Ambiguity and Income Taxation

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Introduction

Imagine you are a contestant in a game show and you are given a choice between two options. If you choose Option A, you will get either $50,000 or zero dollars, which will be determined by the results of a coin flip by the host of the show. If you choose Option B, you will get an amount of money somewhere between zero and $50,000, but you are not told how much, nor are you told how it will be determined. Based on the empirical evidence, most people would choose Option A.[1] That is, they prefer an known risk to an unknown risk.

In general, the discussion of risk and uncertainty in the legal literature has ignored the distinction between risks with known probabilities and risks with ambiguous probabilities. Because risk and uncertainty dominate our lives, they have been important topics in both the economics literature and the legal literature.[2] Until recently, the literature in this area has

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[1]See DANIEL ELLSBERG, RISK, AMBIGUITY AND DECISION 131-150 (2001).

[2]See e.g., Agnar Sandmo, *The Effects of Taxation on Savings and Risk-Taking* in HANDBOOK OF PUBLIC ECONOMICS 1985 (eds. Alan Auerbach and Martin Feldstein), Michael Livingston, *Risky Business: Economics, Culture and the Taxation of High-Risk Activities* 48 Tax L. Rev. 163 (1993) Frank Knight, RISK, UNCERTAINTY AND PROFIT (1921). For a general introduction to the history of the intellectual development of theories about risk and uncertainty see Peter Bernstein AGAINST THE GODS: THE REMARKABLE STORY

presumed that the probability of an event can be precisely calculated by decision-makers.[3] However, rarely can probabilities of real world events be calculated precisely.[4] In the last few decades, the reassessment of assumptions such as the precise calculation of probabilities as well as many other of the assumptions about behavior under risk and uncertainty has been an incredibly productive area of scholarship.[5] Surprisingly, the advances in decision theory have not been very influential in the legal literature.[6] While some authors have started to explore the applications of these ideas in certain areas,[7] none has addressed the effects of the ambiguity of probabilities on tax policy.

OF RISK (1996)

[3]Hillel Einhorn and Robin Hogarth *Decision Making under Ambiguity* 59 Journal of Business 225 (1986) and also Leonard Savage FOUNDATIONS OF STATISTICS (1954)

[4]Daniel Ellsberg, *Risk, Ambiguity and the Savage Axioms* 75 Quarterly Journal of Economics 643 (1961).

[5] See discussion in Colin Camerer *Individual Decision Making* in HANDBOOK OF EXPERIMENTAL ECONOMICS (John Kagel and Alvin Roth eds., 1995), also Colin Camerer and Martin Weber *Recent Developments in Modeling Preferences*: *Uncertainty and Ambiguity* 5 Journal of Risk and Uncertainty 325 (1992)

[6] Cass Sunstein *The Future of Law and Economics: Looking Forward a Behavioral Analysis of Law* 64 U. Chi. L. Rev. (1997).

[7] Christine Jolls, Cass Sunstein and Richard Thaler *A Behavioral Approach to Law and Economics in* BEHAVIORAL ECONOMICS (C. Sunstein ed. 2000), Reid Hastie and W. Kip Viscusi *What Juries Can't Do Well: The Jury's Performance as a Risk Manager* 40 Ariz L. Rev. 901 (1998), Marjorie Anne McDiarmid *Lawyer Decision Making: The Problem of Prediction* 1992Wis. L. Rev. 1847 (1992). see also Ilana Ritov and Jonathon Baron *Reluctance to Vaccinate: Omission Bias and Ambiguity* in BEHAVIORAL ECONOMICS (C. Sunstein ed., 2000), for application of some behavioral economics to tax policy (although it does not address ambiguity) see Edward McCaffrey *Cognitive Theory and Tax also in* BEHAVIORAL ECONOMICS.

This article analyzes the effects of introducing the distinctions between uncertainty[8], risk[9] and ambiguity[10] on the normative analysis of tax policy. In particular, it analyzes the effect of the findings that show that individuals avoid ambiguous risks more than known risks on the way we should develop and assess the effects of tax policy. It will show how these results give strength to the argument for a preferential rate for capital gains.[11] It also shows how ambiguity creates an argument for a low or zero rate of tax on foreign source portfolio income.[12]

Section I discusses Expected Utility Theory and Subjective Expected Utility Theory, two of the most prominent 'classical' theories addressing human behavior under uncertainty. Section I

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[8] Uncertainty occurs when rewards, costs or any other factors which affect decisions are not known with certainty. For example, if you agree to pay me $1,000 if the Yankees win the World Series next year, then we are uncertain who will have the $1,000 next year. Frank Knight=s definition of uncertainty (in Knight note 2) is different. He uses the term for what I mean by ambiguity. Hence ambiguity is often called "Knightian Uncertainty"

[9]Risk is the calculable portion of uncertainty. There are two primary types of risk: *a priori* risk, and empirical risk. Eugene Silberberg THE STRUCTURE OF ECONOMICS: A MATHEMATICAL APPROACH. 440 (1990) As the name implies, *a priori* risk is a risk one can calculate based on certain assumptions or axioms. An example of *a priori* risk would be the odds that a roulette wheel will land on 15. Assuming a standard roulette wheel of 36 numbers, the probability of the ball landing on any one number should be 1/36. Empirical risk on the other hand, is something which requires observation to calculate the odds. An example of empirical risk is the odds of a person dying within the next year. Insurance companies use of actuarial tables to calculate this risk. This type of inference is not limited to insurance companies See also Howard Kunreuther et al. *Ambiguity and Under-Writer Decision Processes* 26 Journal of Economic Behavior and Organization 337 (1995).

[10]Ambiguity or ambiguous risk is the non-calculable portion of any uncertain activity. One can think of it as a risk or hazard that we do not have particularly good information about. An example of an ambiguous risk is the likelihood that a particular inventor will succeed. Another example would be the odds of an 18 year old male driver entering into an accident driving a new kind of car which operates differently than the cars currently being used.. Ellsberg defined it as Aa quality depending on the amount, type, reliability and ›unanimity= of information, giving rise to one=s degree of ›confidence= in an estimate of relative likelihoods@ of future events. Ellsberg, *supra* note 4, p. 657

[11] See Section III.B.2

[12] See Section III.B.1

also discusses how introducing ambiguity into these models changes some of their predictions, and extends their explanatory power.

Section II uses a generalized model of behavior under ambiguity to argue that we should encourage individuals to take on more ambiguously risky activities. This argument, which is original to this article, is based upon the well-known argument for holding a diversified portfolio of investments.[13]

Section III applies the analysis developed in Section II to show how this analysis can be used to improve the economic efficiency of the income tax system. Section III focuses on two areas: the "Home Bias" Problem and Entrepreneurship. The so-called "Home Bias" problem occurs because investors favor investing in their home country even more than the 'classical' theories of behavior under uncertainty would predict.[14] However, once we understand that investors view foreign investment as having more ambiguous risk, it becomes clear why they this occurs. The article concludes that we should tax foreign source portfolio income at a low or zero rate to account for this phenomenon, which is contrast to most prior discussions in the legal literature which advocate taxation at full US rates.[15] Section III also discusses how ambiguity explains the behavior of entrepreneurs and explains why a preferential tax rate for capital gains encourages entrepreneurship. While the debate over whether there should be a capital gains rate preference is perhaps the longest running and most prolific debates in tax policy, and has produced

[13] The classic text in this area is Harry Markowitz *Portfolio Selection* 7 Journal of Finance 77 (1952)

[14] See *infra*, note 147 and surrounding text

[15] In the interest of full disclosure the author recently argued for taxation of foreign source portfolio income at full US rates. Terrence Chorvat, *Ending the Taxation of Foreign Business Income*, 42 Ariz. L. Rev. (forthcoming Winter 2000), and Terrence Chorvat *Taxing International Business Income Efficiently* 53 Tax L. Rev. 225 (2000).

much legislation[16] and many legislative proposals,[17] this article develops a new argument in favor of the preference. However the preference advocated here has important differences with the current capital gains preference. Section III also discusses how understanding the nature of ambiguity helps us to craft rules to help us encourage the financing of entrepreneurial activity by outside investors.

I. The Economic Analysis Of Uncertainty, Risk and Ambiguity

A. Expected Utility Theory

In some sense, the theory of decision-making under uncertainty predates modern economics. [18] The first systematic treatment of how people behave under uncertainty occurred in

[16] There have been changes to the taxation of capital gains in the 1986, 1996, 1997 tax acts. See JAMES FREELAND, STEPHEN LAND AND RICHARD STEPHENS, FEDERAL INCOME TAXATION 678-683 (1999)

[17] Just in the legislative session that started this January there have been many proposals to lower the capital gains rate. For a sampling, see S.302 introduced by Sen. Richard Shelby (which reduces the tax rate for property held for five years or 10 years) , S. 222 introduced by Olympia Snowe (would reduce capital gains tax on Ship-builders), "The Farmland Capital Gain Equity Act of 2001" H. 294 introduced by Rep. Thomas Osborne to reduce capital gains taxation of farmlands. In addition, Rep. Jim Saxton has introduced H.R. 300 which would exclude capital gains distributions from mutual funds from income. Rep .Toomey has introduced a bill to reduce the maximum capital gains rate to 15% , *Toomey Release on Expanded Tax Relief Bill* 2001 TNT 27-84 (Feb. 8, 2001) And Sen. Torricelli has come out in favor a capital gains reduction, *Torricelli Release on His Tax Relief Plan* 2001 TNT 29-68 (Feb. 8, 2001). Furthermore, Senate Majority leader Trent Lott has stated he is favor of a capital gains cut. *Committee Goes Another Round on Tax Cuts* 2001 TNT 28-1 (Feb. 9, 2001)

[18]That is, if you date the beginning of economics as Adam Smith=s publishing of AN INQUIRY INTO THE CAUSES AND CONSEQUENCES OF THE WEALTH OF NATIONS in 1776.

the 1600's when Blaise Pascal and Pierre de Fermat developed Expected Value Theory.[19] Under this theory, people act so as to maximize the expected value of their actions.[20]

In 1728, Nicolas Bernoulli suggested a game which contradicted this theory.[21] He put forward what is known as the St. Petersburg paradox.[22] In the proposed game, an individual would be offered a gamble in which the payoff would be based on the first occurrence of a head in a series of coin flips. If the coin flip turned up heads on the first trial he would be given $2. If the first time it turned up heads was on the second trial he would be given $4 and if it was on the third trial he would be given $8, and so on. The question was how much would a person be willing to pay for this gamble.[23] If Pascal and Fermat were correct, he would be willing to pay an infinite amount.[24] However, this was not the case. In general, people will be willing to pay only a small sum for this gamble.[25]

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[19]See discussion in Mark Machina, *Choice Under Uncertainty: Problems Solved and Unsolved* 1 Journal of Economic Perspectives 121 (1987)

[20] Expected value of an action is Ó x_n p(n), where x = payoff of the action in state of nature n, p(n) is the probability of state n occurring where Ó p(n) = 1. The expected value of an action is often denoted E[y] where y is the action.

[21] It was suggested in correspondence with Montmort. See S. Zabell ADaniel Bernouli@ in UTILITY AND PROBABILITY (J. Eatwell, M. Milgate and P. Newman eds. 1990)

[22]It was a paradox if one assumed that one used only expected values to decided one actions. Machina, *supra* note 18.

[23]The gamble clearly has a positive value, because you can never lose and you are guaranteed at least $2. (of course if believe gambling is immoral it might have a negative value to you).The actual currency used was ducats, but this does not change the basic point.

[24]The E[x] = Ó 2^n $(½)^n$ = Ó $2 (2) + $4(1/4) + $8(1/8) + ... = Ó 1 + 1 + 1 + ... = 4 Actually the gamble as described by Bernoulli had a payoff of Ó 2^{n-1} $(½)^n$, but this simply 2E[x] of the gamble as described above.

[25]Machina, *supra* note 18 at 125.

While a number of people proposed solutions to this problem,[26] in 1738 Daniel Bernoulli (Nicolas=s cousin) developed a solution to this problem by essentially arguing that the marginal utility of an additional dollar of income at higher values of wealth is not as high as the marginal utility of an additional dollar at lower levels of wealth.[27] If the marginal utility of money decreases quickly enough, then this bet will only have a small finite value.[28] This was the beginning of what is known today as Expected Utility Theory. Under this theory, people act in such a way as to maximize their expected *utility*, rather than the expected *value* of an action. This theory was more fully developed by John Von Neumann and Oscar Morgenstern in their foundational work.[29] This theory has been the foundation of much of current thought about human behavior under uncertainty.[30]

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[26] One of the most interesting and practical of the proposed solutionswas the idea that people were aware that in reality any payor has limited resources, and so the actual calculation would not continue out to infinity. See Eugene Silberberg, THE STRUCTURE OF ECONOMICS: A MATHEMATICAL APPROACH p.443 (1990).

[27] *Specimen Theoriae Novae de Mensura Sortis*, 5 Comentarii Academiae Scientiarum Imperialis Petropolintanae 175 (1738), translated into English in A*Exposition of a New Theory on the Measurement of Risk*@ 22 Econometrica 23 (1952). The actual argument was not phrased in terms of utility, but of moral value. The term utility can be traced back to Gersham Carmichael's 1724 edition of Pufendorf's DE OFFICIO HOMINIS ET CIVIS IUXTA LEGEM NATURALEM see R.D. Collison Black, *Utility* in UTILITY AND PROBABILITY (eds. John Eatwell et al., 1990) In modern terms, Bernoulli's argument is equivalent to saying that the utility function is concave (i.e., has a negative second derivative). This implies that the first derivative of the utility function, or the marginal utility of income is getting smaller as income rises, but as long as the marginal utility is positive, then additional income has some additional utility.

[28] That is the utility of the et will be a convergent sequence. Even though it has an infinite number of terms, it can have a finite sum. Therefore in calculating the value of each step the equation should be U($x)p($x), rather than x p($x) where U(x) is the utility of $x of income. If U(x) decreases sufficiently quickly, this series will then yield a finite value. So the value of the gamble would be EU(x) = ÓU(2) **2** + U(4)1/4 + U(8)1/8 + ..., which might converge to a finite number. For example, if U(y) = 1 for y, then EU(x) = 1. See Silberberg p. 443

[29] THEORY OF GAMES AND ECONOMIC BEHAVIOR (1953)

[30] See discussion in Section I. C , *infra*

B. Subjective Expected Utility Theory

One of the major criticisms of expected utility theory [31] is that most people do not actually know the probabilities of real events. For example, a precise calculation of the probability of an individual law student getting a job at a particular law firm, or the probability that a particular party will control Congress 10 years from now does not seem possible. Hence, it is unclear how to calculate the expected utility for many actions in the real world.[32] Therefore, Expected Utility Theory would seem to tell us little about how people behave in these situations.

In response to criticisms like these, Frank Ramsey[33] began an exploration of what is now called Subjective Expected Utility Theory. It was further developed by Leonard Savage[34] and Bruno De Finetti.[35] This theory extends the Expected Utility Theory to those situations in which there has not been an explicit calculation of the probability. This theory argues that people behave as if they have calculated these probabilities. Therefore, one can predict behavior by assuming

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[31] There have been many criticisms of this theory . One of the most famous is the Allais paradox. Maurice Allais *Le Comportement de l-Homme Rationale Devant le Risque:Critique et Axioms de l'Ecole Americaine* 21 Econometrica 503 (1952) Translated in *The Foundations of a Positive Theory of Choice Involving Risk and a Criticism of the Postualtes and Axioms of the American School* in EXPECTED UTILITY HYPOTHESES AND THE ALLAIS PARADOX (M. Allais and O. Hagen eds. 1979), pp. 27-145.

[32]If the probability of outcome, p(x), is unclear, then then3 $p(x_i)$ is also indeterminate and one could not compare the expected utility of two actions. The theory would lose its explanatory power and it falsifiablity.

[33]TRUTH AND PROBABILITY pp. 156-98 (1931)

[34]FOUNDATIONS OF STATISTICS(1954)

[35]*La Prevision: Ses Logiques, Ses Sources Subjectives.* Annales de L-Institut Henri Poincare, Vol. VII, fasc. I (1937) Trans. as *Foresight: its Logical Laws, its Subjective Sources* in STUDIES IN SUBJECTIVE PROBABILITY (eds. H. Kyburg, Jr. & H. Smoker 1964)

that people assign a subjective probability to the event. Of course, this probability might not be able to be determined until after the person has acted.

One way of thinking of this is through what is called Athe urn equivalent@. For example, while the odds of being a successful inventor may not really be susceptible to calculation, for purposes of predicting behavior of the inventor there may be some urn for which the potential inventor is indifferent between the results of the urn and his own chances of successfully realizing his invention.[36] Assume there is an urn with 100 balls which are either red or green. If the inventor draws a green ball, then he will receive the same benefits as inventing his new product. If the urn had only one green ball and 99 red balls, he might still prefer to work on his invention. Whereas if the urn had 99 green balls and 1 red, he might decide to go with the draw from the urn. The assumption is that there is some level of green balls (maybe 80 green balls and 20 red balls) at which the inventor is indifferent between his chances of pulling the green ball from the urn and the odds of his being a successful inventor. This proportion of green balls to red balls in this urn would give us the inventor=s subjective probability.

C. Influence of Expected Utility Theory and Subjective Expected Utility Theory

Subjective Expected Utility Theory and Expected Utility Theory have become some of the most important and influential ways of thinking about uncertainty and behavior.[37] They have had an enormous effect on the way we view risk. This is not surprising in that they present some straight-

[36] One complication to this thought experiment is that the actual process of inventing would incur additional costs so actually this would give too low a probability, so we would have to give the reward would have to be a net amount including the cost of the inventors time. Furthermore the reward would have to include the value of non-monetary or psychic benefits the inventor get from inventing. Camerer, supra note 4.

[37]Einhorn and Hogarth, *supra* note 2.

forward assumptions, from which one can derive useful conclusions. [38] They have influenced legal theory from intellectual property[39] to evidence theory[40], to the separation of powers[41] to tort law[42] to how taxpayers behave under risk.[43] These theories have influenced the thinking about almost every situation in which uncertainty is involved.[44] For example, the Capital Asset Pricing Model, which is the pre-eminent model used to describe how the prices of assets are derived, is based on a subjective expected utility framework.[45]

D. Ambiguity

While both Expected Utility Theory and Subjective Expected Utility theory are very powerful descriptions of behavior, they are not entirely successful at predicting the way people actually behave. Beginning in the 1960's a number of empirical problems arose in dealing with

[38]Einhorn and Hogarth, *supra*, note 2.

[39]Roger Blair and Thomas Cotter, *An Economic Analysis of Seller and User Liability in Intellectual Property Law* 68 U. Cin. L. Rev. 1 (1999)

[40] Lawrence Selum and Stephen Martin *Truth and Uncertainty: Legal Control of the Destruction of Evidence* 36 Emory L.J. 1085(1987)

[41] Suzanne Clair *Separation of Powers: A New Look at Functionalist Approach* 40 Case W. Res. L. Rev. 331 (1990).

[42] Jason Johnston *Punitive Liability: A New Paradigm of Efficiency* 87 Columbia L. Rev. 1385 (1990).

[43] Nina J. Crim *An Explanation of the Federal Income Tax Exemption for Charitable Organizations: A Theory of Risk Compensation* 50 Fla. L. Rev. 419 (1998), Livingston *supra*, note 2

[44] See Sunstein *supra* note 6 and Hogarth and Einhorn *supra* note 2.

[45] Joshua Aizenman *International Portfolio Diversification with Generalized Expected Utility Preferences* NBER Working Paper 5965 (1997) p. 1, also Michael Jensen STUDIES IN THE THEORY OF CAPITAL MARKETS (1972)

both theories.[46] One of the most important of these was first discussed by Daniel Ellsberg.[47] Hence, it is generally known as the Ellsberg Paradox, or Ellsberg=s paradox.[48]

To illustrate this paradox, assume there are two urns, denoted A and B. Each urn contains 100 balls. The balls are either green or red. Urn A contains 49 green balls and 51 red balls. Urn B contains an unspecified assortment of balls. We will conduct two experiments. In each experiment, we randomly select a ball from each urn. We will call them the A-ball and the B-ball, respectively. After each experiment the ball is returned to the urn. In both experiments, the subject must choose either the A-ball or the B-ball. After the choices have been made, the color will be disclosed. In the first experiment, the subject will choose either the A-ball or the B-ball, before the subject knows the color of either ball. The subject wins $1000 if the ball chosen is red. In the second experiment, the same prize is won if the ball is green. With the information given, most people will choose the A-ball in the first experiment. If the decision is made using subjective probabilities, this should mean that the subjective probability that the B-ball is green is larger than .49. Hence, most people should choose the B-ball in the second experiment. However, it turns out that in the overwhelmingly majority of actual experiments the subject will choose the A-ball.[49] The decision maker understands that by choosing the A-ball, there is only a 49% chance of winning. However, this chance is Asafe@ and well understood. The uncertainty encountered is much less clear if he chooses the B-ball. This experiment and experiments like it suggest that

[46] For example see Allais *supra* note 30
[47] See Ellsberg *supra* note 4.
[48] Like the St. Petersburg paradox it is only a paradox under the existing theory.
[49] Camerer, *supra* note 5

people do not simply assign a probability number to each event,[50] and therefore Subjective Expected Utility Theory is not a completely accurate picture of behavior.

One additional feature of the Ellsberg Paradox is that when the probability of success is low or the probability of a loss very high, individuals generally prefer ambiguity.[51] To illustrate, in one experiment the subject was to choose which of two balls was more likely to be numbered 687. The two balls were chosen from two different urns, each of which had 1,000 balls in it. In one urn, each ball had a different number between 1 and 1,000. In the other urn, it was not stated how the balls were numbered. In this case, the subjects preferred the ambiguous urn.[52] An intuitive explanation of this is that if the probability of success is low, ambiguity is more likely to improve the probability of success than to make it worse.[53]

There have been dozens of experiments which replicate these findings in a number of ways.[54] Furthermore, many studies have found that this phenomena is directly applicable to market transactions.[55] Both ambiguity aversion at high to moderate probabilities and ambiguity preference for low probabilities appear to be robust to many different situations.[56]

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[50]Einhorn and Hogath *supra*,note 2.

[51] See Ellsberg note 4, Einhorn and Hogarth, note 2

[52]Einhorn and Hogarth *supra* note 2

[53]Einhorn and Hogarth *supra* note 2, Ellsberg *supra* note 4

[54] Einhorn and Hogarth *supra* note 2,, Camerer supra note 5.

[55] Robin Hogath and Howard Kunreuther *Ambiguity and Insurance Decisions* 75 American Economic Review 386 (1985). There is also some evidence that Catastophic events are not likely to be insured because it is difficult to determine the probabilities. Alliance of American Insurers. NUCLEAR POWER, SAFETY AND INSURANCE; ISSUES OF THE 1980S- THE INSURANCE INDUSTRY'S VIEWPOINT 1979. Howard Kunreuther, Robin Hogarth and Jacqueline Meszeros *Insurer Ambiguity and Market Failure* 7 Journal of Risk and Uncertainty 71 (1993)

[56]Camerer, *supra* note 5

One way to think about this "paradox' is that people rely not only on the probabilities of the events, but also on the strength of the evidence that generated those probabilities. People are averse not only to uncertainty about a result, but also to weak evidence. For a large portion of what occurs in life, the evidence of prior experience can help us to predict what will occur in the future. However, the degree to which prior evidence is reliable to predict the future will vary from situation to situation. Those situations for which the evidence is perceived as a better predictor will be treated more like probabilities that are known. Those events which have weaker evidence will be treated as more ambiguous.[57] In the Ellsberg situation, the subjects had more information about the "known urn" and less about the "unknown urn". The strength of the subjects knowledge about the probability of an event in that experiment significantly affected behavior.[58]

Some have claimed that ambiguity aversion is irrational,[59] but this is not necessarily the case. Ambiguity aversion is completely consistent with a formal definition of rationality. As long as subjects are consistent about which activities they choose in a given situation, then this behavior is not irrational.[60]

Empirical evidence indicates that the size of the amount of added payoff necessary to induce subjects to choose an ambiguous risk can be fairly large, in the range of 20% of the

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[57] Peter Gardenfors and Nils-Eric Sahlin *Unreliable Probabilities, Risk-taking and Decision Making* 53 Synthese 361 (1982) . Ellsberg himself described ambiguity as a "quality depending on the amount, type reliability and 'unanimity' of information, giving rise to one's degree of 'confidence' in an estimate of relative likelihoods." See Ellsberg, *supra* note 2 at p. 645

[58] Gary Gigliotti and Barry Sopher *The Testing Principle: A Resolution of the Ellsberg Paradox. Rutgers University, Department of Economics Working Paper* 92-01 (1992).

[59] Daniel D. Frisch and Jonathon Baron, *Ambiguity and Rationality* Journal of Behavioral Decision Making 49 (1988).

[60] Andreu Mas-Colell, Michael Whinson and Jerry Green MICROECONOMIC THEORY (1995) pp.7-8., also Ellsberg, *supra* note 1, pp.1-5.

expected value of the payoff.[61] Hence, ambiguity aversion can affect behavior a great deal. There appears to be less ambiguity aversion for losses than for gains.[62]

In further support of the idea that ambiguity cannot simply be treated as a form of risk, there is empirical evidence that individuals do not view ambiguity as the same as risk, but view it as something separate from it.[63] Ambiguity aversion does not seem to be well correlated with risk aversion, which one would expect if they were the same phenomena.[64] Someone can be highly ambiguity averse without being highly risk averse and vice-versa. [65] A person may be willing to accept a risk he or she understands, even though the risk may be substantial, whereas he may feel unwilling to accept a risk he or she does not understand.

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[61] Kenneth MacCrimmon and Stig Larson *Utility Theory: Axioms Versus Paradoxes,* In EXPECTED UTILITY HYPOTHESIS AND THE ALLAIS PARADOX (M. Allais and O. Hagen) 1979 , Shawn Curley and J. Frank Yates *An Empirical Evaluation of Descriptive Model of Ambiguity Reactions in Choice Situations* 33 Journal of Mathematical Psychology 396-427 (1989) and Michele Bernasconi and Graham Loomes *Failures of the Reduction Principle in an Ellsberg -type Problem* 32 Theory and Decision 77-100 (1992).

[62] Einhorn and Hogarth (1986), see note 2 and Barbara Kahn and Dakesh Sarin, *Modeling Ambiguity in Decisions Under Uncertainty* 15 Journal of Consumer Research 265-272 (1988) and Michele Cohen, Jean-Yves Jaffray and T. Said *Individual Behavior under Risk and Uncertainty: An Experimental Study* 18 Theory and Decision 203-228 (1985).

[63]Colin Camerer *Ambiguity Aversion and Non-Additive Probability: Experimental Evidence, Models and Applications* in UNCERTAIN DECISIONS: BRIDGING THEORY AND EXPERIMENT (Luigi Luini ed., 1999)

[64] Several investigators have found only very low correlations between people=s risk attitudes and their attitudes towards ambiguity Cohen, Jaffray and Said *supra* note 63, Robin Hogarth and Hillel Einhorn (1990) *Venture Theory: A Model of Decision Weights* 36 Management Science 7780-803 and Paul Schoemaker *The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations* 20 Journal of Economic Literature 529(1982) and also *Choices Involving Uncertain Probabilities: Tests of Generalized Utility Models* 16 Journal of Economic Behavior and Organization 295-317 (1991)these findings indicate that ambiguity aversion is a distinct phenomenon in human behavior. See Jurgen Eichberger and David Kelsey *Uncertainty and Strategic Interaction in Economics* University of Birmingham Working Paper (1999).

[65] See discussion in Section III.B.2.

While risk and ambiguity are distinct phenomena, ambiguity aversion and risk aversion do appear to have many analytical similarities.[66] Individuals generally avoid increases in both ambiguity and risk, [67] although there are occasions in which people become either risk preferring or ambiguity preferring.[68] In addition, ambiguity aversion seems to exhibit the same framing effects that some investigators have found with risk.[69]

There have been a number of models which have been developed to explain behavior under ambiguity. These include models which describe ambiguity as a second-order probability,[70] a variety of models in which the probability of independent events is not additive,[71] as well as models based on the notion of an anchor probability.[72] While there are many different

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[66]See Eichenberger and Kelsey, *supra* note 64

[67]That is reducing the reliability of the determination of P_B has the same effect as decreasing P_B. Einhorn and Hogarth supra note 2

[68]See discussion in note 63.

[69]Framing is the way in which the question is presented to the subject of the experiment. This can affect the response given. Camerer *supra* note 4.

[70] A good example of this type of model was described by Jacob Marshak 6 Theory and Decision 121-53, *Personal Probabilities of Probabilities* (1975). In this model the probability of an event is treated as a distribution of probabilities rather than a single probability. A problem with this type of model is that a simple second order probability reduces to a determinant first-order probability. Therefore, those who adopt this position generally relax the assumption in Expected Utility Theory of the reduction of complex lotteries. See Mas- Collel et al. *supra* note 60. Another model also matching this description was used in Lindsley G. Boiney *The Effects of Skewed Probability on Decision Making under Ambiguity* 56 Organizational Behavior and Human Decision Processes 134-148 (1993). In that model, ambiguity is defined operationally as a subjective second-order distribution on probabilities, f(p), and the skewness of the distribution affects behavior.

[71] In classic probability theory, if A and B are independent P (A or B) = P(A) + P(B)- P(A and B). Paul Hoel INTRODUCTION TO MATHEMATICAL STATISTICS (1984) p. 15. In non-additive models this axiom is not present. Gilboa and Schmeidler introduced a model of which a key feature is the non-additivity of probabilities. This theory is based on Maximin strategy over the distribution of possible probabilities. Itzhak Gilboa, and David Schmeidler *Maxmin Expected Utility with a Non-Unique Prior* 18 Journal of Mathematical Economics 141(1989)

[72] A good example of this type of model was described by Einhorn and Hogarth, *supra note 2*. The basic idea here is that people assign an anchor probability, but because there maybe some vagueness in this probability, this ambiguity is also part of the calculation. This model still

types of models, the majority of them can be described as following a generalized anchor probability model.[73] Under this model, the decision-maker has an anchor probability for an event. One can think of an anchor probability as the decision maker's best guess for the probability of an event occurring. However, this probability is not precise and it has a region of ambiguous probability associated with it.[74] The size of this region is the ambiguity associated with the risk. For example, assume I believe the probability of the Giants winning the World Series is 10%. However, let us assume that I realize that the proper probability to use in handicapping this event[75] this could be anywhere from 2% to 25%.[76] If I used a definite probability, I might be willing to bet $100 if the payoff were greater than 100/.10, or $1,000.[77] If the probability is ambiguous, I might not bet unless the payoff from the bet was 100/.08 or $1,250. That is, I would require an ambiguity premium of $250.[78]

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calculates a single number to account for a person=s attitude to the likelihood of an event occurring. However, this number is now not only dependent on the Aanchor@ probability, but also the chances that the probability is incorrect as well as the Aambiguity aversion@ of the individual. Furthermore, in one version of this model economic agents can weight the ambiguity aversion to losses with a different weight than ambiguity aversion to gains. Einhorn and Hogarth *supra* note 2.

[73] Robin Hogarth, Howard Kunreuther *Risk, Ambiguity and Insurance* 2 Journal of Risk and Uncertainty 35 (1989) This model also would comport with the simple model given in the text. Here P_B would be the expected probability and A would depend on the standard deviation of the probabilities. In this case, how A is determined is where the theories will differ. This article will simply treat A as exogenous and largely as randomly determined.

[74] Einhorn and Hogarth, *supra* note 2

[75] For a discussion of handicapping see Peter Walley STATISTICAL REASONING WITH IMPRECISE PROBABILITIES,(1991) appendix C, p.250-260

[76] By the correct probability, I mean the correct weighting given that I know that this probability might be between 1 % and 25% that this could occur. That is the proper probabilities for handicapping, see Walley note 75 .

[77]This number assumes risk neutrality. If the individual is risk-averse, all of these numbers would have to adjusted upwards to account for a risk premium.

[78] Under the anchor probability model (where the probability of an event is replaced by P_B – A), P_B here would be 10% and A be determined based on the range of the possible probabilities (2% -25%) and my ambiguity aversion. If as the example states I require a $250 ambiguity premium, A is .02. Einhorn and Hogarth, *supra* note 2 , discuss alternative formulas to calculate

Adding ambiguity to an expected utility framework helps to explain many types of behavior that cannot ne explained by the 'classical' theories. It explains the incompleteness of financial markets,[79] certain anomalous behavior of central banks,[80] why some provisions are intentionally left out of contracts[81], the suddenness of stock market crashes and booms[82] and other behavior such as bid and ask spreads.[83] Incorporating ambiguity aversion into the analysis of tax policy is therefore likely to lead to interesting results.

III. Society Should Encourage The Undertaking of Ambiguous Risks

This section sets forth the case that the government should encourage individuals and other persons to take on activities with ambiguous risks. The argument is based on an analogy to the literature concerning whether society should encourage individuals to take on risky activities.[84] However, this section shows that society should encourage ambiguous activities in addition to any

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A based on the amount of ambiguity and the subjects ambiguity aversion.

[79]Sujoy Mukerji and Jean-Marc Tallon *Ambiguity Aversion and Incompleteness of Financial Markets* University of Oxford Working Paper in Applied Economics (Dec. 15, 2000)

[80]Adam Cagliariari and Alexandra Heath *Monetary Policy Making in the Presence of Knightian Uncertainty* Research Discussion Paper 2000-10 Reserve Bank of Australia (Dec. 2000).

[81]Sujoy Mukerji, *Ambiguity Aversion and the Incompleteness of Contractual Form* 88 American Economic Review 1207 (1998)

[82]Larry Epstein and Tan Wang, *Uncertainty, Risk-Neutral Measures and Security Price Booms and Crashes* 67 Journal of Economic Theory 40 (1995)

[83]Larry Epstein and Jianjun Maio *A Two-Person Dynamic Equilibrium under Ambiguity* University of Rochester Working Paper (Dec. 2000), S. Morris *Risk, Uncertainty and Hidden Information* 42 Theory and Decision 235 (1997)

[84] Jack Hirschleifer *Efficient Allocation of Capital in an Uncertain World* 59 American Economic Review 77 (1964) , William Vickrey and Paul Samuelson *Discussion* 59 American Economic Review 88-92) (1964).

incentives given to these activities because they are risky. [85] The Section III will discuss some of the applications of the analysis developed in this section, as well as some of the limitations of the argument.

A. Should Society Encourage Private Risk-Taking

A fair amount of literature has addressed the question of whether the government should encourage risk-taking. [86] One of the most important points of this literature is that society can diversify risk and by so doing effectively reduce it. Hence, because risk is viewed as a cost or negative value, society should attempt to create methods to diversify risks.

The argument in this section assumes that individuals are rational utility maximizers. [87] It further assumes that individuals are risk averse, i.e. they generally prefer a certain outcome to an uncertain one.[88] Furthermore, because it is analyzing risk and not ambiguity, it assumes that individuals can precisely calculate the probability of an event occurring, which of course will be relaxed in the section dealing with ambiguity.

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[85]Einhorn and Hogarth, *supra* note 2 one could use other models as well. One of the assumptions of the argument in this section is that people do not make systematic errors in their anchor probability.

[86]Hirschleifer *supra* note 85 and Vickrey and Samuelson, *supra* note 85 Joram Mayshar *Should The Government Subsidize Risky Private Projects?* 67 American Economic Review 20 (1977). See also S. M. Ravi Kanbur *Risk Taking and Taxation* 15 Journal of Public Economics 163 (1980). Kenneth Arrow and Robert Lind *Uncertainty and the Evaluation of Public Investment Decisions 60* American Economic Review 364 (1970).

[87] Discussed at note 61, *supra*. Here we are assuming individuals act consistently with the 'classical' theories of probability.

[88] That is, given two investments one which is essentially risk-free and one which entails taking on risk, investors would require that the second investment have a higher expected return in order to be indifferent between the two investments.

The general statement that we prefer certainty to uncertainty only refers to positive outcomes. I would prefer an uncertain death to a certain one, ceteris paribus.

The argument begins with the well known point that, *ceteris paribus*, a diversified portfolio of investments has less risk than an undiversified portfolio of stocks.[89] Even though this is well understood, it is profitable to review why this occurs. To illustrate, assume an investor, A, can choose between two portfolios, each requiring a $ 1 million investment. In Portfolio One, the entire $1 million will be invested in one stock. In Portfolio Two, the $ 1 million dollars invested in five stocks, each of which has the same total risk as the single stock in the other portfolio.[90] In general, the variance of Portfolio Two will be less than the variance of the Portfolio One.[91] This arises because there are two types of risk in any investment: idiosyncratic risk[92] and systematic risk.[93] A diversified portfolio will reduce the idiosyncratic risk. Therefore, if the stocks are selected so they all have the same systematic risk, the systematic risk will stay the same, while idiosyncratic risk is reduced (and effectively eliminated if there are 20-30 stocks chosen so as to

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[89]This is because the variance of the diversified portfolio is less than the variance of the undiversified portfolio. This assumes that the stocks in the diversified portfolio have the same or greater systemic risk, or âs. Richard Brealey and Stewart Myers, PRINCIPLES OF CORPORATE FINANCE (1996)

[90] The riskiness of a stock is usually represented by á +âM + å, where á = idiosyncratic risk, â M= systematic risk and å = the remaining variance. Brealey and Myers *supra* note 89

[91]Portfolio variance = $Ó_{i=1}^{N}$ $Ó_{j=1}^{N}$ x_i x_j $ó_{ij}$, where N is the number of investments in the portfolio, and x_i is the amount of the portfolio allocated to the ith asset and x_j is the amount of the portfolio allocated to the jth asset and $ó_{ij}$ is the covariance of the ith and jth asset. For two shares of the same stock the variance is 4 $ó^2$, for two share of different stock it is $ó_1^2$ + $ó_2^2$ + 2 E(x-μ_1) E(y- μ_2), where $ó_n$ = the variance of stock n, and E(w) = the expected value of w, and μ_n = the mean of stock n. So the variance of the five stocks will somewhere between $Ó_1^5$ $ó_n^2$ + $Ó_1^5$ $Ó_1^5$ E(x-μ_i) E(y- μ_j) and 25$ó^2$, whereas the portfolio of a single share will be 25$ó^2$. Notice that when i =j, $ó_{ij}$ is just the variance of the stock. If the risk of stocks are independent then the variance decreases with $1/(n)^2$. Of course, no two stock risks are completely independent. You cannot diversify systematic risk. Brealey and Myers *supra* note 87.

[92]This is also known as unique risk, unsystematic risk, residual risk, specific risk or diversifiable risk. Brealey and Myers *supra* note 87 p.156

[93] This is also referred to as market risk, or undiversifable risk. Brealey and Myers, *supra* note 87.

ensure their idiosyncratic risks are not correlated).[94] Because the variance of possible returns of an investment is closely related to what we would call risk,[95] a lower risk premium is required for the diversified portfolio.[96]

Because the risk premium of the diversified portfolio is lower, we could modify Portfolio Two so that its stocks are slightly individually riskier [97] than the single stock in the undiversified portfolio. In this case, Portfolio Two would give a higher expected return than the undiversified portfolio,[98] yet Portfolio Two has less total risk. Consequently the investor should prefer Portfolio Two, because its total risk is less and its expected return is higher.[99]

The next step in the argument is to look at risk from a societal perspective. Because society can diversify idiosyncratic risk entirely,[100] society will have a much lower risk premium than the individuals would have for any kind of investment which they cannot easily diversify on their own. Of course, the variance of society=s Aportfolio@ in absolute terms is greater than for any individual.[101] However, on a per-capita basis it is a much lower. [102] If individuals only faced this

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[94]Brealey and Myers *supra* note 87

[95]Mark Machina and Michael Rothschild ARisk@ in the UTILITY AND PROBABILITY pp.230-232. (J. Eatwell, M. Milgate and P. Newman, 1990) As long as variance and Arisk@ are monotonic (i.e, one increases so does the other), then we can generally ignore the differences between the two for our purposes.

[96]Brealey and Myers, *supra note 90*

[97] That is for an individual, the total risk for each stock individually (á + âm + å) is greater than for the single undiversified stock. However the risk added to the portfolio is less than its total risk. Brealey and Myers *Supra* note 87

[98] In general, the higher the risk of a stock, the higher the expected return. Brealey and Myers, *supra* note 87.

[99]This is true as long as the stocks in portfolio II are chosen so that the increase in risk form the individual stocks is less than the decrease in risk from diversification.

[100]By definition from society=s perspective, any risk at that level is systematic.

[101] G_1 P (portfolio variance for each individual portfolio) = variance for all portfolios, where P = population.

[102]Lind and Arrow, *supra* note 87 and Mayshar *supra* note 87. That is, because society can diversify risks, it is not a multiple of individual=s variance, it is only a multiple of the systemic risk

per-capita risk on their investments, they would demand a much lower risk premium and hence might take on more risk.[103] However, if individuals are not able to diversify their portfolios in the way society can, they will demand a higher premium. [104] Therefore in the absence of any additional incentives, individuals would not choose the socially optimal portfolio.[105]

One can see this clearly by dividing the single investor in the above example into five separate investors. If each could only invest in a single stock, they would together demand a higher risk premium than they would if the five could invest together in one portfolio of five stocks with each owning a fifth of the joint portfolio.[106] If they could pool their risks, the individuals very likely would be willing to enter into a riskier portfolio than they would have on their own. They could all earn a higher return by investing in riskier stocks, and still have the same individual risk as before.[107] Therefore all the individuals of the society could be made better off by pooling these risks.[108]

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of individuals. The idiosyncratic risk is not included. So on a per-capita basis, the risk is less.

[103] Mayshar,*supra* note 87.

[104]Behavioral problems like this were the subject of Thomas Schelling=s Classic work, MICROMOTIVES AND MACROBEHAVIORS (1978).

[105]Here I use the same definition of social optimum as Mayshar. *supra* note 87 Social optimum is an allocation of resources which maximizes social well-being. For a country like the United States, society diversifies among the portfolios of the entire country. In connection with Lind and Arrow's argument for a lower risk premium for government projects, Hirshleifer makes the argument that the discount rate for governmental projects should not be less than for private sector, or else there will be a misallocation of resources between the two sectors. Vickrey-Samuleson make the group pooling argument. See Discussion note 87

[106]Ó risk premia for the undiversifed portfolio> Ó risk premia diversified portfolio, see discussion footnote 92.

[107] Markowitz, *supra* note 13.

[108] This is related to Arrow-Lind theorem *supra* note 87, See Gareth Myles PUBLIC ECONOMICS, (1995) pp. 205-212 It does not contradict Hirschleifer's argument because this is not arguing that governmental projects alone should be risk-neutral, but rather all projects in society should be risk-neutral. Each individual=s contribution to risk of the whole would be $ó_{iis}/ó_s^2$, X the weighting of society as a whole where σ_s^2 is the variance of society. This argument assumes that there is no systematic error by individuals towards an optimistic assessment of the

This argument is even stronger if there are positive externalities from the investment. If society stands to benefit from the investment and society is less risk averse than the individual investor (because it can diversify the risks), society should be willing to subsidize the risky decision by the individual.[109] To illustrate, this let us look at a case in which an individual, A, chooses between two activities. Assume, that for Activity I the returns at the societal level are $900,000 with 100% certainty and for Activity II, the returns are $2 million with a 55% probability, and a zero return with a 45% probability. Let us assume that because of risk aversion, the expected utility on the societal level of Activity II is $1 million.[110] Let us assume that under either action, A will receive 1/10 of the total societal benefits. One might assume that A would choose the second action. However, because the variance added to A's portfolio by the risky activity is proportionally greater than that added to society's portfolio, he views Activity 2 as

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probability of success of an event. If individuals are overly optimistic, then it is possible that we do not need to encourage risk-taking or we might actually have to restrain them from taking on too much risk. Of course, if they are overly pessimistic then we would need even more to encourage risk-taking. There is actually a fair amount of evidence that people are rather good at this. Michael Smithson *Judgement Under Chaos,* 69 Organizational Behavior and Human Decision Process 59 (1997), Arthur Hoerl and Herbert Fallin, *Reliability of Subjective Evaluations in a High Incentive Situation* 137 Journal of the Royal Statistical Society A 227-30 (1974). Some have argued that individuals are overly optimistic, but this is generally not in market settings. However, some have argued that little can be concluded on this point. see Jon D. Hanson and Douglas A Kysar *Taking Behavioralism Seriously: The Problem of Market Manipulation* 74 NYU L. Rev. 620 (1999). For a discussion of over-confidence see Gerd Gigenrenzer et al. *Probabilistic Mental Models: A Brunswikian Theory of Confidence* 98 Psychological Review 506-528 (1991)

[109]It is possible to make an argument that should risk-pool even if individuals alone capture the benefit i.e., the average wealth of the members of society would be increased. However, the case for societal intervention is very clear when there are positive externalities. The Coasian solution would be to contract it around he externality, but here this benefit only occurs at the societal level, so the most logical for society as a whole to be the contracting party.

[110]That is, EU($2 million) .55 = $ 1 million, which is consistent with the idea that society is risk-averse because the expected value (E[$2 million (.55)] = 1.1 million) is slightly more, so the expected utility is likely to be somewhat less. See discussion notes 20-28, *supra*.

being riskier than society does.[111] Because Activity II is viewed as riskier by A than society, A will put a lower value on it. Let us assume that he would put an $80,000 value,[112] as opposed to a $100,000 value on Activity II (which 1/10 of society's value). However, if society is willing to pay A $21,000 for choosing Activity II, society would be better off by $79,000[113] and A would better off by $1,000[114]. This payment would be Pareto efficient.[115]

It is important to note that this argument only applies to idiosyncratic risk neutrality. This is not quite the same as risk neutrality. Even society cannot diversify systematic risk.[116] Therefore, society should cause individuals to ignore or at least put less emphasis on idiosyncratic risk, but society has no interest in making them neutral as to systematic risks.

While the structure of this argument is in the form of investment in stock or securities, it would apply to other forms of investment as well.[117] It would apply to occupational choice and investment in real assets or any other investment of scarce resources.[118]

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[111]The risk added to society's portfolio by action i is $ó_{im}/ ó_m^2$ where $ó_{im}$ is the covariance between the ith action's return and the market return and $ó_m^2$ is the variance of the market as a whole. The variance added to A's portfolio is $ó_{ip}/ ó_p^2$ where $ó_{ip}$ is the covariance of the action's return and A's portfolio and $ó_p^2$ is the variance of A's portfolio. Because it is likely that $ó_{im}$ is likely to be proportionately much smaller than $ó_{ip}$, the variance added to A's portfolio is greater than to society's portfolio. Hence A's expected utility of the second investment will be proportionally less than for society. Brealey and Myers, *supra* note 87.

[112] This because he had more risk than society, see note 111, *supra*.

[113]Total Benefit to Society($100,000) - Payment to A ($21,000)

[114]Benefit of Activity II unaided ($80,000) + $21,000 - Benefit of Activity I ($100,000)

[115] This means that it makes society can be made better off, without A being made worse off. Richard Posner, ECONOMIC ANALYSIS OF LAW (1998) pp. 14-15.

[116]Brealey and Myers *supra* note 87.

[117]In fact as the demonstrated in the discussion in Section III, it applies more forcefully outside of the context of portfolio investment.

[118]See section III.B

The market has already developed many institutions to diversify risk. For example, mutual funds allow individuals to invest in diversified portfolios of stocks.[119] Insurance companies pool risks of many people together[120] and similarly banks pool the liquidity risks of many people.[121] These are direct applications of the diversification principles. For those risks that the market already diversifies, there is no need for governmental intervention. But as discussed in Section III, for some activities the market does not provide a mechanism to pool these risks .

B. Society Should Encourage the Private Undertaking of Activities with Ambiguous Risks

If ambiguity is analyzed in a similar fashion, a similar conclusion emerges: activities with ambiguous risks should receive additional encouragement from society, in addition to any encouragement they should get for being risky.[122] The conclusion emerges in part because as with risk, people are averse to additional ambiguity.

The argument for ambiguity is largely symmetrical to the argument for risk. The argument for ambiguous activities makes the same basic assumptions as that for risky situations except that we no longer assume individuals can perfectly calculate all the risks, and we will now assume that society is currently optimally encouraging risky activities. In addition, this argument assumes that ambiguity can be diversified in the same way that risk can be. Diversification for ambiguous risks

[119]Brealey and Myers *supra* note 87.

[120]See Emmett J. Vaughan and Therese Vaugh FUNDAMENTALS OF RISK AND INSURANCE (1999) chapter 2.

[121]Brealey and Myers, *supra note 87*

[122]Often ambiguous events are perceived as being risky as well as ambiguous, Camerer, *supra* note 5.

leads to effects similar to those with diversification for risk, although it does not operate precisely the same way.[123]

If we use the simple anchor probability model of behavior relating to ambiguous risk in section II, one can demonstrate that society should encourage ambiguous risk-taking.[124] As discussed in section II, individuals demand a premium for taking on ambiguous risk as compared to known risks.[125] If individuals do not have systematic error in determining the anchor probability, [126] society should want individuals to essentially act as if the anchor probability was the known probability.[127] This results because there is no systematic ambiguity, which is a consequence of the assumption that they have no systematic error in determining the anchor probability. Because society can diversify its "investments" over a very wide number of activities, on average the anchor probability will be the probability of success of the activity there

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[123] See Truman Bewley *Market Innovation and Entrepreneurship: A Knightian View* (April 1989) Universitat Bonn Discussion Paper No A-233 on file with the author. Also Larry Epstein *Sharing Ambiguity* 91 American Economic Review (forthcoming 2001), Jean-Marc Tallon, Alain Chateauneuf, R.A. Dunn, *Optimal Risk Sharing Rules and Equilibria with Non-additive Expected Utility* 34 Journal of Mathematical Economics 191 (2000), Jean- Marc Tallon, *Convex Preference and Non-Empty Core in the Choquet Expected Utility Model* 96 Economic Theory (forthcoming 2001) .

[124] As discussed in note 78, under this model, each individual behaves as if the probability of an event occurring is P_B - A, where P_B is the best guess of the individual of the probability and A is the adjustment for ambiguity. There is no magic in this particular formulation. It could just as easily be written as (P_B)A or any of an infinite possible other formulations. This formula is similar to the method used in Selwyn Becker and Fred Brownson *What Price Ambiguity? Or the Role of Ambiguity in Decision -Making* 22 Journal of Political Economy 62 (1964) As discussed before, the adjustment A can be quite complicated, and can depend on a large variety of factors.

[125]See discussion in note 62.

[126] This model describes both Bewley's model, *supra* note 123 and Einhorn and Hogarth model, *supra* note 2 That is, the say the expected of the probability of the effect is in fact P_B. See Smithson *supra* note 108. In fact, empirical evidence indicates that when people are confronted with chaotic situations, they can often make fairly good guesses about the mean and standard deviation.

[127] This assumes that the resolution of the various A-s in society are uncorrelated. If they are correlated then there is systemic ambiguity, as opposed to idiosyncratic ambiguity.

is little or no systematic ambiguity, from society's perspective. Therefore, society should want individuals to act as if these anchor probabilities are known probabilities.[128]

However, from an individual perspective this would not be rational.[129] Each individual would act in accordance with their lack of knowledge, and the ambiguous risks that they face. Therefore, society needs to provide incentives for the individual to behave as if the idiosyncratic ambiguity surrounding the anchor probability was much smaller or non-existent.

One might argue that society already encourages investment in ambiguously risky activities. For example, social insurance,[130] bankruptcy rules,[131] unemployment compensation[132] and a variety of other kinds of legal rules are often said to encourage risk taking, and therefore might encourage ambiguous risk taking as well. However, none of these rules differentiate between ambiguously risky activities and risky activities. Hence, if we assume society has optimally encouraged risk, but it is not differentiating between risky and ambiguous activities, it is not optimally encouraging ambiguous activities. Furthermore, these rules aim to insulate the decision-maker from losses, rather than increase gains from ambiguous activities. However, because there is less ambiguity aversion to losses than for gains, insulating against losses will encourage the undertaking of

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[128]If we think of the actual P_B as being normally distributed around P_B, then as the number of different activities increases the standard deviation of the distribution around P_B will decrease by $(n)^2$ where n is the number of activities and the per-capita variance is then less as this occurs at the societal level. As illustration, insurance companies do not charge a premium for ambiguous risk in products liability insurance. One explanation of this is they are able to diversify this ambiguity over a large number of products with ambiguous risks. W. Kip Viscusi, *The Risky Business of Insurance Pricing* 7 Journal of Risk and Uncertainty 117 (1992)

[129]From each individuals perspective, they react to the ambiguity they are confronted with. Schelling, *supra* note 104.

[130]Hans Werner Sinn, *A Theory of the Welfare State* 92 Scandinavian Journal of Economics 495 (1995)

[131]Posner, *supra* note 115 at 440.

[132]Sinn *supra note 130* at 503.

ambiguous activities less than increasing the gains from the activity would.[133] Empirical evidence indicates that if society insulates individuals from the potential losses of an activity that this is not as effective at encouraging ambiguous activities as increasing the gains from the activity.[134] Hence, incentives for ambiguous behavior should be geared to improving the profits from ambiguous activities rather than reducing the losses.

Another argument against encouraging ambiguous activities is that those with lower ambiguity aversion already undertake these activities, so that there is no need to encourage these activities.[135] The question is not whether some people will engage in ambiguous activities but rather whether the optimal level of ambiguous activities will result. As shown earlier, on average individuals are averse to ambiguity, but from a societal perspective they should not be. Therefore, to the extent that diversification reduces ambiguity society is likely to be better off by encouraging more undertaking of ambiguous risks.[136]

One caveat to this argument is that, as discussed in Section II, if the probability of success is very low, then ambiguity leads to a higher likelihood of taking on too much ambiguous risk. Therefore, if an activity has a fairly low degree of success, society has no need to encourage it,

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[133]Bewley *supra* note 123, and also discussion at discuss it here.

[134] Pekka Ilmanhunnas, Vesa Kanniainen, Uki Lammi *Entrepreneurship, Economic Risks and Risk Insurance in the Welfare State (1999)* University of Helsinki Working Paper. Section III discusses how capital gains preference is one way society currently does encourage the undertaking of ambiguous risks.

[135]Frank Knight argued that all real profit(as opposed to rents) derived from a low ambiguity aversion. Entrepreneurs profit from having a lower ambiguity aversion.If some people have a lower ambiguity aversion, then they will undertake activities and demand a lower ambiguity premium than others, but because the anchor probability is higher than for simply risky activities on average they will earn a profit. Knight, *supra* note 2.

[136] Viscusi, *supra note 128,* which shows insurance companies price ambiguous risks for products liability without an ambiguity premium, even though they require ambiguity premiums for other types of policies. One explanation for this given the above discussion is that they are able to diversify the ambiguity.

because in these cases ambiguity actually encourages the activity and in fact society may wish to discourage those activities.

IV. Application Of the Diversification Analysis to Specific Activities

Even if we should encourage those activities which have a high degree of ambiguity in their risks, particularly those with positive externalities, what activities are these and how we should encourage them? In an effort to clarify the issue, this section will first discuss what kinds of activities to which the diversification argument does not apply and then it will discuss two examples of activities to which it does apply, both of which have generated a significant amount of literature in economics journals recently, but none yet in the legal literature. In particular, it will analyze how ambiguity is inherent in foreign portfolio investment and entrepreneurial activity and how these ambiguity problems should be dealt with.

A. Activities to Which the Diversification Analysis Does Not Apply

In analyzing what activities should be encouraged, it is useful to first remove certain activities from consideration. First of all, activities in which individuals already diversify the ambiguities involved should be ignored. The benefit society can give is diversification, and if a market mechanism already exists which achieves this diversification, there is no need for society to intervene. Examples would include hazards which can be insured against such as floods, earthquakes, auto accidents etc.[137]

[137] For the possibility that insurance might fail here Eric Johnson, John Hershey, Jacqueline Meszaros and Howard Kunreuther *Framing, Probability Distortions and Insurance Decisions* 7 Journal of Risk and Uncertainty 35 (1999)

A second category of ambiguous activities that we do not need to encourage are those that are so large that society cannot significantly diversify the ambiguity. If diversification cannot be achieved, then society is not in a better position than the individual. Examples of this include the uncertainty in experiments that may destroy the earth[138] or global warming.[139]

Another category of activities where the government should not intervene are activities that generate negative externalities for society. For example, under the framework we have developed both parties to a litigation have an anchor probability for their success at trial, but they understand there may be substantial ambiguity in these probabilities.[140] The greater the ambiguity, the more likely the parties are to settle, because they will place a lower "expected value" on their success at trial.[141] Here, ambiguity might result in a situation where the social outcome is better, because it causes more cases to settle, which is generally viewed as a benefit to society.[142] In these situations, many argue there is no clear social gain from encouraging the undertaking of ambiguous risks.

B. Examples of the Application of Ambiguity Analysis

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[138] Some have argued that an experiment being conducted ay Brookhaven national Laboratory has the potential to destroy the Earth. See *Letters to the Editors*, Scientific American (July 1999) pp. 10-15, See also *Apocalypse Deferred*, Scientific American (December 1999) pp. 30-32

[139] For an application of Knightian Uncertainty to climate change see Ropbert Woodward and Richard Bishop *How to Decide When Experts Disagree: Uncertainty -Based Choice Rules in Environmental Policy* 73 Land Economics 445 (Nov. 1997)

[140] Cynthia Fobian and Jay Christensen-Szalanski *Ambiguity and Liability Negotiations: The Effects of the Negotiator's Role and Sensitivty* 54 Organizational Behavior and Human Decision Prcoses 277 (1993)

[141]Fobian and Christensen-Szalanski, *supra* note 140

[142] For a discussion of when settlement might not be optimal for society see Leandra Lederman *Which Cases Trial* 49 Case W. Res. L. Rev. 315 (1999), Leandra Lederman *Precedent Lost: Why Encourage Settlement and Why Permit Non-Party Involvement in Settlement* 75 NotreDame 221 L. Rev 221 (1999)

If we flip around the analysis of when not to encourage ambiguous activities, if an activity does not have negative externalities, exhibits a greater than average amount of ambiguity and society can provide the benefit of diversification which the market has not yet accomplished, society should encourage this behavior. This is particularly true for activities that have positive externalities. In this subsection, we will analyze two examples of these kinds of activities: Foreign Portfolio Investment and Entrepreneurial Activity. For each activity, we will discuss how the risks involved are ambiguous and why a preferential tax rate is the most effective way to address the ambiguity problems involved. These examples are not in any way exhaustive of the potential applications of the ambiguity analysis. They were chosen because there is already a significant body of economics literature analyzing ambiguity in connection with these investments.

1. The "Home Bias" Problem and the Taxation of Foreign Investment Income

One of the most interesting problems that arises in connection with foreign investment is the "Home Bias" problem. Investors require higher rates of return on foreign investment than they require from domestic investments.[143] Traditional models of investment decisions assume that investors allocate their capital so as to maximize their returns under an expected utility framework.[144] If this were true, the rates of return across countries should equalize.[145] However, for some time it has been empirically demonstrated that investors do not do this.[146] They are far

[143]Karen Lewis, *Trying to Explain the Home Bias in Equities and Consumption* 37 Journal of Economic Literature 571, 571 (1999), Martin Feldstein and Charles Horioka *Domestic Saving and International Capital Flows* 80 The Economic Journal 314 (1980)

[144] Lewis, *supra* note 143

[145]See also Karen Lewis, Larry Epstein , *supra*, note 123

[146] Lewis *supra* 143, Epstein *supra* 123, Feldstein and Horioka, *supra* note 143, Kenneth French and James Poterba *Investor Diversification and International Equity Markets* 81 American Economic Review 222 (1990) Roger Gordon and Lans Bovenberg *Why is Capital So Immobile Internationally? Possible Explanations and Implications For Capital Income Taxation*. 86 American Economic Review 1057 (1996)

more likely to invest in their home country than a risk/return analysis under the 'classical theories' would predict.[147] The most highly cited study in this area found that, in general, investors require a three percentage point higher return for investing in a foreign jurisdiction as compared with a domestic investment.[148]

The most prominent explanation of the "Home Bias" problem is that individuals feel that the information they have about investments in their home country is more reliable than the information they have about foreign investments.[149] This easily fits within an ambiguity model. The risks facing foreign investment are less clear to domestic investors because they have less reliable information about them, making the risks are more ambiguous. Consequently, the expected rate of return must be higher for foreign investments that for domestic investments.

"Home Bias" creates a problem because it reduces the efficiency of the world economy.[150] To maximize world-wide income, we want investors to ignore ambiguity in allocating their investments.[151] However, for individuals this is not rational. Therefore, the "Home Bias" problem reduces world-wide income.[152]

The income tax system is likely the best way to address this problem. It is unlikely that the Government could give enough information to investors to significantly reduce this bias.[153] In

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[147] In fact, the problem is even worse because they should also diversify the labor income part, which is highly do related with national income.

[148]French and Poterba, *supra* note 146 also Kenneth Kasa *Knightian Uncertainty and Home Bias* Federal Reserve Bank of San Francisco Economic Letter 2000-30 (October 6, 2000)

[149] Kasa, *supra* note 150, Larry Epstein, *supra* note 143. Gordon and Bovenberg, *supra* note 146.

[150]Maurice Obstfeld *Risk-Taking, Global Diversification and Growth* 84 American Economic Review 1310 (1994).

[151]See discussion Section II.B.

[152]Obstfeld, *supra* note 150

[153]Lewis, *supra* note143, French and Poterba *supra* note 143

addition, because ambiguity aversion is greater for gains than for losses, increasing the gains is more effective way to encourage the activity.[154] A preferential tax rate is one of the few ways to increase the gains from these investments.

The "Home Bias" problem has largely been ignored in the discussion of international tax issues in the legal literature.[155] The normative analysis of tax policy has generally assumed that investors equalize their expected returns across countries.[156] This is demonstrated in the traditional analysis of international tax policy which has led to the two main competing normative standards of capital export neutrality and capital import neutrality, both of which make this assumption.[157]

Under a capital export neutral system (sometimes referred to as a credit system[158]), the taxpayers will be subject to the same tax rate no matter where they earn their income. In order to alleviate potential double taxation, (by the residence country[159] and the source country[160]) the residence country generally permits its taxpayers a foreign tax credit for income taxes paid on income earned in foreign jurisdictions.[161] United States tax system has as its basic form a credit

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[154]See note 62.

[155]Reuven Avi-Yonah *Globalization, Tax Competition and The Fiscal Crisis of the Welfare State* 113 Harv. L. Rev. 1573 (2000), Chorvat , *supra* note 15, Peter Harris, CORPORATE /SHAREHOLDER INCOME TAXATION AND ALLOCATING TAXING RIGHTS BETWEEN COUNTRIES (1996) pp.30-34.

[156] Thomas Horst *A Note on the Optimal Taxation of International Income* 94 Quarterly Journal of Economics 793 (1980)

[157]Chorvat *supra* note 15, Harris, *supra* note 155.

[158]Chorvat *supra* note 15.

[159]This is the country where the individual taxpayer is a citizen or lives most of the year. In the case of a corporation, it is where it is incorporated. Chorvat, *supra*, note 15

[160]This is where the activities that generated the income occurred. Chorvat, *supra*, note 15

[161] IRC § 901, also see Hugh Ault COMPARATIVE INCOME TAXATION (1998) pp. 320-25.

system.[162] Those who favor a credit system argue that it achieves an efficient allocation of capital because taxes do not enter into the decision of where to place capital (i.e., the tax system is neutral as to the decision to export capital).[163]

To illustrate the operation of the credit system, assume that A, a US resident, earned $100 in Hong Kong and $100 in the United States. Hong Kong will tax the $100 of income earned within its borders at a rate of 17%. The United States will tax A's worldwide income of $200 at a rate of 35%. However, because of the foreign tax credit, A will only have to pay an additional US tax of $53, rather than $70.[164] Because the total amount of tax A will pay is $70,[165] the Hong Kong income and the U.S. source income are both subject to a total tax rate of 35%, which is the rate A would have paid if all the income had been earned in the United States.

Incorporating the "Home Bias" analysis into the capital export neutrality analysis, we find that if the US investor is biased in favor of US investment, there will be over-investment in the United States.[166] Therefore, the tax system should give a tax incentive to invest in the foreign country to compensate for this bias. Because the empirical evidence indicates the amount of the bias is about three percentage points, and given that the tax rates for most US taxpayers earning foreign source income is between 30-40%,[167] and given the historical rate of return to equity is about 11-12%,[168] if these earnings were exempt from all tax, you would have approximately the

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[162]See IRC § 901, also Chorvat, *supra* note 15.

[163]Horst, *supra* note 156

[164] If the Hong Kong income is earned directly by A, it will be taxable income to A under IRC section 61. If A's tax rate is 35%, A's tentative U.S. tax will be $70 (200 X .35). This will be reduced by a $17 credit permitted under IRC § 901. A will then owe $53 (70-17) in U.S. tax.

[165] $53 to the United States and $17 to Hong Kong

[166]Obstfeld *supra* note 150.

[167]See French and Poterba, *supra* note146

[168]Brealey and Myers, note 89 Internal Revenue Service, STATISTICS OF INCOME BULLETIN 90 (Fall 1999)

right incentive to invest.[169] However, a reduction in tax rates by the source country would have no effect unless the residence country changed its rules.[170] It would merely reduce the amount of the credit without reducing the overall tax rate. Therefore, such a reduction must be undertaken by the residence country.

Under a capital import neutral system, all income earned in a single country is subject to a single rate of tax, no matter where the person who earned the income is a resident. This can be accomplished if each country only taxes income earned within its borders.[171] Those who favor this type of system argue that it leads to an efficient outcome because the decision of whether to import capital is not affected by the tax system.[172]

To illustrate, assume that N is a Dutch resident, and N earns $100 in the Netherlands, and $100 in Hong Kong. Assume the Netherlands does not tax income earned abroad[173] and it has a 35% tax rate on income earned in the Netherlands.[174] N will only pay Hong Kong tax rates on N's Hong Kong income. For purposes of earning income in Hong Kong, N is placed on a level playing field as a Hong Kong resident for tax purposes.

Incorporating the "Home Bias" discussion into this analysis results in the source country charging a lower tax rate to foreign investors than it charges it own residents. The source country

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[169]That is, 30% of 11% is 3.3% and 30% of 12% is 3.6%. If we wanted to be more precise in the incentive, we could exclude only 75%-90% of foreign source portfolio income. This would get precisely the right incentive.

[170]If the residence country has a tax rate of 35% and the source country initially has a tax rate of 20%, a drop in the source country rate will have no effect on the total taxes paid. The rate will still be 35%. The amount of the foreign tax credit will drop, but this will not affect total taxes paid.

[171]Chorvat note 15

[172] The argument over which of the two standards in fact improves efficiency the most is beyond the scope of this article, see discussion in Chorvat. Horst *supra* note 156 .

[173] See Ault *supra* note 161, at 384-5

[174] See Ault *supra* note 161 at 87

should give a tax incentive to investment by foreign residents, because the foreign investors will be more averse to investing in the country than domestic investors are. If this is done, the tax system will be neutral between the import of capital and the use of domestic capital. Under a capital import neutrality or exemption system any reduction must come from the source country, because the residence country does not tax foreign source income.

In general, foreign portfolio income is subject to tax in the residence country and is generally only lightly taxed if at all by the source country.[175] Few OECD countries have adopted an exemption system approach for foreign source portfolio income even if they have adopted it for foreign direct investment.[176] While some economists have argued that the optimal strategy is for the host country to give incentives inbound investment,[177] there are several reasons for arguing in favor of the United States giving tax incentives to its investors. First, the United States in general has a credit system with regard to portfolio income. Under a credit system, the appropriate action is for the residence country to grant relief. Therefore, this is more consistent with the US tax system. Second, as a unilateral action, if the US gave a tax preference to foreign portfolio investment, it would have little effect on the taxation of portfolio income because most of the other countries of the OECD have a credit system. Reducing US rates of portfolio income of foreign residents would not encourage more investment in the United States corporations, because it would not reduce the world-wide tax rate of this income.[178] Third, it appears that to some degree the benefits to the United States investors internationally diversifying their portfolios may be higher

[175]Ault, *supra* note 161 Chorvat *supra* note 15
[176]Ault *supra* note 161 and Chorvat *supra* note 15
[177]Gordon and Bovencamp, *supra* note 146
[178]See discussion note 170 *supra*.

than for investors from other countries. [179] Therefore, the United States has more to gain by eliminating this problem. Furthermore, as a strategic concern, because the United States is a capital importing country,[180] we would prefer that in general it is the residence country that gives this preference, because this would benefit the United States the most and would cost us the least. In the past, the United States has been influential in altering the tax policy of many other countries. For example, in the transfer pricing area the "arms length" standard become the norm and there is little question the United States was instrumental in this occurring.[181] It also was influential is getting other countries to adopt legislation similar to our controlled foreign corporation rules.[182] Therefore, by taking the lead in this way, the United States may be able to influence other countries to adopt a position favorable to its interests. In addition, the United States would have a good argument because such a system is more consistent with most countries tax systems.

Therefore, the United States should either exempt foreign source portfolio income of its residents or give tax incentives to foreign residents who invest in the United States corporations. The efficiency and strategic concerns appear to favor lowering taxes on foreign source portfolio income.

2. Entrepreneurial Activity

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[179] Thomas Flavin and Micahel Wilkens *Optimal International Asset Allocation and Home Bias* National University of Ireland- Maynooth Economics Working Paper Series (Dec. 1998)

[180] US Trade Deficit Review Commission THE US TRADE DEFICIT: CAUSES, CONSEQUENCES AND RECOMMENDATIONS FOR ACTION (Nov. 14, 2000) p.239

[181] Avi-Yonah, *supra* note 157, at 1601

[182] Avi-Yonah *supra* note 157, at 1603.

The connection between entrepreneurship[183] and ambiguity dates at least back to Frank Knight, [184] and it has been a constant point in the literature since then.[185] He argued that entrepreneurs take on ambiguity and get compensated for it by higher returns.[186] Setting up a new business has less clear probabilities than investing the funds in a diversified portfolio of stocks.[187] Consequently, entrepreneurs on average have a higher rate of return.[188]

Entrepreneurial income is subject to greater ambiguity than other kinds of income in part because the potential profit from an entrepreneurial activity could be infinite, and in general the probabilities of any given return are more hazy.[189] Hence particularly as to gains, the probabilities and the amounts of income are very often very ambiguous. Because entrepreneurial activity is therefore subject to ambiguous risks, the analysis in Section II predicts we will have too little entrepreneurial activity. A fair amount of the literature supports this proposition.[190]

Ideally, we would like to give a preferential tax rate to entrepreneurial activity. One commonly used proxy for entrepreneurial income is a preferential tax rate for capital gains.[191] A

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[183] Entrepreneurship is defined as "... [S]tarting (founding) and managing a new business and assuming the associated risks." Jae Shim and Joel Siegel DICTIONARY OF ECONOMICS(1995) p. 123

[184]Knight, *supra* note 2.

[185]Bewley *supra* note 123, Larry Epstein and Tan Wang *Intertemporal Pricing with Knightian Uncertainty* 62 Econometica 283 (1994)

[186]Knight, *supra* note 2, at 183.

[187]Thomas A. Smith, *Institutions and Entrepreneurs in American Corporate Finance* 85 Calif. L. Rev. (1997), Joshua Aizenman *Investment in New Activities and the Welfare Costs of Uncertainty* 52 Development Economics 259 (1997) Knight, *supra* note 2, Maria Brouwer *Entrepreneurship and Uncertainty: Innovation and Competition Among the Many* 15 Small Business Economics 149 (2000)

[188]Brouwer, *supra* note 187

[189]Bewley, *supra* note 123, Knight, *supra* note 2.

[190]Aizenman, *supra* note 187, Bewley, *supra* note 123 Smith, *supra*, note 187

[191]Capital Gains are defined as gains on the sale of capital assets is defined under IRC § 1221. These are generally all assets other than inventory and depreciable property. Gains form the sale of depreciable property is also potentially eligible for the preference under IRC § 1231.

higher proportion of the income of entrepreneurs comes in the form of capital gains as compared to others with similar wealth,[192] and entrepreneurial income is more likely to be in the form of capital gains income.[193] Because the value of the profits from the taking on of ambiguous risks are now relatively higher than they would be in the absence of the preference, taxing capital gains at a preferential rate will encourage entrepreneurial activity. Taxing labor income at a higher rate than capital income encourages potential entrepreneurs to engage in entrepreneurial activity.[194] The potential entrepreneur will be given an incentive to channel his capital and energies into the entrepreneurial activity.[195] That capital gains preferences encourage entrepreneurial activity has a fair amount of empirical support.[196]

A capital gains preference operates in the correct way to encourage entrepreneurial activity. It increases the profits from the ambiguous activity rather than decreasing its potential losses and as discussed previously this is a more effective method of encouraging ambiguous activity.[197] Because individuals are less ambiguity averse to losses than gains, by increasing the gains you can more effectively encourage ambiguous activities than insuring these businesses against losses.[198] Furthermore, empirical studies indicate insurance against losses actually

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[192] R. Glenn Hubbard *The Golden Goose? Understanding (and Taxing) the Savings of Entrepreneurs* in ADVANCES IN THE STUDY OF ENTREPRENEURSHIP, INNOVATION AND ECONOMIC GROWTH (ed. Gary Libecap, 1998)

[193]Hubbard, *supra* note 192

[194]Hubbard, *supra* note 192, Roger Gordon *Can High Personal Tax Rates Encourage Entrepreneurial Activity* 45 IMF Staff Papers 49 (1998).

[195]Paul Gompers and Josh Lerner *What Drives Venture Capital Fundraising* NBER Working Paper 6906 Jan (1999)

[196]Roger Gordon, *supra* note 194, Gompers and Lerner *supra* note 195.

[197] See Discussion note 62.

[198]This also supported by Bewley, *supra* note 123. He argues that if the losses are reduced, this reduces the ambiguity of the investment, and then those who prefer ambiguity might curtail their entrepreneurial activity in favor of some other activity.

discourages entrepreneurial activity.[199] And the same studies indicate that increasing the payoff from entrepreneurial activity increases the amount of it.[200] Beyond this, the capital gains preference has been found to even increase the willingness of third party venture capitalists to invest in entrepreneurial activity. It is thought this occurs because the venture capitalists are convinced the entrepreneur will devote more time to the enterprise.[201]

The analysis in the legal literature addressing capital gains preference has assumed that the one of the chief goals of a tax system is to affect investment decisions as little as possible.[202] Under this analysis, the primary reason for a capital gains preference is to reduce the problems that result from the realization requirement.[203] In particular, the capital gains preference helps to overcome the "lock-in" effect which occurs because the gains from property are only taxed when they have been realized by a sale or exchange.[204] Therefore, a person can avoid paying income tax on theses gains by retaining the assets.[205] Hence, the tax system would encourage the holding of assets even when this is inefficient. Another argument in favor of the preference is that some of the gains are the result of inflation because we do not index the price of the asset for inflation.[206]

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[199]Ilmanhunnas et al. *supra* note 134, Gompers and Lerner *supra* note 196

[200]Ilmanhunnas et al. *supra* note 134, Gompers and Lerner *supra* note 196

[201]Gompers and Lerner, *supra* note 196

[202] Noel Cunningham and Deborah Schenk *The Case For a Capital Gains Preference* 48 Tax. L. Rev. 319 (1993), Daniel Shaviro, *An Efficiency Analysis of the realization and Recognition Rules Under the Federal Income Tax* 48 Tax L. Rev. 1 (1992)

[203]Boris Bittker and Lawrence Lokken, FEDERAL TAXATION OF INCOME, GIFTS AND ESTATES (1990) P. 5-20 and Cunningham and Schenk, *supra* at note 202

[204]IRC § 1001

[205]A sale is optimal only when $(1+ r)^e < (1-tg)/(1+s)^e$, where r =after tax rate of return of the old asset and t = the tax rate, g is the amount of gain in the assets and s is the rate of return of the new asset. Bittker and Lokken , *supra* note 203

[206] Bittker and Lokken, *supra* note 203. For example, assume A pays $100 for an assets and will next year for $110. If there will be 10% inflation during the year, then there has been no real gain. However, under the current rules, A would have to pay tax on the $10 of phantom gain.

Many have argued that a capital gains preference is not necessarily the best way to solve these problems.[207]

However, when we introduce ambiguity aversion into the analysis, we find that an argument for the capital gains preference develops which is independent of the traditional considerations. Because entrepreneurial activity is subject to fairly ambiguous risks, in the absence of some incentive, the amount of entrepreneurial activity will be lower than the social optimum.[208]

Additionally, because entrepreneurial activities generate large positive externalities, the argument in favor of encouraging them is even stronger.[209] They create jobs and new products, for which the entrepreneurs themselves do not capture the entire surplus.[210] Hence because society benefits, it has an increased incentive to encourage entrepreneurial activity.

This analysis does not necessarily argue in favor of the general capital gains preference as we currently structured.[211] Currently, the gains from the sale of any capital assets held more than one year are eligible in the capital gains preference.[212] Capital assets include not only stock held

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[207]Mitchell Engler, *Partial Basis Indexation: an Implicit Response to Tax Deferral* 53 Tax L.Rev. 177 (2000)

[208]Wen-Fang Liu *Saving and Portfolio: Observable Implications with Knightian Uncertainty*, University of Washington Working Paper (April 2000). Mayshar, *supra* note 87

[209]Brouwer *supra* note 187

[210]Brouwer *supra* note 187, Also Joint Economic Committee THE ECONOMIC EFFECTS OF CAPITAL GAINS TAXATION (June 1997)

[211] There may be an argument for a preference based on an argument for encouraging risk-taking, but that is beyond the scope of this article.

[212] IRC §§ 1(h), 1221 et seq. There is an additional preference create under IRC § 1202, which allows for 50% of capital gains income on qualifying stock sale stock sales to excluded from income. However, this preference has very limited usefulness, because it only applies to sales of stock of so-called "C" corporations, which is not the usual form of entrepreneurial activities, and it does not apply to sales of stock publicly traded corporations. See Joint Economic Committee , *supra* note 210.

by entrepreneurs, but also portfolio assets as well as homes and other personal assets.[213] However, these other assets generally do not face greater than average ambiguity.[214] In fact, portfolio income could potentially compete with entrepreneurial activity for the time and effort of the entrepreneur.[215] Because generally such entrepreneurs will own a significant stake in their business,[216] one reasonable limit to the capital gains preference would be to require that the taxpayers own 5% or 10% more the shares of the enterprise. The 5% and the 10% limits are commonly used in the tax law and securities law to differentiate portfolio investors from those who take an active role in the business.[217] Furthermore, it is consistent with the general ownership levels of entrepreneurs in their business.[218]

Another issue to consider arises because currently corporations do not have a capital gains preference.[219] However, a large amount of the financing of entrepreneurial activity comes from corporations.[220] Because these corporate investors are also taking on ambiguous risks to the extent that they have equity investments in entrepreneurial activities, they should also receive a tax

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[213] IRC § 1211

[214] Smith, *supra* note 183 and See discussion in Section III.B.1 for an exception for foreign source portfolio income.

[215]Hubbard, *supra* note 192

[216]Christian Keuschnigg and Soren Bo Nielsen *Tax Policy, Venture Capital and Entrepreneurship* NBER Working Paper 7976 (October 2000)

[217] IRC § 382 (limitation on the use of net operating losses) sets the cutoff at 5% shareholders, the Controlled Foreign Corporation Rules (IRC§§ 951-964) set the cut-off at 10%, The Deem Paid Credit rules (§ 902) set the cutoff at 10% and § 13(d) of the Securities Exchange Act of 1934 requires disclosure of all shareholders who own more than 5% of a publicly traded company.

[218]Keuschnigg and Nielsen, *supra* note 216.

[219] IRC § 11

[220]James Poterba *Venture Capital and Capital Gains Taxation* in TAX POLICY AND THE ECONOMY vol. 3 1989 (ed. Lawrence Summers) about 50% of venture capital is supplied by corporations.

advantage. Furthermore, the available evidence indicates that corporate managers are actually more ambiguity averse than individual decision-makers.[221]

However, granting a capital gains preference on sales of ownership interests of greater than 5-10% could cause many opportunities for abuse of the preference by corporations.[222] In particular, because parent corporation have subsidiaries that are generally that are not subject to large ambiguities, [223] and these subsidiaries will always be owned by more than 10%,[224] granting a preference to the gains from sales of subsidiaries would permit corporations to treat income that ought to be taxed at ordinary rates as eligible for the preference.[225] Even aside from revenue consideration, this would dilute the incentive effects of the preference by allowing some non-entrepreneurial income to able to benefit from it. One relatively simple response to this problem would be to limit the preference to gains from the sale of interests in enterprises in which the corporate investor owns between 5% and 40% of the total interests. This would fit the general ownership profile for venture capital investment by corporations, [226] but it would still permit the preference to be used in situations where the corporations are taking on ambiguous risk.

An alternative way to address this problem would be that in place of a corporate rate preference we could permit a lower tax rate for income earned through venture capital funds. This

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[221] Howard Kunreuther and Jacqueline Meszeros *Organizational Choice Under Ambiguity: Decision Making in Chemical Industry Following Bhopal* in ORGANIZATIONAL DECISION MAKING (Ed. Zur Shapira 1997). Zur Shapira *Ambiguity and Risk- Taking in Organizations* 7 Journal of Risk and Uncertainty 89 (1993)

[222]Boris Bittker and James Eustice FEDERAL TAXATION OF CORPORATIONS AND SHAREHOLDERS (1998) ¶ 15.01(2).

[223] Smith, *supra* note 183

[224]Bittker and Eustice, *supra* note 222.

[225]This is one of the reasons for the current lack of a corporate capital gains preference, Bittker and Eustice, *supra* note 222.

[226] Poterba *supra* note 220, Ilmanuhannas et al., *supra* note 130

would require adoption of a set of rules defining a Venture Capital Fund. One of these rules should be that Venture Capital Funds cannot own more 40% of the stock any single venture, but also income from interests of less than 5% in any venture would not eligible for the preference [227] The Government could also place additional limitations such the kinds of business that the enterprises can conduct, the length of time the interest is held by the investor etc. to make to insure that the preference is limited to those who are actually investing in entrepreneurial activities.[228] By adopting this type of regime, we could encourage capital to flow to entrepreneurial activities, and also not dilute the effectiveness of the lower rate by allowing other activities to share in the preference.[229]

Conclusion

By incorporating the distinction between risk and ambiguity into our analysis we see that much of the traditional analysis changes. This arises because we should often grant incentives for undertaking ambiguous investments. In particular, the tax system should give incentives for entrepreneurial activity and foreign portfolio investment

However, these two examples do not begin to exhaust the potential applications of the principle of ambiguity. There are many areas for further research. For example, how should we address the issue of comparing the relative ambiguity of two ambiguous activities (e.g., foreign portfolio income and entrepreneurial activities)? How should they be encouraged relative to each

[227] Five percent is about the lowest level of investment a venture capital investor is likely to have. See Vesa Kanniainen, Christian Keuschnigg *Optimal Portfolio of Start-Up Firms in Venture Capital Finance* CeSifo Working Paper Series No. 381 (December 2000). India has adopted a regime similar to this. Reuters *India Announces New Tax Incentive for Venture Capital* 2000 WTD 214-1 (Nov. 2, 2000)

[228] These rules would be similar to Indian system. Reuters, *supra* note 227

[229] Poterba, *supra* note 227, When India adopted a similar regime, venture capital investments grew by 100 % Reuters, *supra* note 227.

other, as opposed to less ambiguous activities? In addition, more research needs to be done on what is the proper tax rate on entrepreneurial income to optimally encourage these activities. Further areas of research would include whether we should give different levels of incentives to invest in particular regions of the world (e.g., Europe and South America), because the level of ambiguity may differ throughout the world. Perhaps most importantly, more research needs to done on the application of ambiguity to other kinds of activities. For example, how should we analyze ambiguity of investments in human capital? This should be a productive area of research for many years to come.