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Volume 34  
Number 3 *Symposium: Internet Voting and  
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Article 13

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4-1-2001

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### **Recommended Citation**

Johan Deprez, *Risk, Uncertainty, and Nonergodicity in the Determination of Investment-Backed Expectations: A Post Keynesian Alternative to Posnerian Doctrine in the Analysis of Regulatory Takings*, 34 Loy. L.A. L. Rev. 1221 (2001).

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# **RISK, UNCERTAINTY, AND NONERGODICITY IN THE DETERMINATION OF INVESTMENT-BACKED EXPECTATIONS: A POST KEYNESIAN ALTERNATIVE TO POSNERIAN DOCTRINE IN THE ANALYSIS OF REGULATORY TAKINGS**

## **I. INTRODUCTION**

In the conflict between those who recognize the desirability of an effective public sector and social regulation against those who wish to minimize the reach of the democratic public realm and concentrate power in private hands, the jurisprudence on regulatory takings has become an active and important battlefield.<sup>1</sup> On the one hand, there are those who wish to use the Fifth Amendment's Takings Clause<sup>2</sup> as a means of imposing a prohibitively high cost on government regulation on the use of land so as to effectively prevent significant government influence on private decisions. On the other hand, there are those who wish to limit the reach of the Takings Clause and the application of the just compensation requirement to physical takings and extreme regulatory situations. By doing so, government regulation can be freed to be an effective tool in

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1. The importance of regulatory takings is reflected in a relatively recent report prepared by the Congressional Budget Office. *See* CONG. BUDGET OFFICE, REGULATORY TAKINGS AND PROPOSALS FOR CHANGE (1998), *available at* <http://www.cbo.gov/showdoc.cfm?index=1051&sequence=0&from=5>. This type of report has, of course, generated critical reactions. *See, e.g.,* C. FORD RUNGE, THE CONGRESSIONAL BUDGET OFFICE'S "REGULATORY TAKINGS AND PROPOSALS FOR CHANGE": ONE-SIDED AND UNINFORMED (Georgetown Univ. Law Ctr. Envtl. Policy Project ed., 1999).

2. The Takings Clause of the Fifth Amendment states: "nor shall private property be taken for public use, without just compensation." U.S. CONST. amend. V.

exercising society's interest in the public use of real and personal property.

Central in the modern analysis of regulatory takings is the concept of "reasonable investment-backed expectations" (RIBE).<sup>3</sup> The destruction of such expectations by a government regulation is a key element in a court finding that a regulatory taking by the government has occurred. When that happens, the government is required to pay just compensation to the party whose property was taken because the government regulation destroyed their RIBE.

The problem with the use of RIBE in takings jurisprudence is that RIBE is a rather ephemeral concept that can be used to suit the political perspectives of a particular court. Such malleability creates an undesirable legal uncertainty for both government regulators and private property owners. It would be to the benefit of both parties if RIBE could be redefined to incorporate greater scientific content, reduce its malleability, and increase legal certainty.

The special significance of expectations in determining investment has long been recognized in the economics literature—at least since John Maynard Keynes developed his seminal General Theory.<sup>4</sup> Central to Keynes's articulation of the nature of expectations is the recognition that "[u]ncertainty, as opposed to mathematical risk, is a pervasive fact of life."<sup>5</sup> This perspective puts Keynes at odds with

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3. The concept of reasonable "investment-backed expectations" was first introduced as a factor in takings analysis in *Penn Central Transportation Co. v. New York City*, 438 U.S. 104, 124 (1978).

4. Keynes's General Theory was most thoroughly articulated in his magnum opus, JOHN MAYNARD KEYNES, *THE GENERAL THEORY OF EMPLOYMENT, INTEREST, AND MONEY* (First Harbinger ed. 1964) (1936). In Keynes's General Theory, investment depends on long-term expectations, is influenced by liquidity considerations, and generates direct and indirect expenditures that are usually insufficient to generate full employment. See *id.* at 147-64, 222-54. Important components of his General Theory were created in his prior work, as well as developed in his later expositions. See, e.g., Johan Deprez, *Rediscovering the Missing Visionary of the Middle Way: A Review of Skidelsky on Keynes*, 17 J. POST KEYNESIAN ECON. 313, 320-23 (1995).

5. Tony Lawson, *Uncertainty and Economic Analysis*, 95 ECON. J. 909, 909 (1985). With respect to the expectational concepts employed in this Comment, a certain degree of priority should be recognized in the work of Frank Knight. See FRANK H. KNIGHT, *RISK, UNCERTAINTY AND PROFIT* (Augustus M. Kelley 1964) (1921) (distinguishing between the roles of risk and uncertainty in determining economic profits).

“the viewpoint of economic orthodoxy which essentially presupposes certainty of foresight.”<sup>6</sup>

Economic orthodoxy provides the foundation for the Law and Economics school of thought.<sup>7</sup> Its key practitioners are central advocates of imposing extreme limits on government regulation<sup>8</sup> and are regularly cited by those judges who wish to push these types of constraints.<sup>9</sup> Hence, if one were to apply Keynes’s perspective on expectations to the issue of regulatory takings, then, because this economic perspective is different than the orthodox perspective, the analysis of regulatory takings will necessarily be different than that applied by those following the Posnerian perspective of the Law and Economics school.

The goal of this Comment is to propose ways in which RIBE can be substantially grounded so as to remove some of the legal uncertainty associated with the regulatory takings analysis. In order to do this, the economics and statistics literatures are utilized. In particular, the Post Keynesian school of economic thought’s conception of expectations and uncertainty is drawn on.<sup>10</sup> The Post Keynesian perspective is itself based upon the statistical dichotomy between ergodic and nonergodic contexts.<sup>11</sup> An ergodic context is one where

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6. Lawson, *supra* note 5, at 909.

7. The Law and Economics school of thought is based upon the Chicago variant of neoclassical economics and finds its most well-known articulation in the work of Richard Posner. See, e.g., RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* (5th ed. 1998).

8. See *id.* at 61-68.

9. See, e.g., *Dist. Intown Props. Ltd. v. District of Columbia*, 198 F.3d 874, 884-85 (D.C. Cir. 1999) (Williams, J., concurring) (citing RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 58 (4th ed. 1992); ROBERT COOTER & THOMAS ULEN, *LAW AND ECONOMICS* 45-46 (1988); and RICHARD A. EPSTEIN, *TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN* 281 (1985)), *cert. denied*, 121 S. Ct. 34 (2000).

10. The original articulation of Post Keynesian economics as a distinct school of economic thought recognizes Keynes’s view on expectations and uncertainty as a central point of departure. See Alfred S. Eichner & J.A. Kregel, *An Essay on Post-Keynesian Theory: A New Paradigm in Economics*, 13 J. ECON. LITERATURE 1293, 1293-95, 1309-10 (1975).

11. The incorporation of the ergodic/nonergodic dichotomy into the Post Keynesian paradigm is due to the work of Paul Davidson. See, e.g., Paul Davidson, *Rational Expectations: A Fallacious Foundation for Studying Crucial Decision Making Processes*, 6 J. POST KEYNESIAN ECON. 182 (1982-83) [hereinafter Davidson, *Rational Expectations*], reprinted in 2 PAUL DAVIDSON,

there is no structural change, so that the statistical observations of one period coincide with those of another period and those of all periods combined.<sup>12</sup> A nonergodic context is one where there is structural change so that the statistical observations of one period do not coincide with those of other periods and those of all periods combined.<sup>13</sup>

From this Post Keynesian basis, RIBE can be developed into a more coherent concept. Building upon this new, coherent view of RIBE, a test is suggested to distinguish between situations in which the investment-backed expectations are reasonable and where they are not. In an ergodic context, expectations may be substantive and reasonable enough to hold that regulations may result in a taking and that an amount of just compensation may be determined. In a nonergodic context, expectations are predominantly speculative, so that a regulation is not capable of destroying any reasonably substantive expectations because such reasonably substantive expectations do not and cannot logically exist. Hence, in a nonergodic context one cannot find that a regulatory taking has taken place and, consequently, no compensation needs to be paid by the government to the property owner.

Part II of this Comment reviews the jurisprudence of regulatory takings and the role of RIBE therein. Part III explores the concept of reasonable investment-backed expectation in some detail. Part IV discusses how the Posnerian perspective on law and economics looks at regulatory takings. This part also points the way to alternative economic paradigms for addressing the issue. Part V explains the

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INFLATION, OPEN ECONOMIES AND RESOURCES: THE COLLECTED WRITINGS OF PAUL DAVIDSON 123 (Louise Davidson ed., 1991) [hereinafter DAVIDSON, INFLATION, OPEN ECONOMIES AND RESOURCES]; Paul Davidson, *A Technical Definition of Uncertainty and the Long-Run Non-Neutrality of Money*, 12 CAMBRIDGE J. ECON. 329 (1988) [hereinafter Davidson, *A Technical Definition*], reprinted in 2 DAVIDSON, INFLATION, OPEN ECONOMIES AND RESOURCES, *supra*, at 159.

12. See, e.g., GEORGE R. COOPER & CLARE D. MCGILLEM, *PROBABILISTIC METHODS OF SIGNAL AND SYSTEM ANALYSIS* 100 (1971). Flipping a fair coin is an example of an ergodic system because the odds of heads or tails do not change over time and fifty percent of the outcomes would be heads in any single time-period or all time-periods combined.

13. See *id.* The likelihood of discovering planets—inside and outside the solar system—varying with historical time-periods is an example of a nonergodic system. See *infra* Part V.

dichotomy between ergodic and nonergodic contexts, and the significance thereof, for formulating expectational concepts. Part VI explains and develops the economic distinction between industrial and speculative activity and how these concepts relate to the ergodic/nonergodic dichotomy. Building upon these economic foundations, Part VII then describes a Post Keynesian perspective on regulatory takings. From this perspective, a legal test is then proposed in Part VIII to distinguish between ergodic and nonergodic contexts and the reasonableness of investment-backed expectations. The application and implications of this test are then discussed. Part IX concludes by reemphasizing the advantages of a Post Keynesian perspective on regulatory takings over the Posnerian alternative.

## II. REGULATORY TAKINGS AND INVESTMENT-BACKED EXPECTATIONS

In modern jurisprudence, government regulation of private property interests may be significantly constrained by the Takings Clause of the Fifth Amendment. This clause states no more than: "nor shall private property be taken for public use, without just compensation."<sup>14</sup> It provides that the federal government may not take private property for public use without paying just compensation. The Takings Clause also applies to the states, based upon the incorporation doctrine, through the Fourteenth Amendment's Due Process Clause.<sup>15</sup>

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14. U.S. CONST. amend. V.

15. See U.S. CONST. amend. XIV, § 1. The early foundations for the incorporation doctrine were, in fact, initially laid out in a takings case where the Court found the principle of just compensation to be "fundamental" in considering the taking of part of a railroad's right-of-way. See *Chi., Burlington & Quincy R.R. Co. v. Chicago*, 166 U.S. 226, 241 (1897); see also ERWIN CHEMERINSKY, *CONSTITUTIONAL LAW: PRINCIPLES AND POLICIES* § 8.4.1, at 504 (1997) (indicating that, via *Chicago, Burlington*, the Takings Clause "was the first provision of the Bill of Rights to be applied to the states"); ALLAN IDES & CHRISTOPHER N. MAY, *CONSTITUTIONAL LAW: INDIVIDUAL RIGHTS* § 1.3, at 9 (1998) (identifying *Chicago, Burlington* as the initial step in the absorption process of constitutional provisions into the Fourteenth Amendment). More recently, the Court cited *Chicago, Burlington* when stating that "of course [the Takings Clause] is made applicable to the States through the Fourteenth Amendment." *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 122 (1978).

Initially, the Takings Clause addressed the confiscation of private property by the government. This vision has been greatly extended. The original idea is captured in the modern idea of physical takings. Not only has the category of physical takings been expanded, but the courts now also recognize regulatory takings in which there is no physical confiscation at all.<sup>16</sup>

### A. *Physical Occupations and Invasions*

The classic taking occurs when the government physically occupies or invades private property or allows others to do the same. The traditional situation occurs when the government uses its powers of eminent domain to take over private real property in order to build a road, bridge, or other similar public infrastructure.<sup>17</sup>

The degree of physical invasion may be very small. In *Loretto v. Teleprompter Manhattan CATV Corp.*,<sup>18</sup> the Court found a per se taking where the City of New York required apartment building owners to allow cable television companies to install television cable in their buildings.<sup>19</sup> The small amount of physical invasion involved had no bearing upon whether an invasion had occurred or not.<sup>20</sup> It only affected the amount of just compensation that the city should have to pay the apartment owners.<sup>21</sup> Similarly, a permanent invasion occurs where the state gives the public an easement to cross a private beach at any hour of the day or night.<sup>22</sup> Physical invasions that are temporary, as opposed to permanent, may not be takings per se.<sup>23</sup>

### B. *Regulatory Takings*

Takings Clause jurisprudence has been extended to situations where government regulations impose restrictions on what private

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16. See generally *Penn Cent.*, 438 U.S. at 121-22 (stating that an upsetting of reasonable expectations can constitute a taking).

17. See, e.g., *Chi., Burlington*, 166 U.S. at 258 (holding that a taking exists where the City of Chicago takes part of the railroad's right-of-way in order to widen a street).

18. 458 U.S. 419 (1982).

19. See *id.* at 421-26.

20. See *id.* at 437-38.

21. See *id.*

22. See *Nollan v. Cal. Coastal Comm'n*, 483 U.S. 825, 831-32 (1987).

23. See *IDES & MAY*, *supra* note 15, § 3.5, at 111-13.

property owners may do with their property. When the nature or extent of these regulations cause a large enough interference with a private property owner's rights, the court will hold that a regulatory taking has occurred for which just compensation must be paid. While courts are generally more tolerant of regulatory interference with property than interference caused by physical invasion—because they recognize the possible problems of hampering governance by overly extending the regulatory taking concept—there is also the attitude that “if regulation goes too far it will be recognized as a taking.”<sup>24</sup> The trick, of course, is trying to determine what “too far” is.

While there is no set formula for determining what “too far” is, one may delineate three different types of regulatory situations: (1) where property owners are arbitrarily singled out for adverse treatment, (2) where the property is stripped of virtually all use or value, or (3) where RIBE of the property owner are destroyed.<sup>25</sup> A significant number of regulatory taking cases deal with RIBE—the most difficult of the three possible situations and the focus of this Comment.<sup>26</sup>

What is key, and easy to understand, is the idea that one wants to prevent regulations from arbitrarily imposing a burden on particular property owners, while not imposing the same burden on similarly situated property owners. The potentially problematic question one needs to address is how one defines “arbitrary” and “similarly situated.” For example, when building restrictions are imposed on historical landmarks, the singling out of these buildings is usually not a regulatory taking if there is a clear landmark designation plan.<sup>27</sup>

The second category in which regulatory takings are found is where the regulation effectively deprives the property owner of all economically beneficial use or value of the property. These rare situations of “confiscatory regulations” or “total regulatory takings”

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24. *Pa. Coal Co. v. Mahon*, 260 U.S. 393, 415 (1922).

25. *See* IDES & MAY, *supra* note 15, § 3.6 at 114.

26. *See* THOMAS J. MICELI & KATHLEEN SEGERSON, *COMPENSATION FOR REGULATORY TAKINGS: AN ECONOMIC ANALYSIS WITH APPLICATIONS* 4-6 (1996).

27. *See* *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 131-33 (1978).



are found where a government regulation deprives the property owner of all economically beneficial or productive use of his or her land, so that it must be left economically idle.<sup>28</sup> The Court has explicitly recognized that it draws an arbitrary line between a total deprivation of economic value and a deprivation marginally less than total.<sup>29</sup> The determination of the appropriate parcel of land in these types of situations is, of course, crucial.<sup>30</sup>

Finally, a regulatory taking occurs when the government regulation defeats the reasonable investment-backed expectations of the property owner.<sup>31</sup> While the destruction of these expectations is an important factor in many cases, it is ground for finding a *prima facie* taking only where the government has given specific assurances to a property owner upon which she has relied.<sup>32</sup>

### III. REASONABLE INVESTMENT-BACKED EXPECTATIONS

Reasonable investment-backed expectations is the central concept driving much of regulatory takings jurisprudence. The original appearance of "distinct investment-backed expectations" occurred in 1978.<sup>33</sup> This term and its alternative "reasonable investment-backed profit expectations" have been repeated a number of times in

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28. See *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1027, 1029 (1992) (holding a regulatory taking existed where a beachfront landowner was prevented from building a permanent structure).

29. See *id.* at 1019 n.8.

30. See, e.g., *Dist. Intown Props. Ltd. v. District of Columbia*, 198 F.3d 874, 875-77 (D.C. Cir. 1999) (recognizing that, in examining whether a regulation preventing the owner of an apartment building from subdividing the lot and building townhouses on the former lawn of the apartment building is a regulatory taking, the court first needs to determine whether the relevant parcel of land is the property as a whole or the subdivided lots from the lawn before proceeding to a *Lucas* analysis), *cert. denied*, 121 S. Ct. 34 (2000).

31. See *Penn Cent.*, 438 U.S. at 122-24.

32. When a property owner is given explicit assurances that a project is permissible, this creates well-founded expectations, so that when a government regulation later outlaws the project and destroys these expectations, the government must pay just compensation to the property owner. See *Kaiser Aetna v. United States*, 444 U.S. 164 (1979).

33. See *Penn Cent.*, 438 U.S. at 127 (holding that the severe frustration of distinct investment-backed expectations may amount to a taking of property).

later opinions.<sup>34</sup> These terms have, however, left most observers rather confused and looking for a way to make the concept more concrete.<sup>35</sup>

To understand the concept of RIBE one must realize that it is really only one of three elements of the balancing test initially developed in *Penn Central*.<sup>36</sup> The three main factors to be considered in the *Penn Central* balancing test are: (1) the character of the government action, (2) the regulation's economic effect on the party claiming a taking has occurred, and (3) the effect of the regulation on the claimant's RIBE.<sup>37</sup> In practice, however, the RIBE factor tends to dominate.

When determining the character of the government action, there is an inquiry to see if there is "a general regulation with a legitimate public purpose."<sup>38</sup> The regulation's economic effects on the claimant may include the question of whether the regulation has made the property unprofitable to maintain or whether it creates an insufficient rate of return of the property.<sup>39</sup> Depending upon one's conception of RIBE, these expectations are likely to include a profitability component.

When examining the use of the concept of RIBE, one must realize that "the Court is confused about the meaning of this term, federal and state courts divide on how to apply it, and its role in taking law remains a puzzle."<sup>40</sup> Initially, RIBE was considered a minor part

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34. See, e.g., *Connolly v. Pension Benefit Guar. Corp.*, 475 U.S. 211, 226-28 (1986) (holding that amendments to ERISA did not interfere with reasonable investment-backed expectations); *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1005-10 (1984) (holding that, although trade secrets are protected under the Takings Clause, they are entitled to just compensation only when a "reasonable investment-backed expectation" is destroyed).

35. See Bruce W. Burton, *Post-Lucas Regulatory Takings and the Supreme Court's Riddle of the R.I.B.E.: Where No Mind Has Gone Before*, 25 U. TOL. L. REV. 155, 155-62 (1994).

36. See *Penn Cent.*, 438 U.S. at 124-25.

37. See *id.*; see also *Dist. Intown Props. Ltd. v. District of Columbia*, 198 F.3d 874, 882-84 (D.C. Cir. 1999) (repeating and applying the three factors of the *Penn Central* balancing test), *cert. denied*, 121 S. Ct. 34 (2000).

38. *Dist. Intown*, 198 F.3d at 883.

39. See *id.*

40. Daniel R. Mandelker, *Investment-Backed Expectations in Taking Law*, 27 URB. LAW. 215, 215 (1995).

of the takings analysis. However, with the U.S. Supreme Court's decision in *Lucas*,<sup>41</sup> courts have become more comfortable in basing their decisions predominantly on whether the government regulation "wrongly interfered with the reasonable investment-backed expectations of the landowner," even to the extent of disposing of cases solely on this element.<sup>42</sup>

Given this rather confusing history and state of affairs of RIBE, this Comment seeks to inject substance and clarity into the situation. By making use of particular statistical and expectational concepts as employed by certain Post Keynesian economists, a taxonomy will be arrived at that leads to a simpler way to decide when expectations are reasonable enough so that it is possible that a government regulation destroyed them. If employed, this taxonomy will make takings jurisprudence much easier to understand and apply.

#### IV. TAKINGS, ECONOMICS, AND EXPECTATIONS

The analysis of regulatory takings is inexorably intertwined with economic theory, policy, and effects. RIBE must, therefore, also be understood in the context of these economic considerations. Economics helps us understand the context in which expectations are formed, how expectations are formed, the link between investment and expectations, and the social impact of expectations formation and investment decisions. Examining these issues leads to policy recommendations and suggestions for legal rules.

##### A. *The Posnerian Perspective on Takings*

The preeminent scholar of the Law and Economics school of thought is Chief Judge Richard Posner.<sup>43</sup> His work is based upon the Chicago School of economics, a sub-school of the broader Neoclassical paradigm to economics.<sup>44</sup> Posner and his colleagues have

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41. *Lucas v. S.C. Coastal Council*, 505 U.S. 1003 (1992).

42. Robert M. Washburn, "Reasonable Investment-Backed Expectations" as a Factor in Defining Property Interest, 49 WASH. U. J. URB. & CONTEMP. L. 63, 95-96 (1996).

43. See POSNER, *supra* note 7 (starting with the first edition in 1973, this book provides the key statement of the Law and Economics paradigm).

44. Economics, like all other sciences, has a variety of conflicting paradigms. Dominant in the United States today is Neoclassical Economics. Neo-

extended their perspective on the economic analysis of legal issues to a wide range of topics, including suicide, sexual behavior, adoptions, and drug use.<sup>45</sup>

The orthodox Law and Economics paradigm treats the Takings Clause as a check on the government's potentially wasteful use of its taking power.<sup>46</sup> The requirement of just compensation imposes a cost on the government for the property that is taken, so that a rational government will not engage in taking unless the social benefits thereof exceed the just compensation costs.<sup>47</sup> By using the fair market value of the property to determine the amount of compensation—assuming efficient markets—this will limit the government to engage in only socially-efficient takings where the social benefits exceed this private cost.<sup>48</sup>

If there was no just compensation or insufficient just compensation, the orthodox perspective then argues that the government would treat the private property taken as a completely or partially free good and would, consequently, engage in too many physical and regulatory takings.<sup>49</sup> For some, of course, having the proper amount of just compensation means that the government should never engage in any takings and that all economic decisions should be left to an efficient private market.

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classical Economics contains a number of variants, with different labels, which depend upon the author and the topic being examined. In contrast to this "orthodox" paradigm there exist a variety of other paradigms. These "heterodox" paradigms include the Institutional, Marxian, Neo-Ricardian (Surplus Approach), Post Keynesian, Neo-Schumpeterian, Socio-Economics, and Austrian perspectives. See, e.g., MARC LAVOIE, FOUNDATIONS OF POST-KEYNESIAN ECONOMIC ANALYSIS 1-41 (1992) (providing a good introductory discussion on the limits of neoclassical economics, the need for an alternative, and the appropriate alternative paths).

45. See, e.g., WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF TORT LAW (1987); RICHARD A. POSNER, SEX AND REASON (1992); William M. Landes & Richard A. Posner, *The Economics of Trademark Law*, 78 TRADEMARK REP. 267 (1988); Richard A. Posner, *Free Speech in an Economic Perspective*, 20 SUFFOLK U. L. REV. 1 (1986); Michael J. Trebilcock & Rosemin Keshvani, *The Role of Private Ordering in Family Law: A Law and Economics Perspective*, 41 U. TORONTO L.J. 533 (1991).

46. See, e.g., POSNER, *supra* note 7, at 61-68.

47. See COOTER & ULEN, *supra* note 9, at 191-205.

48. See *id.* at 198-201.

49. See, e.g., EPSTEIN, *supra* note 9, at 331-34.

### *B. Takings Analysis Under Broader Neoclassical Analysis*

Even within the broad neoclassical framework that also forms the basis for the Chicago School approach embodied in the Posnerian perspective, it is easily argued that a proper analysis of takings would be much more sympathetic to government regulation than the Posnerian view. One such perspective is the "New Haven" school that recognizes that in some situations there may be insufficient regulation, as opposed to too much regulation.<sup>50</sup>

Once one recognizes that markets may fail on both the supply and demand sides of the market and that production and consumption externalities may be created by the operation of a market, then it may be the private property owner that creates uncompensated social costs by using her property. Government regulations (and the threat thereof) are then a means by which society can curtail the negative externalities and promote the positive externalities generated by private property owners. When there are market failures, such regulations may be a necessary means by which to generate more efficient economic results.<sup>51</sup>

### *C. Alternative Economic Perspectives*

Many legal commentators imply that there is only one "economists' perspective" and that economics is a homogenous science.<sup>52</sup> That single perspective is usually taken to be the Posnerian approach, or neoclassical economics more broadly.<sup>53</sup> Nothing, however, could

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50. See Nicholas Mercuro & Steven G. Medema, *Schools of Thought in Law and Economics: A Kuhnian Competition*, in *LAW AND ECONOMICS: NEW AND CRITICAL PERSPECTIVES* 65, 81-84 (Robin Paul Malloy & Christopher K. Braun eds., 1995).

51. See THOMAS J. MICELI, *ECONOMICS OF THE LAW: TORTS, CONTRACTS, PROPERTY, LITIGATION* 137-55 (1997) (providing a mathematical model that can incorporate both the broader neoclassical approach as well as the narrower Posnerian perspective).

52. Asserting that there is only one economic perspective is, of course, self-serving and intellectually dishonest (as well as lazy). To argue that one's perspective is the most appropriate one, while recognizing that there exist plausible alternatives, is the intellectually honest path to meaningful debate and progress.

53. See, e.g., *Dist. Intown Props. Ltd. v. District of Columbia*, 198 F.3d 874, 884-85 (D.C. Cir. 1999) (Williams, J., concurring) (stating "[t]he economist's justification for the Takings Clause," followed by a citation to Posner

be farther from the truth. There are many competing economic perspectives and paradigms.

Since the beginning of modern economics, it has been a field ripe with rich debate. In fact, Adam Smith's *The Wealth of Nations*<sup>54</sup>—the often referred to starting point of modern economics—was itself a creative amalgamation of two different schools of economic thought: Mercantilism and the Physiocrats.<sup>55</sup> Debates between different economic schools of thought have existed, persisted, and developed ever since. Modern economics is rich with alternatives to the neoclassical orthodoxy and, especially, the Posnerian perspective.

#### *D. Heterodox Alternatives to Posnerian Orthodoxy*

In opposition to the neoclassical or Chicago School perspectives, there exist a variety of other economics paradigms.<sup>56</sup> In one way or another, these heterodox perspectives reject key foundational elements of the orthodox schools of thought. Some of the heterodox perspectives—like Institutional Economics—have a long history of examining the interrelationships between law and economics.<sup>57</sup> Institutional Economics is one heterodox perspective that has maintained a vibrant, if small, presence in the discussions of economics and law.<sup>58</sup>

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and similar remarks), *cert. denied*, 121 S. Ct. 34 (2000).

54. ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS (Dent & Sons 1947) (1776).

55. See Andrew S. Skinner, *Smith, Adam*, in 4 THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS 357, 362-67 (John Eatwell et al. eds., 1987).

56. See Mercurio & Medema, *supra* note 50 (discussing an alternative to the orthodox Law and Economics school of thought); see also NICHOLAS MERCURIO & STEVEN G. MEDEMA, ECONOMICS AND THE LAW: FROM POSNER TO POST-MODERNISM (1997) (discussing the development of different paradigms in law and economics).

57. See, e.g., JOHN R. COMMONS, LEGAL FOUNDATIONS OF CAPITALISM (Transaction Publishers 1995) (1924) (providing an early contribution to the interaction of law and economics by one of the founding fathers of Institutional Economics).

58. See WARREN J. SAMUELS & A. ALLAN SCHMID, LAW AND ECONOMICS: AN INSTITUTIONAL PERSPECTIVE (1981); Steven G. Medema et al., *Institutional Law and Economics*, in ENCYCLOPEDIA OF LAW AND ECONOMICS 418, 419-20 (Boudewijn Bouckaert & Gerrit De Geest eds., 1996-2000), available at <http://encyclo.findlaw.com/lit/0520book.pdf>.

Post Keynesian economics, as a much newer explicit paradigm in economics, is a newer entrant to the discussions of law and economics.<sup>59</sup> Post Keynesian economics recently started to find a presence in legal academic literature.<sup>60</sup>

Post Keynesian economics has four distinguishing characteristics.<sup>61</sup> First, economic actions by firms and individuals are understood to be taking place within a context of true uncertainty, instead of the orthodoxy's full certainty or risk context.<sup>62</sup> Second, a model based in historical time, rather than one based in logical or mechanical time, is the most appropriate abstraction for analyzing the economy.<sup>63</sup> Third, oligopolistic market structures are seen to dominate modern economies, in contrast to the usual orthodox assumption of perfect competition.<sup>64</sup> Fourth, the social nature of income

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59. For the first time, a panel on Post Keynesian Economics and Law (Mathew Forstater, Johan Deprez, and Timothy A. Canova) participated in the American Association of Law Schools meeting in San Francisco on January 3, 2001. See ASS'N OF AM. LAW SCH., PURSUING EQUAL JUSTICE: LAW SCHOOLS AND THE PROVISION OF LEGAL SERVICES, ANNUAL MEETING JANUARY 3-6, 2001, at 4-5 (2001).

60. See, e.g., Charles R.P. Pouncy, *Contemporary Financial Innovation: Orthodoxy and Alternatives*, 51 SMU L. REV. 505, 559-62 (1998) (finding that heterodox Post Keynesian economics gives a much better foundation for analyzing financial questions in legal matters than does orthodox economics); Timothy A. Canova, *Banking and Financial Reform at the Crossroads of the Neoliberal Contagion*, 14 AM. U. INT'L L. REV. 1571, 1571-1645 (1999) (applying a Post Keynesian perspective to the analysis of the banking and finance industries in the United States and Mexico); Timothy A. Canova, *Financial Liberalization, International Monetary Dis/order, and the Neoliberal State*, 15 AM. U. INT'L L. REV. 1279, 1283-90 (2000) (discussing the modern international monetary system and certain Post Keynesian perspectives on its operation).

61. See Johan Deprez & John T. Harvey, *Introduction* to FOUNDATIONS OF INTERNATIONAL ECONOMICS: POST KEYNESIAN PERSPECTIVES 1, 2-3 (Johan Deprez & John T. Harvey eds., 1999); see also Eichner & Kregel, *supra* note 10, at 1294 (emphasizing four distinguishing characteristics as dealing with "(1) growth dynamics, (2) distributional effects, (3) the Keynesian constraints, and (4) the microeconomic base").

62. See Deprez & Harvey, *supra* note 61, at 2. This allows for the logical existence of money and unemployment. See *id.*

63. See *id.* This means that qualitative change is important and that the orthodox general equilibrium model is an inappropriate abstraction. See *id.*

64. See *id.* at 3. This means that market power, markup pricing, and institutional behavior are important to modern macrodynamics. See *id.*

distribution is important in explaining the dynamics of advanced capitalist economies, as opposed to technology and thrift that explain income distribution in orthodox economics.<sup>65</sup>

One important way to get to these types of distinguishing characteristics is by rejecting certain central orthodox axioms. The orthodox axioms that need to be rejected are, in addition to the *neutrality of money axiom*, “the *gross substitution axiom* that asserts that everything is a substitute for everything else and . . . the *axiom of an ergodic economic environment*, the presumption that future economic events can be reliably predicted by studying the economy’s past market price data.”<sup>66</sup>

Because most economic schools of thought—especially the ones built on neoclassical foundations—make the ergodic assumption, they are immutable reality models. Only a few models—of which Post Keynesian and Institutionalist theories are the most important representatives—employ a transmutable or creative reality model. They do so because they explicitly or implicitly reject the ergodic assumption.<sup>67</sup>

### *E. Heterodox Economics and Dynamic Change*

One particularly persuasive theme that appears time and again in a broad variety of heterodox economic paradigms is the emphasis on the importance of dynamic change in modern economies. Heterodox economics finds a fatal flaw in the adherence of orthodox economics to a static methodology within which no meaningful qualitative change can be incorporated. The heterodox alternatives propose a

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65. *See id.* Therefore, Post Keynesian economics rejects the marginal product theory of income distribution put forth by neoclassical economics. *See id.*

66. PAUL DAVIDSON, POST KEYNESIAN MACROECONOMIC THEORY: A FOUNDATION FOR SUCCESSFUL ECONOMIC POLICIES FOR THE TWENTY-FIRST CENTURY 17 (1994) [hereinafter DAVIDSON, POST KEYNESIAN MACROECONOMIC THEORY]. The neutrality of money axiom is the idea that the amount of money in the economy does not affect any real variables, such as output and employment, and only affects the aggregate price level. *See id.* at 15-16. Gross substitution means that all goods are—to one degree or another—substitutes for each other. *See id.* at 17-18.

67. *See* Paul Davidson, *Reality and Economic Theory*, 18 J. POST KEYNESIAN ECON. 479, 482 (1996) [hereinafter Davidson, *Reality*].



methodology that highlights persistent qualitative change arising from normal economic activity as a fundamental tenet.<sup>68</sup>

Part of the problem with orthodox economics is that much of its methodology is based upon Newtonian physics. This "physics envy" creates severe limitations on the types of economic issues that orthodox economics can handle. Crucial among these is that orthodox models are ones in which decisions by economic actors do not change the economy in a qualitative fashion. In contrast to these models with a predetermined and immutable history stand heterodox models that focus on the qualitative nature of economic decisions in changing and developing the economy.<sup>69</sup>

## V. ERGODIC AND NONERGODIC CONTEXTS

One important argument regarding how the distinction between orthodox static theory and heterodox dynamic theory can be grounded relies on the statistical dichotomy between ergodic and nonergodic contexts.<sup>70</sup> The basic distinction between the two contexts has been defined as follows:

Some stationary random processes possess the property that almost every member of the ensemble exhibits the same statistical behavior that the whole ensemble has. Thus, it is possible to determine this statistical behavior by examining only one typical sample function. Such processes are said to be *ergodic*.

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A process that does not possess [this] property . . . is *non-ergodic*.<sup>71</sup>

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68. See Mercurio & Medema, *supra* note 50, at 95-108 (outlining key characteristics of the Institutional approach to law and economics, including the "central themes of evolution, interdependence, and order").

69. See Davidson, *Reality*, *supra* note 67, at 479-83 (distinguishing between predetermined, immutable models and transmutable models, and linking this distinction to the distinction between ergodic and nonergodic contexts).

70. This distinction between ergodic and nonergodic contexts is a common one recognized in the statistics literature. See, e.g., COOPER & MCGILLEM, *supra* note 12, at 100 (incorporating in their advanced statistical discussion of random processes the distinction between ergodic and nonergodic random processes as distinct from stationary and nonstationary random processes).

71. *Id.* (footnote omitted).

These authors point out that one usually assumes ergodicity when dealing with physical processes, unless there are solid reasons to reject the assumption.<sup>72</sup> This is done even though it is hard to directly justify the ergodic assumption when dealing with physical processes.<sup>73</sup>

The initial articulation of this distinction between ergodic and nonergodic contexts and its importance for uncertainty, expectations, and choice of economic paradigms is found in the work of Paul Davidson.<sup>74</sup> Davidson extended and developed this concept numerous times in articulating the Post Keynesian vision of modern economics.<sup>75</sup> Other Post Keynesians have further developed and applied this fundamental concept of the Post Keynesian paradigm.<sup>76</sup>

Because there occurs no meaningful structural change in an ergodic context, orthodox economic theory may be an appropriate methodology to deal with events in such a context. On the other hand, a nonergodic context is generated and perpetuated by qualitative dynamic change. Orthodox theory cannot logically apply in this context and a heterodox alternative needs to be looked to. By recognizing that a nonergodic context is fundamental to accurately addressing most economic questions, important implications arise for

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72. *See id.*

73. *See id.* ("It is generally difficult, if not impossible, to prove that ergodicity is a reasonable assumption for any physical process, since only one sample function of the process can be observed. Nevertheless, it is customary to assume ergodicity unless there are compelling physical reasons for not doing so.").

74. *See Davidson, Rational Expectations, supra note 11.*

75. *See, e.g., Davidson, POST KEYNESIAN MACROECONOMIC THEORY, supra note 66; Davidson, A Technical Definition, supra note 11; Paul Davidson, Is Probability Theory Relevant for Uncertainty? A Post Keynesian Perspective, 5 J. ECON. PERSP. 129 (1991) [hereinafter Davidson, Is Probability Theory Relevant]; Davidson, Reality, supra note 67; Paul Davidson, Reviving Keynes's Revolution, 6 J. POST KEYNESIAN ECON. 561 (1984), reprinted in 1 PAUL DAVIDSON, MONEY AND EMPLOYMENT: THE COLLECTED WRITINGS OF PAUL DAVIDSON 567 (Louise Davidson ed., 1990) [hereinafter DAVIDSON, MONEY AND EMPLOYMENT].*

76. *See, e.g., Philip Arestis & Malcolm Sawyer, Keynesian Economic Policies for the New Millennium, 108 ECON. J. 181 (1998); Fernando J. Cardim de Carvalho, Keynes on Probability, Uncertainty, and Decision Making, 11 J. POST KEYNESIAN ECON. 66 (1988); David Dequech, Expectations and Confidence Under Uncertainty, 21 J. POST KEYNESIAN ECON. 415 (1999).*

the proper characterization of expectations, investment, and uncertainty.

*A. Statistics, Economics, and Law*

The law seems to be skeptical—to an extreme—of using statistical methods to analyze problems, develop theories and tests, and determine damages. For example, courts quickly deem expectational damages to be too speculative under circumstances that would surprise scholars outside law.<sup>77</sup> In contrast, the social sciences pervasively use statistical methods to analyze a wide variety of issues. In economics, for example, the applications of statistical theory range from modeling how an individual makes decisions to models of how the macroeconomy fluctuates and grows.<sup>78</sup>

As part of developing the arguments of this Comment, a scheme for organizing legal thinking about the appropriateness of statistical techniques arises. This scheme points out in which contexts the law's skepticism is healthy and when the usual application of statistical techniques is inappropriate. This scheme differentiates these contexts from one where common statistical techniques are appropriate for use in handling legal issues, and the law's skepticism, consequently, comes across as paranoia.

To do this, this Comment draws upon theory developed to challenge the inappropriate use of statistical techniques in economics. Simply put, this theory distinguishes between an ergodic context, in which there is no structural change, only "risk" exists, and traditional theory may be applicable, from a nonergodic context in which there is structural change, true uncertainty exists, and traditional statistical techniques are inappropriate. By categorizing legal problems as fitting into one or the other of these contexts, the possible relevance of traditional statistical techniques is easier to analyze.

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77. See, e.g., Roger D. Blair & Amanda Kay Esquibel, *Yardstick Damages in Lost Profit Cases: An Econometric Approach*, 72 DENV. U. L. REV. 113 (1994).

78. See, e.g., G.S. MADDALA, *ECONOMETRICS* 4-9 (1977).

### *B. The Ergodic Assumption and Orthodox Economic Theory*

The vast majority of traditional science is built on the usually implicit assumption of ergodicity.<sup>79</sup> In the realm of economics, Paul Samuelson explicitly recognized this.<sup>80</sup> The ergodic assumption is, in essence, an assumption that one is analyzing a system within which there is no structural change occurring.<sup>81</sup> This means that classical statistical theory can only be applied to the scientific study of such unchanging systems.

A system is ergodic when the probability distribution from which events are drawn at any point in time is identical to the probability distributions from which events are drawn at any other point in time.<sup>82</sup> As such, the space (cross-sectional) averages—the results obtained by observation at any point in time—approach each other and will converge to the time averages—the results obtained over time. Such a system can accurately be seen as a “Monte Carlo” or “Las Vegas” world where actual events occur based on the same probability laws that govern games like roulette, baccarat, blackjack, craps, and coin tosses.

An example can illustrate the ergodic concept. Logically, we know that the probability of a fair roulette wheel generating a “0” on any one spin is 1/38.<sup>83</sup> This probability will not vary whether the roulette wheel is in Las Vegas, Monte Carlo, Macao, or the Bahamas. This is the probability today; it was the probability yesterday, last week, last year, and a hundred years ago; and it will be the probability tomorrow, next week, next year, and in a hundred years. If one observed the results from all the spins at all these casinos at all these different times, then one would see that each set of observations would generate essentially identical results so that each of these cross-sectional or space averages would be statistically identical to

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79. See Davidson, *Is Probability Theory Relevant*, *supra* note 75, at 129-31.

80. See P.A. Samuelson, *Classical and Neo-classical Monetary Theory*, in *MONETARY THEORY* 170, 184-85 (R.W. Clower ed., 1969) (acknowledging that orthodox economics implicitly embraces the “ergodic hypothesis”).

81. See Davidson, *Is Probability Theory Relevant*, *supra* note 75, at 132.

82. See *id.*

83. Roulette is a game that uses a spinning wheel where a small ball can land in one of thirty-eight equally small holes, numbered 1 through 36, 0, and 00.

each other and would also match the time averages generated by putting all of this data together.

*C. The Significance of the Ergodic Assumption for Expectations*

By accepting the assumption that the world is ergodic, orthodox economists are limited to narrow views on how knowledge, information, and uncertainty are treated by the agents in their economic models.

Knowledge about economic processes can be obtained in one of two ways. First, one can simply study the game itself and, by knowing the possible events, determine the probability of particular results. To understand what the chances are of tossing heads with a fair coin, one does not need to toss a coin an infinite number of times and take accurate measures thereof. Simply studying the game and its rules will do. This can, however, only relate to simple games.

In a more sophisticated world, however, such direct study may not be possible. The alternative method is to rely on meticulous and repeated empirical observations in order to judge what the correct probability distribution is. While one would have to make sure that the measurement was correct and sufficient, in an ergodic world one would not have to worry about the timing of the observations because all time-series observations are drawn from an identical probability function.

Prediction in such a world is very straightforward. Because the probability function from which real events come does not change with time, once one properly identifies this probability distribution from past and present information, then one can unambiguously predict future outcomes on a probabilistic basis. The future is certain in a probabilistic sense. One knows "on average" what the future results of the economy will be. Hence, one has a world in which there is nothing but "risk" in the sense that only the specific individual results are unknown as to when they will occur. Coin heads will show up with a given probability, but one does not know on which toss.

Thus, there is nothing in the past, present, or future of an ergodic world that is not knowable. The only asymmetry that exists between the past and the future is that the future is only knowable in a probabilistic sense, while the past can be known exactly. One can know exactly the recorded historical sequence of observations and, in an

ergodic world, the probabilistic functions from which they come. Hence, the only possibility for mistakes that exists in such models is when there are impediments to understanding the past or to obtaining information about the past. Only then is the actor making decisions that can result in true mistakes. Such exogenously introduced rigidities are the basis for ergodic economic models which use imperfect information arguments. From this perspective, persistent mistakes are a rather strange and counterintuitive occurrence for rational agents.

Ergodic models are, by their very nature, ahistorical. The relationships between economic variables are timeless. The economy can thus be seen as governed by immutable "natural" laws. The economic events that occur have no qualitative impact on the economic structure. All economic decisions are "quality-less" in that they cannot have any effect on the probability distributions that generate economic results.<sup>84</sup> Economic actions in an ergodic world do not change what the economy has to offer.

#### *D. The Definition of Nonergodicity*

A nonergodic system is the diametric opposite of an ergodic system. A nonergodic system is a stochastic system where the probability distribution governing events at one point in time is different than the probability distributions governing processes at other points in time.<sup>85</sup> This means that the cross-sectional or space averages are different at different points in time, and that these cross-sectional or space averages are different from the time averages. In contrast to an ergodic system, in a nonergodic system there is no tendency for these space and time averages to converge.

A nonergodic system is one where the probability distributions governing events change over time. It is as if the probability of a "5" occurring yesterday is governed by a fair roulette wheel, today it is governed by the rolling of two dice, and tomorrow by drawing a card from a fifty-two card deck. The underlying structure which governs events is incessantly changing. The space or cross-sectional

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84. See NICHOLAS GEORGESCU-ROEGEN, *THE ENTROPY LAW AND THE ECONOMIC PROCESS* 63 (1971).

85. See Davidson, *Is Probability Theory Relevant*, *supra* note 75, at 136-37 (discussing predictions based on past experiences).

averages generated by each one of the three different games are necessarily different.<sup>86</sup> The observed occurrences of a particular number will not be the same on any of the three days. In fact, there are some numbers possible on one day that are not possible on another day. These cross-sectional averages will also not coincide with the time averages created by putting all the observations of the three days together.

### *E. The Significance of Nonergodicity for Expectations*

The rejection of the ergodic assumption of orthodox economics is a key starting point for modern Post Keynesian economics.<sup>87</sup> Accepting that the world is fundamentally nonergodic requires the introduction of a completely different view of knowledge, information, uncertainty, and prediction than what is put forward by orthodox economics. Basically, the economic actor deals with an ever-changing world. If she interprets reality rationally and with any degree of accuracy, she realizes that the future will be qualitatively different from the past.

In a nonergodic world, knowledge of the past, no matter how thorough and complete, does not give information sufficient to determine the probability distributions from which future events will be generated. In a nonergodic world, this historical information relates to *different* probability distributions from those that govern future events. Observing outcomes of spins of a roulette wheel and determining the probabilities associated with roulette does not tell you what the probabilities are with a game of cards.

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86. The probability of a "5" showing up in roulette is 1/38; in dice it is 1/9 (probability for a total value of five from the two dice); and in cards it is 1/13.

87. Paul Davidson initially pointed out that the rejection of each of the ergodic assumption, the axiom of reals, and the axiom of gross substitution are fundamental to building a useful monetary theory. See DAVIDSON, POST KEYNESIAN MACROECONOMIC THEORY, *supra* note 66, at 4-18. Such a well articulated monetary theory is a key component of Post Keynesian economics. See, e.g., Paul Davidson, *Keynes and Money*, in KEYNES, MONEY AND MONETARISM 2 (Roger Hill ed., 1989), reprinted in 1 DAVIDSON, MONEY AND EMPLOYMENT, *supra* note 75, at 389; Johan Deprez & L. Randall Wray, *Monetary Theory of Production*, in 2 ENCYCLOPEDIA OF POLITICAL ECONOMY 759 (Phillip Anthony O'Hara ed., 1999).

Yet, even facing true uncertainty, people make decisions. The wisdom of these decisions will only be known when the future happens. People make decisions and act speculating that the future will turn out to be consistent with their hopes.

## VI. INDUSTRIAL ACTIVITY VERSUS SPECULATION

In the economics literature there has long been made a distinction between industrial and speculative activity.<sup>88</sup> Industrial activity is productive from a social point of view and should, therefore, be promoted by public policy. Speculative activity, on the other hand, has negative or, at best, neutral effects on economic output and employment. If negative effects are generated, then speculative activity should be discouraged as a matter of public policy.<sup>89</sup> This dichotomy between industrial and speculative activities interrelates with issues such as the ergodic/nonergodic distinction, what types of investment-backed expectations are reasonable, and what types of expectations should be protected from government regulation.

The logical existence of speculative activity requires the rejection of the orthodox economics' restrictive ergodic assumption. Within an ergodic context, all future events are statistically foreseeable. This means that speculation is logically impossible because there are no guesses to be made about an unknown future. Only if one is dealing with a nonergodic context is speculation likely because there is logical room for guesses about a truly unknown and uncertain future.

Post Keynesians, following the ideas of Keynes, argue that the future is uncertain. This means that at any point in time, the actuarial profits or reliable expectations of gain cannot be calculated from any existing data set.<sup>90</sup> Keynes himself specifically stated that in orthodox economics:

[F]acts and expectations were assumed to be given in a

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88. See JOHN MAYNARD KEYNES, *A TREATISE ON MONEY* 250-59 (1930).

89. See, e.g., Lynn A. Stout, *Why the Law Hates Speculators: Regulation and Private Ordering in the Market for OTC Derivatives*, 48 DUKE L.J. 701 (1999) (providing a history of antispeculation rule in American law and discussing alternative theories of speculation, including the importance of the distinction between risk and uncertainty).

90. See KEYNES, *supra* note 4, at 161-63.



definite and calculable form; and risks . . . were supposed to be capable of an exact actuarial computation. The calculus of probability . . . was supposed to be capable of reducing uncertainty to the same calculable status as that of certainty itself . . . .

. . . .

. . . I accuse the classical economic theory of being itself one of these pretty, polite techniques which tries to deal with the present by abstracting from the fact that we know very little about the future.

. . . [A] classical economist . . . has overlooked the precise nature of the difference which his abstraction makes between theory and practice, and the character of the fallacies into which he is likely to be led.<sup>91</sup>

In Keynes and Post Keynesian analysis, therefore, even if “fundamentals” of any investment or stock exist today, such fundamentals do not form a reliable foundation for forecasting the future. Within a nonergodic system, today’s fundamentals are not a reliable actuarial guide to the future. As such, no market of goods, services, real property, or financial assets can be presumed to be efficient. Today’s markets and the information they provide can, in a nonergodic system, never be an accurate predictor of future outcomes.<sup>92</sup>

Speculation in such a context occurs because guesses on profits and returns are being made about an uncertain future in order to motivate decisions. Because logical people in an uncertain, nonergodic environment know that today’s fundamentals do not provide a statistically reliable guide to the future, they also recognize that many of their investment decisions are, at least partially, based on pure speculation. In such a world, protecting the value of one’s assets against unforeseen and unforeseeable changes in market values becomes an important economic activity. People will try to guess how

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91. John Maynard Keynes, *The General Theory of Employment*, 51 Q. J. ECON. 209 (1937), *reprinted in* 14 THE COLLECTED WRITINGS OF JOHN MAYNARD KEYNES: THE GENERAL THEORY AND AFTER, PART II: DEFENCE AND DEVELOPMENT 109, 112-13, 115 (Donald Moggridge ed., 1973).

92. *See, e.g.,* Paul Davidson, *Public Policy Problems of the Domestic Crude Oil Industry*, 53 AM. ECON. REV. 85 (1963), *reprinted in* 2 DAVIDSON, INFLATION, OPEN ECONOMIES AND RESOURCES, *supra* note 11, at 275-76.

other speculators in a market will behave. Entering into hedging contracts is another way to deal with the uncertain future.<sup>93</sup>

Following Keynes, in a nonergodic system, firms, households, and other economic agents are always uncertain about future market valuations and try to adjust to this fact:

Now a practical theory of the future [profits or market valuation is] . . . based on so flimsy a foundation, it is subject to sudden and violent changes. The practice of calmness and immobility, of certainty and security, suddenly breaks down. New fears and hopes will, without warning, take charge of human conduct. The forces of disillusion may suddenly impose a new conventional basis of valuation.<sup>94</sup>

Speculation about the psychology and behavior of other market players can result in herd-like behavior that can become self-reinforcing and self-justifying. In a nonergodic system, if enough people possess the same faulty expectations, the result can be that these faulty expectations actually create future outcomes.<sup>95</sup>

The characteristics of real property markets mean that they can be very speculative markets. Real property markets, like financial markets, involve essentially nonreproducible items that are practically indestructible. Real property markets also involve active secondary markets that allow for the ongoing valuation of properties. These markets are, of course, not as well-organized and liquid as financial markets, commodities markets, and the markets for certain produced goods. This illiquidity is a factor that may contribute to sharp price fluctuations. Just like financial markets, the speculative expectations of economic agents drive real property markets. Consequently, such market prices cannot reflect social costs and benefits nor can they reflect the actual costs and benefits of improvements upon the land. Therefore, real property markets are generally highly speculative and inefficient.

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93. See, e.g., Pouncy, *supra* note 60, at 572-73 (discussing how hedging—being active on both sides of a transaction—helps firms deal with uncertainty).

94. Keynes, *supra* note 91, at 114-15.

95. See Arestis & Sawyer, *supra* note 76, at 188-89.

## VII. REGULATORY TAKINGS FROM A POST KEYNESIAN PERSPECTIVE

The dichotomy between ergodic and nonergodic contexts leads to a distinction between *risk-based investments* and *uncertainty-based investments*.<sup>96</sup> Risk-based investments are those investments that are carried out based upon probabilistically-certain profit expectations. Uncertainty-based investments are those investments that do not have such a certainty foundation and are, therefore, based on uncertain profit expectations that make these investments speculative. Reasonable investment-backed expectations can logically exist when one is dealing with risk-based investments. When dealing with uncertainty-based investments, however, the expectations driving these investments cannot be reasonable. Hence, a government regulation can only destroy reasonable investment-backed expectations when one is addressing risk-based investments. When dealing with uncertainty-based investments, there are no reasonable expectations for a regulation to destroy. Consequently, a regulatory taking can only occur if one has a risk-based investment and the necessary ergodic context.

### A. Risk-Based Investments

If the expectations upon which the investment decision is based are reasonably grounded in an ergodic context, then one is dealing with a risk-based investment. In this context, investments are carried out on the basis of probabilistically-certain profit expectations. Consequently, investments work like games of chance such as roulette, craps, or flipping a coin. If, for example, on a bet of \$1.00, heads pays \$3.00 and tails pays nothing, then, with a fair coin, the expected value of the bet is \$1.50.<sup>97</sup> The probabilistically-certain profit expectation is \$0.50 per flip of the coin.<sup>98</sup> Making this bet or

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96. The dichotomy between probabilistically-certain risk and uncertainty, where this certainty does not exist, goes back to the work of Knight. See KNIGHT, *supra* note 5, at 197-232 (distinguishing the meaning of risk and uncertainty).

97. The expected value (EV) of the payout is equal to the probability of each outcome times the amount of the associated payout added to the same product for all other outcomes, i.e.  $EV = (.50 \times \$3.00) + (.50 \times \$0.00) = \$1.50$ .

98. The expected profit (EP) is the expected value minus the cost of the bet, i.e. the net expected proceeds. Here,  $EP = \$1.50 - \$1.00 = \$0.50$ .

investment is a risk-based investment. There is no uncertainty about what the outcome will be when the bet is made, only risk of what will happen on a specific flip of the coin.

Furthermore, expectations in such an ergodic context are based upon objective foundations. Hence, reasonable investment-backed expectations are associated with these risk-based investments. Consequently, a government regulation that significantly alters the rules of the game inevitably destroys expectations with such an objective foundation. If, in the example above, the government regulation changed the probability of heads to twenty-five percent and tails to seventy-five percent, then, on the same payout \$3.00 for a head and nothing for a tail, the expected value of a flip becomes \$0.75.<sup>99</sup> There is now a probabilistically-certain expected loss per flip of \$0.25.<sup>100</sup> This change destroyed reasonable investment-backed expectations. Therefore, the government regulation that destroyed the RIBE can be held to be a taking for which just compensation of \$0.75 per flip can be determined.<sup>101</sup>

### *B. Uncertainty-Based Investments*

Uncertainty-based investments are those investments that are not or cannot be based upon probabilistically-certain profit expectations. Because the investment-backed expectations for these investments are grounded in a nonergodic context, both broadly and within the narrow industry context of the investment, these investments are necessarily highly speculative in nature. The uncertainty of the expectations created by the nonergodic context means that these expectations cannot be meaningful in an objective sense and, therefore, cannot be reasonable. Thus, if there are no RIBE to begin with, then a regulation has no RIBE to destroy, and a regulatory taking for which compensation is required cannot take place.

When investment-backed expectations are projections about the uncertainty in a nonergodic context, the investment is a highly speculative one. Under these conditions it becomes impossible to attach an objectively meaningful value to the investment. Even if a

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99.  $EV = (.25 \times \$3.00) + (.75 \times \$0.00) = \$0.75$ .

100.  $EP = \$0.75 - \$1.00 = -\$0.25$ .

101. The just compensation is the difference between the expected profit of \$0.50 before the regulation and the expected loss of \$0.25 after the regulation.

taking was held to have occurred, there is no objective, independent monetary value that could be attached to the loss.

Under these conditions, the investor could only have undertaken the investment on the basis of a purely speculative return. If she were a rational person, the investor would have recognized that her choice to invest was based only on intuition, hope, and subjective calculations. To then suffer a partial or total loss on the investment would not be a surprise.

In a nonergodic context, one knows that structures and fundamental characteristics of the economy are going to change. The bet is that they will change in a way that will benefit the speculator. When unexpected and unforeseen changes occur in economic, technological, social, political, or legal—including regulatory—conditions, the investor should not be surprised. It is not a surprise to the investor when her expectations end up being disappointed. Hence, under such conditions, it is part of the bet that there may be changes in government regulations that will substantially change the economic context and severely alter the profitability of an investment. Consequently, in a nonergodic context, the logically rebuttable presumption is that there is no regulatory taking.

Currently-existing market prices are useless in that they do not reflect future profitability. They cannot help us in understanding what future social value is lost or gained by a regulation. Prices of assets in an uncertain context reflect only the speculative expectations of what people hope the future will be.<sup>102</sup> If the market participants have no reasonable basis for these expectations, then the market prices are purely speculative, do not meaningfully reflect future economic conditions, and will change purely on actions based on a speculative mindset.<sup>103</sup> Consequently, some of these markets tend

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102. See, e.g., Johan Deprez, *Technology and the Terms of Trade: Considering Expectational, Structural, and Institutional Factors*, 29 J. ECON. ISSUES 435, 439-40 (1995) (arguing that exchange rates are not and cannot reflect any fundamentals).

103. Keynes discussed the fact that, in this context, prices are expectationally-driven and are only based on the speculators' mindset. See KEYNES, *supra* note 4, at 156-77 (explaining the speculative and subjective nature of markets, as well as why herd behavior is a common reaction of speculators to changes in this context).

to be dominated by the large institutional traders and speculators, without reflecting any meaningful fundamentals.<sup>104</sup>

### *C. The Destruction of Reasonable and Speculative Expectations*

Whether a regulatory taking has occurred depends on whether one is dealing with risk-based investments or uncertainty-based investments. If one has risk-based investments, then one has reasonable investment-backed expectations. These expectations are something substantive that a regulation can destroy to create a regulatory taking. The value of the investment can also be substantive enough to determine an amount of just compensation. If, on the other hand, one has uncertainty-based investments, then there cannot be reasonable investment-based expectations. One is dealing with speculative expectations. Here, there is nothing substantive for a regulation to destroy. No regulatory taking can exist and no just compensation could be calculated in a reasonable manner.

## VIII. A SUGGESTED TEST FOR EVALUATING ERGODIC AND NONERGODIC CONTEXTS

From the foregoing discussion it is useful to arrive at a legal test for distinguishing between investment-backed expectations that are grounded in an ergodic context and those that are grounded in a non-ergodic context. This is essentially a test to determine the reasonableness of the expectations held by the investing party. This test is applicable to investments in real property, as well as investments in most other economic sectors, whether carried out by business firms or individuals.

### *A. Is There Ergodicity at the Industry Level?*

The first fundamental question is whether the specific industry about which the investor formulated expectations is one that has essentially reflected an ergodic pattern of development. This can be

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104. See, e.g., John T. Harvey, *Exchange Rates: Volatility and Misalignment in the Post-Bretton Woods Era*, in FOUNDATIONS OF INTERNATIONAL ECONOMICS: POST KEYNESIAN PERSPECTIVES, *supra* note 61, at 200 (arguing that the volatility of exchange rates in the post-Bretton Woods era is not linked to fundamentals but to speculative activity led by currency traders).

captured by the following factors:

1. Is the industry one in which important structural changes have taken place, are taking place, or will take place? For example, has the industry transformed itself from a highly competitive one to one that is oligopolistic or exhibits significant monopoly or monopsony power?<sup>105</sup>
2. Is the industry one that has experienced significant technological changes? For example, is the industry rapidly developing new products, using new capital goods, or employing new production processes?
3. Is the industry one in which the skills of its labor force have changed significantly? For example, has the predominant part of the labor force moved from unskilled or semi-skilled laborers to highly-skilled technicians?
4. Is the industry one in which prices have fluctuated significantly? This refers especially to prices of the output of the industry, but could also mean the prices of inputs that the industry uses.
5. Have the markets, which the industry deals with, changed significantly? For example, has there been a significant globalization of the relevant market both in terms of where local firms are selling and in terms of foreign firms selling to the local market?
6. Have there been changing regulatory structures in the industry? One should note that the nonexistence of significant regulation usually only indicates a newly developing industry that can logically expect the imposition of a regulatory structure in the near future. It rarely indicates an explicit choice of nonregulation.

These six factors do not necessarily create an exhaustive list of the relevant factors to be considered. There may be other sources of significant change indicative of a nonergodic environment. Many of these factors are similar to those found in product life-cycle analysis. New and immature industries generally reflect a nonergodic

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105. Monopoly is a market in which there is one seller facing many buyers, while monopsony is a market in which there is one buyer facing many sellers. *See, e.g., COOTER & ULEN, supra* note 9, at 37 n.8.

environment of rapid and unexpected changes. Computer hardware and software industries are probably the most recognizable examples of this situation. Mature industries would be the ones that tend to exhibit an ergodic environment. The automobile and beer industries may be approximations thereof. A mature industry that is showing serious signs of collapse would begin to fall into the nonergodic category.

### *B. Is There Ergodicity at the Economy Level?*

The second fundamental question arises if the first, industry-specific analysis results in an answer that the industry about which expectations were generated is essentially ergodic. If so, then the next question is whether the broader economic and social context over the time period that the party is formulating expectations about can reasonably be categorized as ergodic.

The ergodicity or nonergodicity of the economy as a whole can be determined by identifying whether important, economy-wide changes have occurred. These changes could be in terms of significant changes in the stages of the business cycle that an economy is in, as may be indicated by the growth rate of gross domestic product (GDP), the growth rate of employment, and the unemployment rate. Significant changes in the rate of inflation or the rate of interest may also be indicia of nonergodicity. Rapid technological progress and significant changes in the relative importance of economic sectors may also rupture the conditions required for ergodicity. Sharp fluctuations in exchange rates or trade deficits and surpluses may indicate the same. Significant political upheaval via revolutions and wars may also rip apart the structural stability required for ergodicity. Natural disasters or supply shocks, such as an energy crisis, may also create structural change substantial enough to indicate that the time period in question is a nonergodic context.

### *C. Combining the Answers to the Two Fundamental Questions*

If the expectations at both the level of the industry and the level of the economy in general are dealing with an essentially ergodic environment, then the investment-backed expectations are concrete enough for regulatory takings to be a meaningful concept. A relatively objective value for the investment can be determined.



Therefore, the value of what was lost due to the government regulation and the required just compensation can be determined. Here, it is clear that the regulation in question creates a special rupture in the temporal environment.

If at either one of the levels of analysis one finds that one is essentially dealing with a nonergodic environment, then investment-backed expectations are too fleeting to be a meaningful concept upon which to determine that a regulatory taking has occurred. There is just no way to arrive at a relatively objective or socially meaningful valuation of the investment. Under such conditions, the investor in property took her speculative chances and lost. New regulations are as likely as other unexpected changes in a nonergodic environment. Hence, regulations that fully or partially destroy investment-backed expectations are no different than any economic or social factor that would do the same. Losing—getting less value than expected—in a changing environment because of the changes that occur in an unexpected manner is just part of the capitalist game. Investors should not be compensated for such losses. Regulation took nothing from that investor that the investor had in the first place. The government regulation created no special rupture in the economic environment.

Applying the above test to individuals, as opposed to businesses, may generate significantly different outcomes. Individuals tend to buy property in a relatively stable context. When buying a house to live in, the homebuyer's primary purpose is not speculative. If housing prices, property taxes, mortgage interest rates, and insurance premiums all grow at relatively stable and similar rates, and there are no major crises in the economy as a whole, then it is clear that the homebuyer is dealing with an ergodic context. A government regulation—such as allowing toxic waste to leech into the soil and groundwater of a housing development—that effectively destroys the habitability of the house would clearly be a regulatory taking under this test.

## IX. CONCLUSION

The recognition of a nonergodic context and true uncertainty creates insurmountable logical problems for Chicago-style economics and the Posnerian perspective on law and economics that has been built upon Chicago-style economics. Posnerian views on

efficiency, prices, valuation, decision making, and justice cannot be sustained in the real world where true uncertainty dominates. Meaningful foundations for examining the interrelationship between law and economics must thus be found in heterodox perspectives to economics, such as those provided by Post Keynesian and Institutional Economics.

By applying the Post Keynesian perspective to expectations that is built upon the dichotomy between ergodic and nonergodic contexts, one is able to develop a substantive foundation for reasonable investment-backed expectations. Expectations can only have a substantive and objective foundation if they are referring to an ergodic context. Only then can they be "reasonable." Within such an ergodic context, some of the concerns of orthodox economists and legal scholars with respect to regulatory takings may have some merit. In an ergodic context, expectations can be reasonable enough so that there is something substantive that government regulation can destroy and for which a meaningful just compensation amount can be determined.

But, investments are generally long-term decisions that require long-term expectations about the distant future. If this future is subject to persistent structural change, then we are dealing with a nonergodic context. Expectations within this context—no matter how confidently held—cannot have an objective basis. Consequently, these expectations are purely speculative. An investor profits if the future turns out as she hoped it would, and suffers a loss if her hopes are disappointed. Either way, this is not predictable in any substantively objective fashion in a nonergodic context.

As expectations are purely speculative in a nonergodic context, there is nothing of any substance that government regulation destroys when investment-backed expectations are destroyed. Because investors' expectations cannot be reasonable, their expectations cannot form the basis for finding a regulatory taking. The property owner must bear the risk, not society. That is the game the capitalist entrepreneur and investor must face.

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