors will trade legal entitlements before committing potential infringements, as opposed to infringing and then litigating. They suggest that under conditions of asymmetric information adopting "blurry or uncertain" as opposed to "definite" entitlements can mitigate the problems posed by asymmetric information and so help to prevent bargaining breakdown. However, their motivating

example involves a set of property owners who go from assigning a probability of 1 to their likelihood of winning a nuisance suit against an adjacent polluter, to assigning probabilities somewhat less than 1.

4.8 One concept or many?

Is there one concept of legal uncertainty – as the title of this article suggests – or many? Little turns on how this issue is resolved but the competing arguments are worth setting out. On the one hand, the sheer number of measures of legal uncertainty weighs in favor of the view that they capture multiple concepts. On other hand, all of these concepts measure dispersion in the beliefs that the members of a population hold about whether particular legal outcomes, or their associated payoffs, will occur. This weighs in favor of the unified theory. On this view, the aggregate measures of legal uncertainty simply measure dispersion along additional dimensions, namely fact patterns and individuals.

5 Collecting data to construct measures of legal uncertainty

Distinguishing concepts of legal uncertainty is of limited value if there is no practical way of measuring them—otherwise there would be no way of falsifying claims about cause or consequences of the relevant form of uncertainty. Creating conceptually distinct measures is also of limited use if the various measures are perfectly correlated with one another. As it turns out, it is possible to construct measures of several distinct forms of

subjective legal uncertainty, and there is preliminary evidence that those measures are not necessarily correlated with one another.

5.1 Measures of objective uncertainty

Before turning to measures of subjective uncertainty it is helpful to distinguish them from the handful of efforts that have been made to measure objective forms of legal uncertainty. One such effort has been made by Lefstin (2007), who measures the extent to which judges presented with the same fact pattern disagree with one another by examining the likelihood of dissents, as well as reversals of the tribunal below, in a set patent cases decided by panels of the U.S. Federal Circuit. However, this is not a satisfactory method of measuring the subjective legal uncertainty experienced by litigants or other non-judicial actors since there is no strong reason to presume that judges' beliefs about the law are representative.

Farnsworth et al (2010) use responses to survey questions to measure the "ambiguity" of legal texts. They presented their subjects with hypothetical fact patterns, a hypothetical statute, and two alternative ways of reading the statutory text as applied to the facts that lead to two different legal outcomes. They then asked their subjects whether the statute as applied to the facts was ambiguous. The possible answers ranged from "it is impossible to say which reading is better" to "one of the readings is obviously right."[13] They also asked whether "ordinary readers of English" would disagree about which reading of the statute was better, with answers ranging from "there would be widespread

[13] Some respondents were asked whether the two readings were "plausible", with answers ranging from "Absolutely: each side's reading is entirely plausible, and it is impossible to say which reading is better" to "No: the text has only one plausible reading."

disagreement about which side's reading was better" to "everyone would agree about which side's reading was better."

The data collected by Farnsworth et al might be useful in constructing measures of objective legal uncertainty but they are not good measures of subjective uncertainty. The responses to their survey are designed to capture views about how the text *could* or *should* be interpreted according to different theories of interpretation, rather than beliefs about how it *would* be interpreted. They asked their respondents to put themselves in the position of a judge and report the ambiguity of a specific text. They did not ask them to report their beliefs about how some other judge was likely to interpret the text. Farnsworth et al's data might be used as proxies for data on beliefs about how texts will in fact be interpreted, but that would require making heroic assumptions about the relationship between subjects' beliefs about what the law could be, should be and will be.[14]

5.2 Using surveys to measure subjective legal uncertainty

It does not take a great leap from Farnsworth et al's efforts to see how a survey can be used to collect data on beliefs about the likelihood of specific legal outcomes. The basic idea is to elicit information about the probabilities that respondents assign to legal officials' actions conditional on a given set of facts. Consider the following two illustrations.

[14] It is particularly challenging to hypothesize about the relationship between a) beliefs about a whether ordinary readers will disagree about what the outcome should be, and b) actual levels of disagreement about what the outcome will be.

The World Justice Project

In the World Justice Project General Population Opinion Poll members of a representative sample of the population in 102 countries – at least 1000 people for each country – were asked the following series of questions:

The following questions describe hypothetical situations. In each question, I will provide you with a set of assumptions. Please select the single option that best represent your views.

1. Please assume that the government decides to build a major public works project in your neighborhood (such as a railway station or a highway), and assume the construction of this public works project requires the demolition of private homes in your community/neighborhood.

   a. **q1a**. How likely are these homeowners to be fairly compensated by the government?
   Very likely 1
   Likely 2
   Unlikely 3
   Very unlikely 4
   DNK 9
   DNA 0

   b. Now, assume that the monetary compensation offered by the government for the demolition of the houses is clearly unfair and inadequate. How likely are the following outcomes?

	Very likely	Likely	Unlikely	Very Unlikely	DNK	DNA
q1b_1. Homeowners would sue the government in court	1	2	3	4	9	0
q1b_2. Homeowners would revolt, barricade the roads and seek a solution by force	1	2	3	4	9	0
q1b_3. Homeowners would do nothing and resign themselves to losing the money	1	2	3	4	9	0

   c. **q1c.**Finally, if the homeowners sue the government, how likely is it that they obtain fair compensation in court?
   Very likely 1

Likely	2
Unlikely	3
Very unlikely	4
DNK	9
DNA	0

Question 1c is of greatest interest. The responses to this question provide all of the basic information required to construct measures of legal unpredictability and legal disagreement. The statement of the fact pattern is very simple and the range of possible answers is limited, but for the given fact pattern the survey question does elicit individual subjects' beliefs about the likelihood of one of two mutually exclusive legal outcomes (by implication the two possible legal outcomes are "they obtain fair compensation in court" and "they do not obtain fair compensation in court").

At the same time, these data are by no means perfect. The survey data do not represent subjects' beliefs in terms of precise probabilities. Nor does the survey provide information about the subjects' preferences over the various outcomes, in monetary terms or otherwise. It also does not provide direct information about the confidence with which beliefs about likelihood are held (except to the extent that "don't know" can be interpreted as an expression of extreme lack of confidence). Finally, the survey question only asks about a single fact pattern rather than asking, for instance, how respondents' answers would vary depending on the type of transportation project or the value of the homes. And this particular fact pattern is defined in very broad and somewhat subjective terms, which may contribute to respondents' uncertainty about the associated legal outcomes. Consequently these data cannot be used to measure legal risk or legal ambiguity, and are limited to a single legal proposition.

Despite these limitations, the survey data can be used to construct noisy measures of legal unpredictability and legal disagreement for each country. Since the survey responses are not in the form of probabilities it is not possible to calculate the entropy of the distribution of responses. However, a cruder measure of legal unpredictability can be constructed. For each country, we can calculate the proportion of the population that responded "likely" or "unlikely", implying probabilities closer to maximal unpredictability, as opposed to "very likely" or "very unlikely." The greater is the proportion of the population that responds "likely" or "unlikely", the higher the country's level of legal unpredictability. Our measure of legal disagreement for each country is the standard deviation of responses to the question set out above.[15] This is a direct measure of the level of disagreement across individuals.[16]

The mean response, legal unpredictability and legal disagreement for each country are shown in Table 1. The key point for present purposes is that the Spearman correlation between the two measures is a modest -0.73. Interestingly though, as Figure 5 reveals, in most countries the measures are strongly, though negatively, correlated. In fact, if seven outlier countries are dropped (Botswana, China, Myanmar, Hong Kong, Malaysia, Philippines, Thailand) the Spearman correlation coefficient becomes a robust -0.93. This implies that our measures of legal unpredictability and legal disagreement usually, but do not always, capture closely related phenomena.

[Figure 5 about here]

[15] Wei (1997) adopts a similar approach in interpreting the standard deviation of individual responses to survey questions about the level of corruption as a measure of uncertainty.
[16] This particular dataset did not contain any "don't know" responses to question 1c. If they had appeared, they could have been interpreted as a crude measure of ambiguity.

[Table 1 about here.]

The World Justice Project survey contains several additional questions that take the same form as question 1c. They include:

> 9b. Please assume that one day the President decides to adopt a policy that is clearly against the [COUNTRY] Constitution…How likely are the courts to be able to stop the President's illegal actions?
>
> 10b. Assume that a government officer makes a decision that is clearly illegal and unfair, and people complain against this decision before the judges... If the people complain against the same decision before a chief or traditional ruler, how likely is that, in practice, this leader is able to stop the government officer from implementing the illegal decision?
>
> 13. Think about business owners engaging in small operations (for example, selling food in a small establishment). How likely do you think it is that these people would be fined if they:
> a. Engage in the business operation without the required documentation?
> b. Do not register to pay taxes when they should?

Each of these questions can be used to generate country-level unpredictability and disagreement scores. Interestingly, as shown in Table 2, most of the scores are not strongly correlated across questions. This suggests that levels of legal unpredictability and disagreement can vary significantly within a legal system.

[Table 2 about here.]

The World Bank Enterprise Survey

Another survey that points toward ways of collecting data on legal uncertainty is the World Bank's Enterprise Survey. This survey collects data on the business environment from manufacturing and service sector establishments in selected countries around the world. The 2006-2009 survey includes the following question (labeled "j1a"):

> I am going to read some statements that describe the courts and the way government officials interpret laws and regulations that affect this establishment's business. For each statement, please tell me if you Strongly disagree, Tend to disagree, Tend to agree, or Strongly agree.
>
> ….
>
> "Government officials' interpretations of the laws and regulations affecting this establishment are consistent and predictable."

Reactions to this statement are recorded on a scale of 1 (Strongly disagree) to 4 (Strongly agree) or -9 (Don't know).

The response to question j1a can be interpreted as an ordinal measure of the overall level of uncertainty associated with the set of legal propositions "affecting this establishment's business." However, it is far from an ideal measure. In the first place, it is not immediately obvious which fact patterns are covered because the set of "laws and regulations affecting this establishment's business" is not specified (although it may be possible to speculate based on other data from the survey, such as the establishment's sector, size and ownership structure). A more serious concern is that it is unclear what kind of legal uncertainty is being measured by this question because the terms "consistent" and "predictable" are not defined. We can tentatively rule out the possibility that legal disagreement is being measured because there is no reference to the opinions of

other actors. And the wording of the question, at least in English, makes it plausible to assume that the responses will reflect assessments of what we have labeled legal unpredictability. However, it is also plausible that the data reflect assessments of ignorance. On account of these limitations the World Bank Enterprise Survey data is merely suggestive, at best, of how to construct a valid measure of the uncertainty of laws.

6 Potential applications

Measures of legal uncertainty can be used either as explanatory variables, in analyses of the consequences of legal uncertainty, or as dependent variables, in analyses of the causes of legal uncertainty.

6.1 Explaining the consequences of legal uncertainty

Fair notice. Legal uncertainty is sometimes said to undermine the rule of law by depriving actors of notice of the legal consequences of their actions (Waldron 1994). Legal unpredictability seems to be the primary basis for this concern since it captures the degree of confidence actors have in their beliefs that their best guess as to the outcome will turn out to be correct. The measure of legal unpredictability proposed above is essentially a measure of actors' beliefs about the likelihood they will be 'surprised' by the actual outcome. Legal risk is a measure of the economic significance of any lack of fair notice. Meanwhile, legal ambiguity is a measure of how confident actors are in their assessment of the quality of notice they have received.

Settlement. Measures of various kinds of legal uncertainty can be used to test well-established theories concerning the determinants of settlement. However, as D'Amato

(1983: 15-18) and others have pointed out, theory suggests that different forms of legal uncertainty can have very different effects. Increasing the riskiness of legal entitlements should encourage settlement under the conventional assumption that actors are averse to risk (Gould, 1973). Increasing the amount of ambiguity should have similar effects if actors are averse to ambiguity. However, experimental evidence suggests that in this and other contexts aversion to ambiguity varies depending upon the probabilities involved. By contrast, increasing the amount of legal disagreement should discourage settlement when, as is conventionally assumed, the disagreement takes the form of mutual optimism about the outcome of litigation (Priest and Klein, 1984). Similarly, in Bebchuk's (1984) model, increasing the amount of legal ambiguity that one party faces tends to discourage settlement.[17] These models also imply that legal disagreement and legal ambiguity have different effects on the outcomes of the cases that are not settled (Waldfogel 1998).

Compliance. Measures of legal uncertainty can be used to examine how changing the degree of legal uncertainty affects individual actors' decisions to undertake potentially costly actions, such as taking precautions against violating the law, and whether the consequences are efficient or fair. For example, we might be interested in knowing whether making some aspect of nuisance law more uncertain induces more efficient precautions against pollution. There is a substantial of theoretical literature on the effects on compliance of varying legal risk (see for example Craswell & Calfee (1986) and Kahan (1989)). There are also a growing number of discussions of the potential effects of varying legal ambiguity (see for example, Segal and Stein 2006), but more attention ought to be paid to implications of legal disagreement.

[17] Cooter, Marks and Mnookin (1982: 236-237) suggest that uncertainty about other actors' beliefs, i.e. the extent of legal disagreement, may also impede settlement.

Other welfare effects. Legal uncertainty can also have indirect welfare effects. One issue that has recently attracted attention is the impact of legal uncertainty on the availability of insurance (see, for example, Geistfeld, 2011).

Access to legal information. The costs of storing and transmitting a set of data with any given degree of reliability tend to be inversely related to the predictability of the dataset's contents. The more predictable are the contents of a dataset the easier it is to guess reliably at those contents by taking a small sample. Therefore, if members of a society believe that judges' reactions to a particular fact pattern are highly predictable they will be fairly confident that they can learn the law by reading one or two opinions. Conversely, if they believe that outcomes are highly unpredictable they will believe that more reading is required to achieve the same level of confidence.

6.2 Explaining the causes of legal uncertainty

Measures of subjective legal uncertainty can also be used as dependent variables in studies of the causes of legal uncertainty. Here are a few examples of the kinds of claims that might be tested:

Procedural sources of ambiguity. When legal outcomes are influenced significantly by institutions that generate outcomes with known probability distributions, such as the processes for selecting judges, jurors or arbitrators, we can expect to find unpredictability or risk without ambiguity or disagreement. So for instance, prosecutors who litigate a large number of similar cases before jurors who are randomly selected from a population

with a known distribution of predispositions might find the outcomes of the set of cases risky but not ambiguous (Segal and Stein, 2006).

Discretion as a source of uncertainty. Unpredictability and ignorance tend to arise where officials are not bound by clear and binding authority and therefore enjoy discretion to select either legal outcomes or legal propositions (see e.g. Calfee and Craswell, 1986: 283; Segal and Stein, 2006).[18] Discretion of this sort may be granted either explicitly or implicitly by using vague words such as "reasonable" or "due" to define rights and duties (Endicott, 2000). It also arises where authorities are contradictory or transparently absurd.[19] The less information actors have about the factors likely to influence the exercise of discretion, the more ignorance they will experience.

Asymmetric information and disagreement. Legal disagreement will only arise when actors possess asymmetric information. For example, we might conjecture that if all the parties to a nuisance suit have access to the same legal experts, or they have access to different experts who all rely upon the same materials, they will form the same beliefs

[18]There are at least two subtly different ways in which lawmakers might exercise discretion. One kind of discretion involves unchecked authority to assign outcomes to specific fact patterns, in other words, it involves discretion over legal outcomes. The other form of discretion involves discretion over legal propositions, that is to say, unchecked authority to choose which legal proposition governs a fact pattern. The difference is between saying 'judges have discretion when deciding whether a particular defendant's conduct exhibited reasonable care,' as opposed to 'judges have discretion in deciding what counts as reasonable care.' The first kind of discretion can be exercised consistently across fact patterns – many different kinds of conduct can be subject to the same discretionary standard. By contrast, exercising the second kind of discretion implies treating different fact patterns differently since discretion will determine what standard governs any given conduct.

[19] D'Amato (1983) goes further and suggests that even in the face of relatively clear authorities, judges and scholars have incentives to manufacture discretion and propose novel interpretations of existing laws. Somewhat counter-intuitively, D'Amato also suggests that opportunities to exercise discretion increase with the volume of legal pronouncements. He reasons that as the volume of legal pronouncements increases, so does the difficulty of interpreting them accurately. He also suggests that increasing the volume of law increases the likelihood of contradictory laws since lawmakers have limited resources to devote to legal research.

about how judicial discretion is likely to be exercised. At the same time, if actors' beliefs are based upon their own limited amount of direct experience with officials then the existence of discretion will generate disagreement as well as unpredictability and ignorance. Following this line of reasoning, Wei (1997) conjectures that foreign investors who base their beliefs about prevailing levels of corruption in a country upon their own past experience are more likely to have divergent beliefs about the prevalence of corruption when the level of corruption is in fact highly variable.

Factual versus legal sources of uncertainty. Legal outcomes typically depend upon decisionmakers' beliefs about both legal and factual propositions and so uncertainty can be generated by either legal or factual uncertainty (Priest and Klein 1984). Surveys that remove factual uncertainty by presenting stipulated facts can isolate the purely legal component of uncertainty.

7 Conclusion

There are strong theoretical grounds for believing that legal uncertainty is an important factor in determining how law works in the world. Defining and measuring legal uncertainty are the first steps toward learning more about its consequences and causes. The definitions and measures set out above provide starting points, but more work needs to be done. For instance, more needs to be done to define and measure forms of uncertainty that measure variations in beliefs across fact patterns and actors. There are also opportunities to collect better data through surveys that elicit precise information

about subjects' beliefs concerning the likelihood of different kinds of legal outcomes in different factual settings. With improved measures of legal uncertainty we should be able to learn a great deal more about an undeniably important phenomenon.

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Figure 1: Unpredictability/Risk

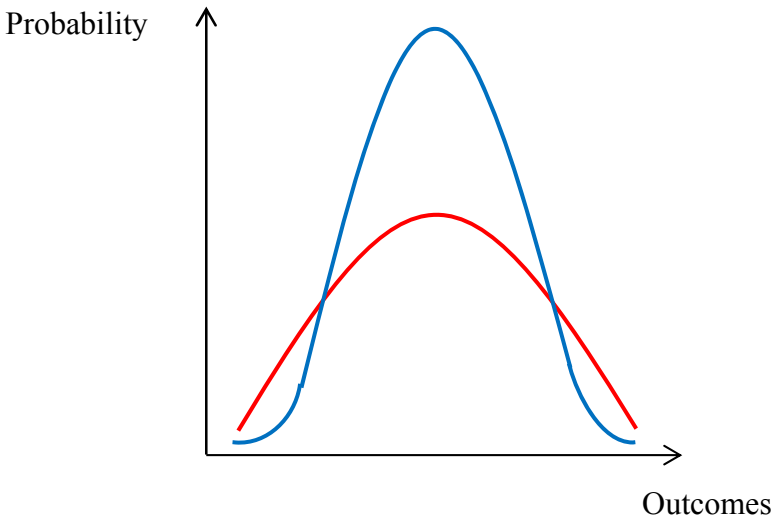

Figure 2: Ignorance/Ambiguity

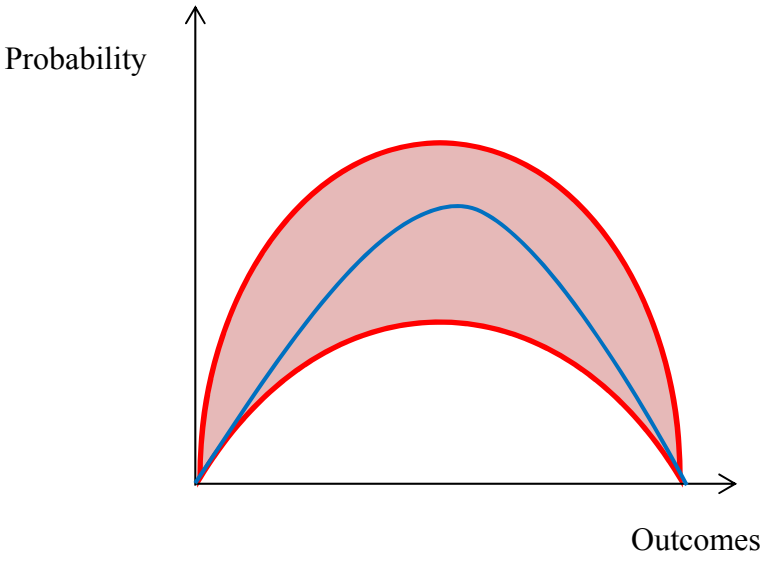

Figure 3: Indeterminacy

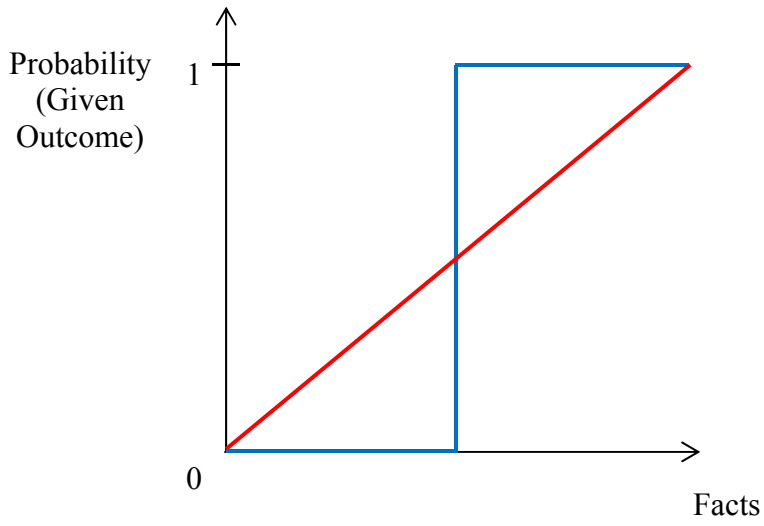

Figure 4: Disagreement

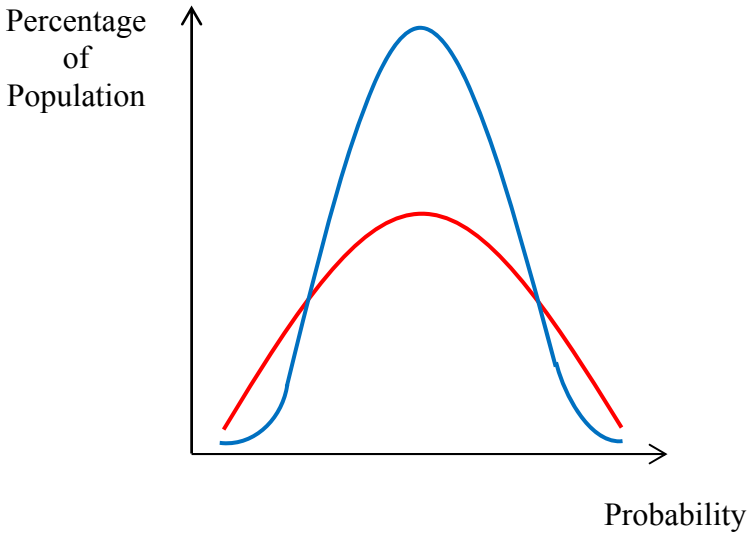

Figure 5: Unpredictability and Disagreement: WJP 2014 q1c

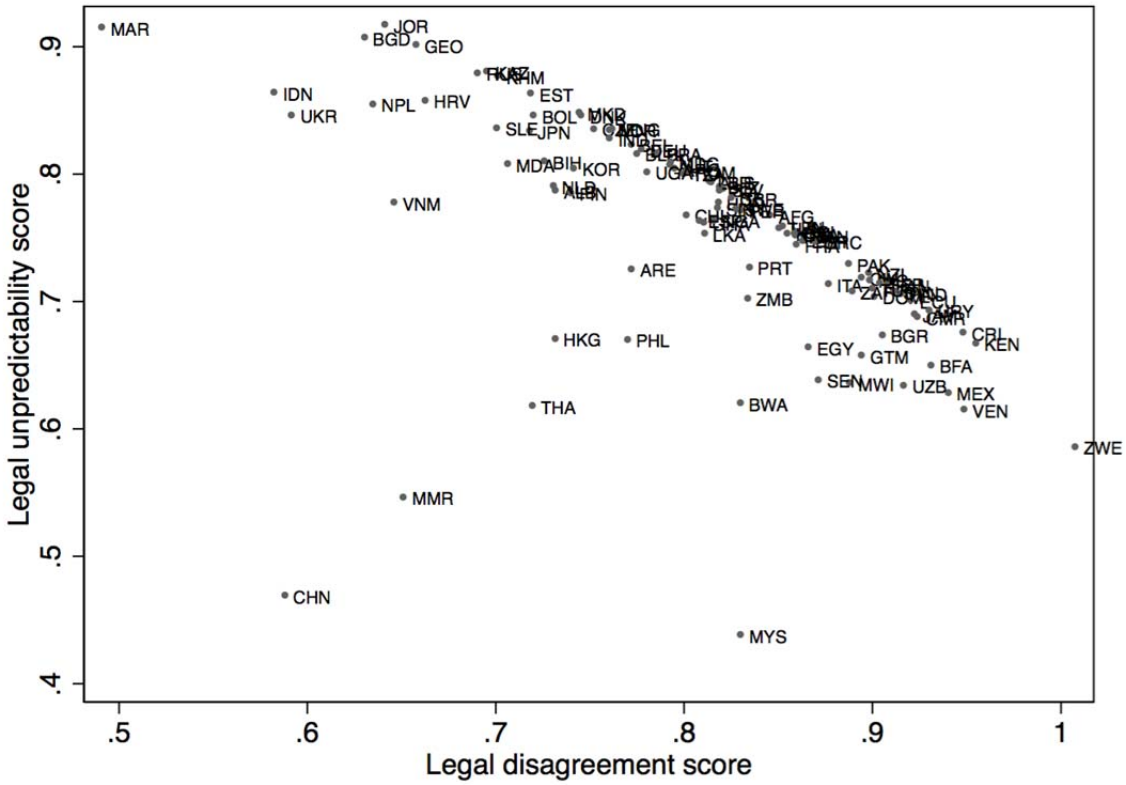

Table 1: Survey-based Measures of Legal Unpredictability and Legal Disagreement

Country	Mean Response*	Unpredictability**	Disagreement***
Afghanistan	2.48	0.77	0.85
Albania	2.12	0.79	0.73
Argentina	2.60	0.80	0.80
Australia	2.48	0.79	0.81
Austria	2.40	0.81	0.79
Bangladesh	2.30	0.91	0.63
Belarus	2.63	0.82	0.78
Belgium	2.59	0.82	0.77
Belize	2.53	0.79	0.82
Bolivia	2.70	0.85	0.72
Bosnia and Herzegovina	2.18	0.81	0.73
Botswana	1.93	0.62	0.83
Brazil	2.48	0.82	0.79
Bulgaria	2.79	0.67	0.91
Burkina Faso	2.79	0.65	0.93
Cambodia	2.57	0.88	0.70
Cameroon	2.65	0.69	0.92
Canada	2.45	0.75	0.86
Chile	2.77	0.77	0.80
China	3.48	0.47	0.59
Colombia	2.56	0.75	0.86
Costa Rica	2.48	0.68	0.95
Cote d'Ivoire	2.62	0.72	0.89
Croatia	2.81	0.86	0.66
Czech Republic	2.62	0.84	0.75
Denmark	2.44	0.85	0.75
Dominican Republic	2.68	0.70	0.90
Ecuador	2.45	0.70	0.92
Egypt	2.09	0.66	0.87
El Salvador	2.52	0.79	0.82
Estonia	2.41	0.86	0.72
Ethiopia	2.60	0.75	0.86
Finland	2.86	0.78	0.74
France	2.65	0.74	0.86
Georgia	2.37	0.90	0.66
Germany	2.59	0.82	0.78

Country	Mean Response*	Unpredictability**	Disagreement***
Ghana	2.23	0.76	0.81
Greece	2.53	0.75	0.87
Guatemala	2.87	0.66	0.89
Honduras	2.54	0.71	0.92
Hong Kong SAR, China	3.11	0.67	0.73
Hungary	2.66	0.78	0.82
India	2.37	0.83	0.76
Indonesia	2.07	0.86	0.58
Iran	2.40	0.75	0.86
Italy	2.74	0.71	0.88
Jamaica	2.64	0.69	0.92
Japan	2.76	0.83	0.72
Jordan	2.43	0.92	0.64
Kazakhstan	2.58	0.88	0.70
Kenya	2.43	0.67	0.96
Kyrgyzstan	2.39	0.75	0.86
Lebanon	2.58	0.76	0.85
Liberia	2.53	0.79	0.81
Macedonia, FYR	2.47	0.85	0.74
Madagascar	2.56	0.81	0.79
Malawi	2.06	0.64	0.89
Malaysia	3.33	0.44	0.83
Mexico	2.83	0.63	0.94
Moldova	2.87	0.81	0.71
Mongolia	2.49	0.84	0.76
Morocco	2.08	0.91	0.49
Myanmar	3.36	0.55	0.65
Nepal	2.13	0.85	0.64
Netherlands	2.13	0.79	0.73
New Zealand	2.49	0.72	0.90
Nicaragua	2.60	0.72	0.90
Nigeria	2.26	0.76	0.82
Norway	2.44	0.83	0.76
Pakistan	2.43	0.73	0.89
Panama	2.46	0.71	0.91
Peru	2.64	0.77	0.83
Philippines	3.06	0.67	0.77
Poland	2.42	0.79	0.82

Country	Mean Response*	Unpredictability**	Disagreement***
Portugal	2.82	0.73	0.83
Republic of Korea	2.80	0.80	0.74
Romania	2.57	0.80	0.80
Russia	2.62	0.88	0.69
Senegal	2.04	0.64	0.87
Serbia	2.57	0.71	0.90
Sierra Leone	2.20	0.84	0.70
Singapore	2.69	0.77	0.82
Slovenia	2.56	0.71	0.91
South Africa	2.29	0.71	0.89
Spain	2.77	0.76	0.81
Sri Lanka	2.20	0.75	0.81
Sweden	2.64	0.77	0.83
Tanzania	2.40	0.80	0.80
Thailand	3.20	0.62	0.72
Tunisia	2.39	0.76	0.85
Turkey	2.35	0.71	0.90
Uganda	2.70	0.80	0.78
Ukraine	2.96	0.85	0.59
United Arab Emirates	2.05	0.73	0.77
United Kingdom	2.41	0.78	0.83
United States	2.41	0.75	0.86
Uruguay	2.49	0.69	0.93
Uzbekistan	2.88	0.63	0.92
Venezuela	2.85	0.61	0.95
Vietnam	1.97	0.78	0.65
Zambia	2.89	0.70	0.83
Zimbabwe	2.75	0.59	1.01

*Mean response, on a scale from 1 to 4, to question 1c: "Finally, if the homeowners sue the government, how likely is it that they obtain fair compensation in court?"

**Inverse of the mean value of the absolute difference between each individual response to question 1c and 2.5.

***Standard deviation of responses to question 1c.

Source: The World Justice Project: General Population 2014 – Opinion Poll.

Table 2: Correlations Between Unpredictability Scores: WJP 2014

	q1c	*q9b*	*q10a*	*q10b*	*q13a*	*q13b*
q1c	1					
q9b	0.3785	1				
q10a	0.3726	0.7494	1			
q10b	0.4069	0.6094	0.7012	1		
q13a	0.1629	0.1701	0.1625	0.1726	1	
q13b	0.1692	0.2667	0.1948	0.1928	0.9109	1

Table 3: Correlations Between Disagreement Scores: WJP 2014

	q1c	*q9b*	*q10a*	*q10b*	*q13a*	*q13b*
q1c	1					
q9b	0.6371	1				
q10a	0.6935	0.7799	1			
q10b	0.728	0.725	0.7712	1		
q13a	0.5021	0.5771	0.467	0.3999	1	
q13b	0.4322	0.5525	0.4301	0.3654	0.8786	1